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RESEARCH ARTICLE

ALLELOPATHIC ACTIVITY OF *PARTHENIUM HYSTEROPHORUS L.* LEAF EXTRACT ON *PISUM SATIVUM*

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ABSTRACT

Allelopathic activity of Parthenium hysterophorus L. leaf extract of different concentratios were studied on seed germination, seedling growth, fresh wt., r:s ratio, inhibition(-) or stimulation(+),relation elongation of root and shoot and SVI values of Pisum sativum were recorded. In the present study allelopathic activity of leaf extract of different concentrations (5%, 10%, 15%, 25%,50%) were compared to control condition. The higher concentrations of leaf extract reduced the rate of seed germination. In the present study the length of root was inhibited in different treatments (63 to 77%) compared to control condition but the shoot length decreased from 2 to 45% only. The fresh weight of root except for 15% treatment and shoot, r:s ratios and SVI decreased compared to control treatment. The values for relative elongation ratios for root and shoot ranged from 23.09 to 37.67% and 55.54 to 98.34%, respectively.

INTRODUCTION

Parthenium hysterophorus L. is a harmful weed of family Aesteraceae which has invaded more than 20 countries around the globe. The most threatened areas from Parthenium are south east Asia, the Pacific and Western Africa. Parthenium weed will become more problematic in future when Co2 levels will increase due to climatic change. It is an upright annual herb of 30-150cm. in height. Its first occurrence in India was identified in 1955 in Maharashtra, Pune. In 1980, Parthenium weed was seldom noticed in Cropland but now it has spread into almost all types of Cereal, Pulse, Cash crop, Vegetable crops as well as pastures, forests and plantation ecosystem. P.hysterophorus has negative impacts on humanbeings, animal health, the economy and the environment (Seier *et al*.2000, Kishor *et al*.2010a, Kishor *et al*.2010b, Patel 2011, Veena and Shivani 2012, Anil 2014).

This weed has prolific seed production, high allelopathic effect on neighbouring plants and strong competitiveness with crop plants (Haseler 1976, Adkins and sowrby1996, Tamado *et al*.2002). Parthenium contains "Parthenin" an active chemical which is a terpenoid (sesquiterpene). Singh *et al*. (2005) have reported that this group of chemicals are affected the early growth and physiology of Ageratum conizoides. Swaminathan *et al*.(1990) have mentioned some allelochemicals released from Parthenium affecting many plant species are sesquiterpene lactones and phenolics. Birader *et al*.(2006) and Son(2008) have reported that the high level of N, P and K in Parthenium compost. Patel (2011) has reported that Parthenin is the major constituent of the plant, exhibits significant medical attributes including anticancer property. Parthenium is used to a herbal remedy for various intestinal and skin disorders using a decoction of boiled roots.

The phenolics found in Parthenium also inhibit the germination and growth of several crop plants and multipurpose trees. (Dharmaraj and Ali, 1985; Shrivastava *et al*.1985; Dayama 1986). Positive and negative allelopathic effects have been reported of Parthenium on many agricultural crops and other plant species (Oudhia *et al*.1997, Aggarwal and Kohli 1992) and it inhibits the surrounding herbaceous vegetation(Nath 1988, Srivastava *et al*.1985). Einhelling (2002) has reported that there are hundrades of secondary metabolites in the plant kingdom and many are known to be phytotoxic.

The main objective of this study was to determine the effect of leaf extract of Parthenium hysterophorus on seed germination and other growth performance of important leguminous seeds Pisum sativum.

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MATERIALS AND METHODS

The experiment was conducted in the laboratory of Botany department. The fresh green leaves of Parthenium were collected from the University campus and chopped on an electronic shredder. Ten gram of ground dry powder was soaked in for 24hrs. in 100ml distilled water for extraction. Aqueous extract was obtained as filtrate of the mixture and final volume was adjusted. The extract was considered as stock solution to prepare various concentrations 5%, 10%,15%, 25%, 50% by adding distilled water. Seeds were pre-soaked in different concentrations of leaf extract for 10hrs. Ten seeds each were placed in petridish on a two layered moistened filter paper. Three replicates were kept for each treatment. One treatment was run as control with only distilled water. Petridishes were kept at laboratory temperature and distilled water was added in the each petridishes when moisture content of the filter paper declined. The root-shoot length and fresh weight was taken after one week.

RESULTS AND DISCUSSION

Data collected on seed germination, length of root and shoot,fresh weight of root and shoot,R:S ratios, inhibition(-) or stimulation(+), relation elongation of root and shoot and SVI are presented in Table 1.,Fig 1(a to j).

The per cent seed germination values ranged from 63.33% to 80% in different concentrations of leaf extract (5 to 50%) whereas this value was 80% in control condition. The minimum value 63.33% was observed in 50% and maximum value 80% for 5% treatment. The length of root values ranged from 1.79cm to 2.92cm in different concentrations of Parthenium leaf extract (5 to 50%) whereas this value was 7.75cm in control condition. The minimum value was 1.79cm in 10% treatment and 2.92cm for 50% treatment. The length of root decreased from 63% to 77% compared to control condition.

The length of shoot values ranged from 1.68cm. to 2.98cm. in different concentrations of Parthenium leaf extract whereas this value was 3.03cm in control condition.

The minimum value was 3.03cm. in control condition. The minimum value was 1.68cm. in 10% treatment and maximum 2.98cm. for 5% treatment. The length of shoot decreased from 2% to 45% compared to control condition. The fresh weight of root values ranged from 0.30gm to 0.72gm in different concentrations of leaf extract whereas this value was0.60gm in control condition. The minimum value was 0.30gm in 25% treatment and maximum value 0.72gm for 15% treatment. The fresh weight of shoot value ranged from 0.4gm to 0.67gm in different treatments of leaf extract, whereas this value was 0.86gm in control condition.

The minimum value was 0.4gm in 5% treatment and maximum value 0.67gm for 25%. The root: shoot ratio values ranged from 0.77 to 1.22 in different treatments whereas this value was 2.55 in control condition. The minimum value was 0.77 in 5% concentration and 1.22 for 15% concentration. In this study both inhibitory and stimulatory effect was observed on seed germination of Parthenium. The inhibitory effect on seed germination of -16.66% and -20.83% for 25% and 50% concentrations and stimulatory effect in 4.16% in 10% and 15% concentration were recorded.

The relation elongation ratio of root values ranged from 53.20% to 97.04% in different concentrations of leaf extract. The minimum value was 53.20% in 50% and maximum value 97.04% for 10% treatment. The shoot relation elongation ratio values ranged from 83.04% to 155.65% in different concentrations. The minimum value was 83.04% in 5% treatment and maximum value 155.65% for 15% treatment. The SVI values ranged from 70.66 to 240.7 in different concentrations of Parthenium leaf extract (5 to 50%) whereas this value was 250.15 in control condition. The minimum value was 70.66 in 25% treatment and maximum value 240.7 for 5% treatment.

Effect of aqueous leaf extract of Parthenium hysterophorus on seed germination, seedling growth, fresh wt.(root and shoot), r/s ratio, inhibition(-) or stimulation(+), relation elongation(root and shoot) and SVI values of Pisum sativum.

Sl N0.	Treatment	Germination (%)	Radicle length (cm) ± SE &(% decrease)	Plumule length (cm) ± SE & (% decrease)	Fre.wt. of Root (gm)	Fre. wt. of Shoot (gm)	R/S ratio	Inhibition(-) or Stimulation(+)(%)	Relation elongation of root (%)	Relation elongation of Shoot(%)	SVI
1	Control	80	7.75 ±1.41	3.03 ±0.53	0.60	0.86	2.55	___	___	___	250.15
2	5%	80	2.3 ±1.36 (70%)	2.98 ± (2%)	0.43	0.4	0.77	0	29.67	98.34	240.7
3	10%	83.33	1.79 ±0.77 (77%)	1.68 ±0.82 (45%)	0.32	0.58	1.06	4.16	23.09	55.54	141.78
4	15%	83.33	2.70 ±1.60 (66%)	2.21 ±0.51 (28%)	0.72	0.55	1.22	4.16	34.83	72.93	186.85
5	25%	66.66	1.93 ±1.44 (76%)	2.07 ±1.24 (32%)	0.30	0.67	0.93	-16.66	24.90	68.31	70.66
6	50%	63.33	2.92 ±1.41 (63%)	2.65 ±0.79 (13%)	0.49	0.59	1.10	-20.83	37.67	87.45	170.74

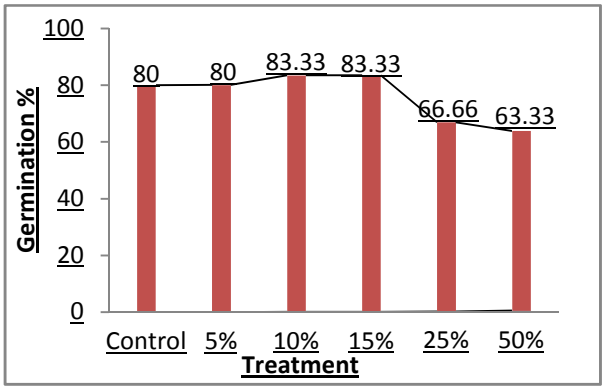


Fig.a Seed germination of *Pisum sativum*

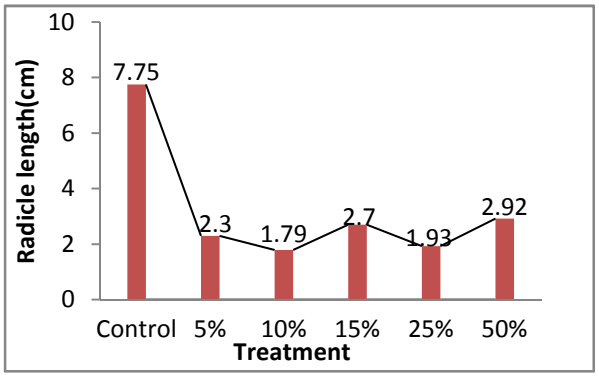


Fig.b Root length of *Pisum Sativum*

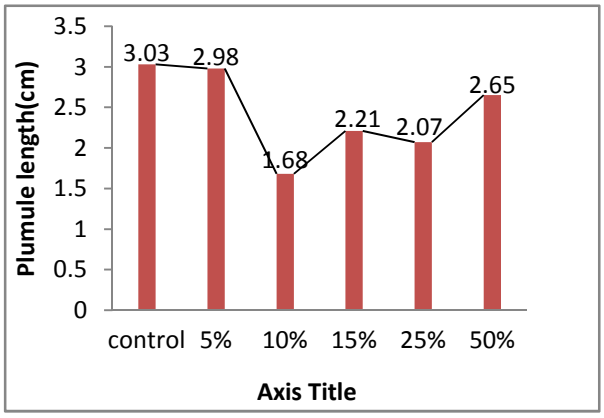


Fig.c Shoot length of *Pisum sativum*

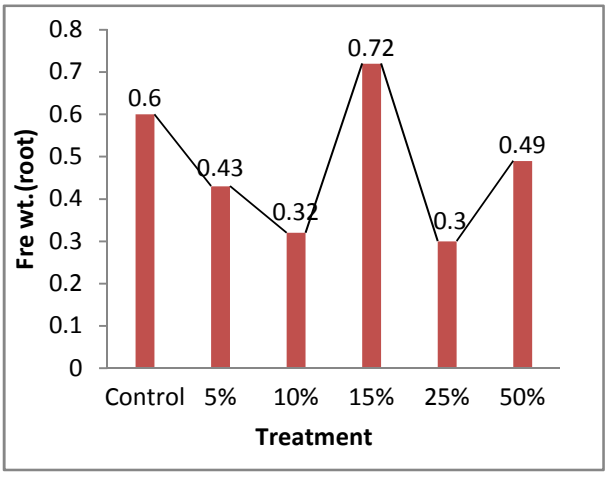
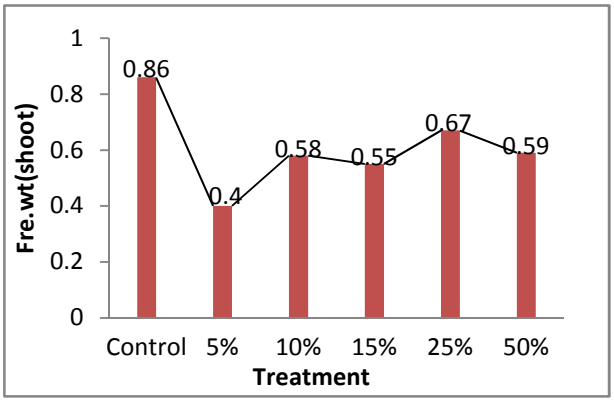


Fig.d Fre.wt. of Root(gm).



Fig,e. Fresh wt. of Shoot(gm).

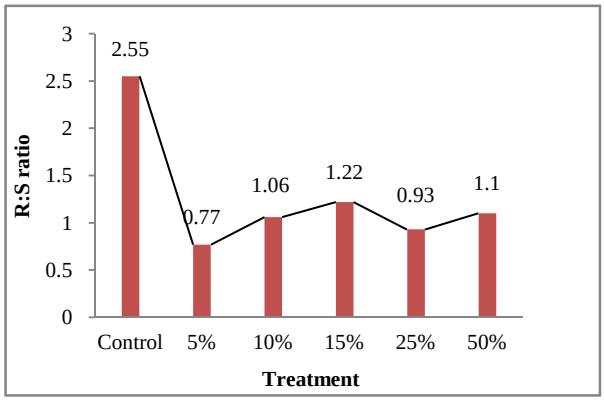


Fig.f. Root Shoot ratio of *Pisum sativum.*

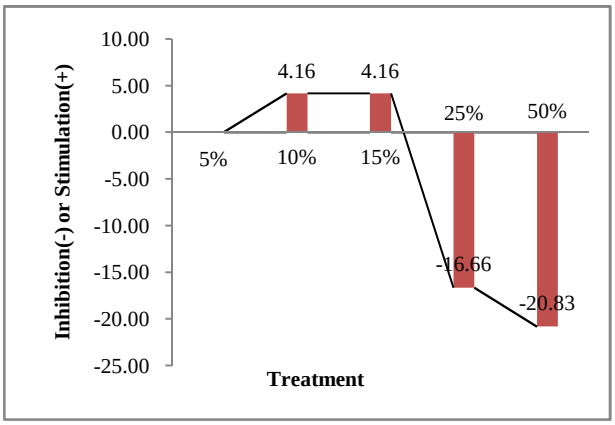


Fig.g Inhibition(-) or Stimulation(+)of *Pisum sativum*

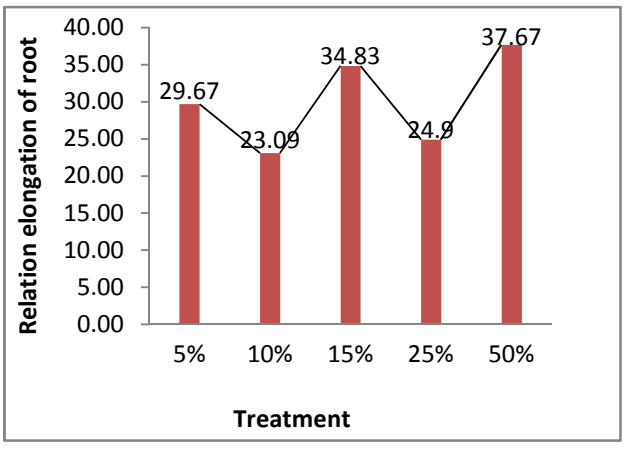


Fig.h Relation elongation ratio of root(%).

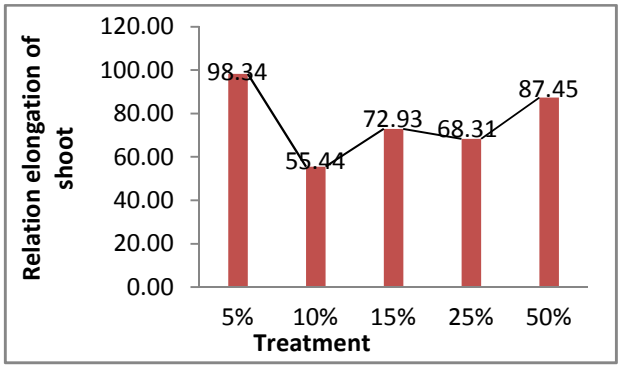


Fig.i. Relation elongation ratio of Shoot(%)

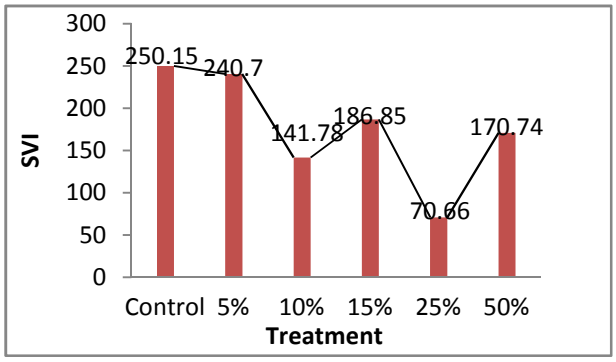


Fig.j. SVI value of *Pisum sativum*

Fig 1.(a-j) Effect of different concentrations of leaf extract of P.hysterophorus on seed germination and growth of P.sativum.

In the present study we assessed the both inhibitory (-) or stimulatory(+) effect of leaf extract of Parthenium hysterophorus on seed germination of Pisum sativum was observed. From preliminary screening it was found that leaf extract had the strongest allelopathic effect on seed germination as earlier reported by Netsere and Mendesil(2011) on soyabean and haricot bean; Khan *et al*.(2012) on wheat; Devi and Dutta(2012) on Zea mays; Jarvin *et al*.(1985) on fruits like chilli, tomato, brinjal etc.; Maharajan *et al*.(2007) on Oryza sativa, Triticum aestivum, Zea mays, Raphanus sativus, Brassica compestris, Brassica oleraceae, Ageratina adenophora and Artemisia dubia; Oudhia(1998) on rice and other crops in India; Oudhia *et al*.(1997), Oudhia and Tripathi(1998) on chickpea, musterd and linseed; Karim amd Forzwa(2010), Biswas(2010), Demissie *et al*.(2013) on Allium cepa; Tamado *et al*.(2002) on Sorghum grain; Kumar and kumar(2010) on Phaseolous mungo; Guzman(1988) on pumpkin and tomato; Bajwa *et al*.(2004) on sunflower. Peters and Zam(1981) on Festuca arundinaceae Digitaria sanguinalis; Amin *et al*.(2007) on wheat and associated weeds; Batish(2001) on Ocimum americanum. Afjal *et al*.(2000) have reported that growth of Vigna radiate and Phaseolous vulgaris was reduced by aqueous shoot extract of Imperata cylindrica; Hussain and Abidi(1991) have also reported similar reduction in root growth of Dicanthium annulatum, Chrysopogon montanus and Medicago polymorpha by the Imperata cylindrica.

In the present study the length of root was inhibited in different treatments (63 to 77%) compared to control condition but the shoot length decreased from 2 to 45% only. The fresh weight of root except for 15% treatment and shoot; r:s ratios and SVI value decreased compared to control treatment. The values for relation elongation ratios for root and shoot ranged from 23.09 to 37.67% and 55.54 to 98.34% , respectively. Similarly earlier Shikha and Jha (2016 a,b) have reported inhibitory effect of leaf extract of Parthenium on seed germination and growth of seedlings of Phaseolous mungo and Cicer aeritinum . P.sativum is an important pulse crop of India. P.hysterophorus is invading agricultural lands in India on large scale. Thus integrated management programme is needed to control the spread by Parthenium further.

CONCLUSION

The inhibitory effect of aqueous leaf extract of P.hysterophorus on the rate of seed germination and length of root was more than the length of shoot of P.sativum. In general the fresh weight of root and shoot, root:shoot ratios and seed vigour index were affected by high concentrations of leaf extract of Parthenium.

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