

Allelopathic Effect of Leaf Extract of *Parthenium hysterophorus* L. on Seed Germination and Growth of *Cicer aeritinum* L.

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Abstract: We studied the allelopathic effect of *Parthenium hysterophorus* on seed germination, root & shoot length and fresh weight of root & shoot and fresh weight of root & shoot of *Cicer aeritinum* L., root:shoot ratios, inhibition(-) or stimulation(+) %, relation elongation of root & shoot, and seed vigour index(SVI) were calculated also. In this study allelopathic effect of leaf extract of different concentrations(5% , 10% , 15% , 25% , and 50%) were compared with control treatment. Seed germination and growth performance of Chickpea were low at high concentrations of leaf extract except for shoot length and fresh weight of shoot.

Keywords: Allelopathic effect, *Parthenium*, Leaf extract, *Cicer aeritinum*, Allelochemicals.

1. Introduction

Parthenium hysterophorus L. is a member of the Asteraceae family an annual wasteland weed and aggressive colonizer of road sides, railway sides and crop fields in East and South Africa, India, Australia, Mexico, Canada etc.(Towers et al.,1977).Dwivedi et al.(2009) have reported about five million hectares of land in India has been invaded by *Parthenium*. This is the major problem in rangelands, cultivated lands etc. It affects the production of crops, human and animal healths and biodiversity of the ecosystem. *P. hysterophorus* invasion causes changes in above-ground vegetation and below-ground soil nutrient contents, disturbing the entire grassland ecosystem. It contains special characters such as high germination ability, high survival rate, large seed production capacities, easy dispersal of seeds, high allelopathic impact, completes life-cycle within four weeks, sometimes completes life-cycle twice in a year. It produces 15,000 to 25,000 seeds per plant (Haselar 1976, Joshi 1991) and seeds survive for several years in soil seed bank. *P.hysterophorus* fastly grows and is comfortable on alkaline to neutral clay soil. It induces changes in the physical, chemical and biological properties of soil. It also inhibits growth and nodulation of legumes because of the inhibitory effect of allelochemicals on nitrogen fixing and nitrifying bacteria (Deyama,1986). The allelochemicals released from *Parthenium* affecting many plant species are sesquiterpene lactones and phenolics(Swaminathan et al.1990). *Parthenium* secretes some allelochemicals which are lethal to plants, human beings and animals. *P.hysterophorus* is commonly known as congress grass, carrot grass, white head(English), ragweed *Parthenium*(USA), in India chatak chandani, gazar ghas and thandi booti, lewani bhang(Pakistan).

The present study was conducted to evaluate the effects of leaf extract of *P.hysterophorus* on seed germination and seedling growth of important pulse crop *Cicer aeritinum*.

2. Materials & Methods

The seeds of *Cicer aeritinum* purchased from market were used in this experiment. Chapra is situated between 25^o 36'-26^o 15' N latitude and 84^o 25' - 85^o 15'E. longitude and is hot and dry. Fresh leaves of *Parthenium hysterophorus* were collected from the J.P.University campus Chapra. Leaves were crushed with the help of pestle and mortar. Ten gram of leaf powder was mixed with 100ml distilled water and was left for 24h. in dark at the room temperature and then was filtered; and different concentrations for treatments were prepared.Ten healthy seeds of *Cicer aeritinum* were placed in each petridish having three replicates for different concentrations such as control, 5%, 10%, 15%,25% and 50%,and were maintained under room temperature. Equal volume of distilled water was added in the petridishes when moisture content of the filter paper declined. After seven days, the data on seed germination%, root&shoot length were measured; and fresh weight of each replicate for root & shoot was taken. Root: Shoot ratios, relation elongation ratios of root, relation elongation of shoot and inhibition or stimulation on percentage in seed germination were calculated as reported in Shikha and Jha(2016). Seed vigour index(SVI) was calculated as:

$$SVI = (\text{length of radicle} + \text{length of plumule}) \times \text{seed germination\%}.$$

3. Results and Discussion

The data collected are presented in Table 1 and in Fig.1(a-g).The per cent seed germination was 70% to 100% in different concentrations of leaf extract of *Parthenium*. The minimum rate of seed germination (70%) was observed for 50% treatment. The length of root values varied from 1.08cm.to 2.03cm.,and minimum value 1.08cm was observed for 50%treatment. The length of shoot values varied from 1.91cm to 3.58cm and minimum value1.91cm was recorded for 5% treatment.

The fresh weight of root was 0.41g in control condition, and 0.27g to 0.42g in different treatments. The minimum value 0.27g was recorded for 50% treatment. In different

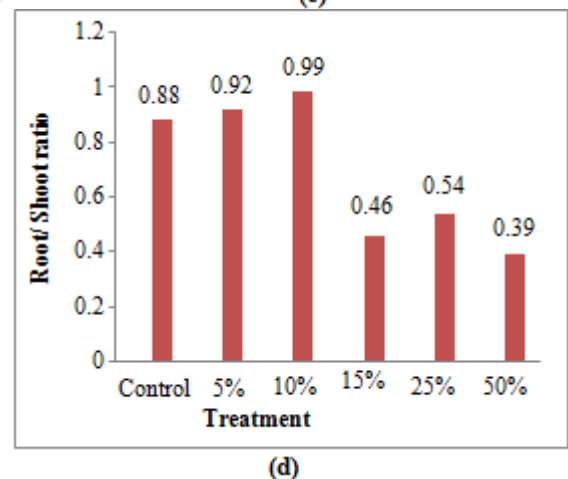
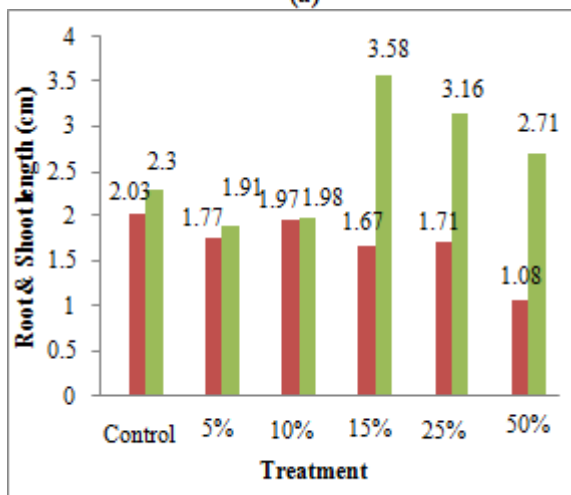
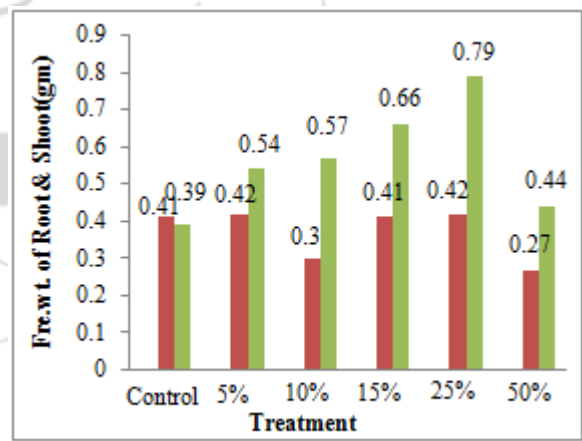
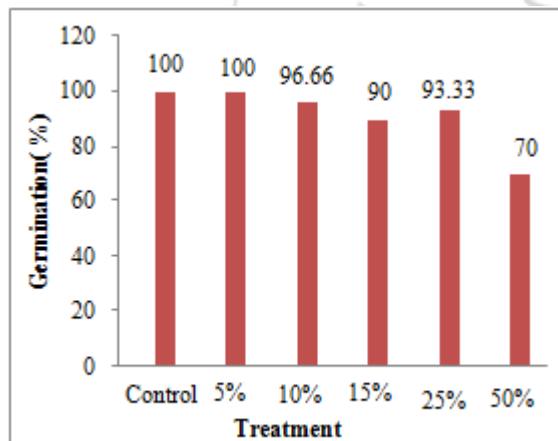
concentrations of leaf extract the fresh weight of shoot values ranged from 0.44g to 0.79g. The maximum value was 0.79g for 25% and minimum value was 0.44g for 50% treatment. Root:Shoot ratio values ranged from 0.44 to 0.79 in different concentrations of leaf extract. The inhibitory effect on seed germination ranged from -3.33 to -30% in different concentrations of leaf extract.

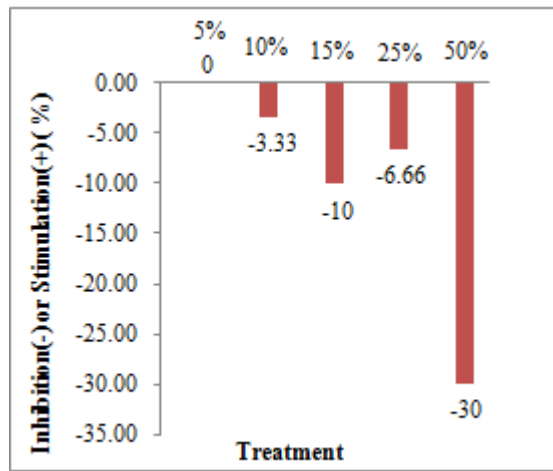
SVI values ranged from 192.77 to 359.67 in 5 to 50% treatments compared to control condition(232.03%).The per cent decrease in root length was maximum in 50% treatment(-53.20%) to minimum in 10% treatment (-97.04%) compared to control treatment. The per cent shoot length decreased by 83.04% to 86.08% in 5% and 10% treatments, respectively compared to control treatment whereas this value increased by 117.82 to 155.65% in 50% to 15%, respectively (Table 1).

The relation elongation ratios of root and shoot recorded in different concentrations of leaf extract of *Parthenium* ranged from 97.04 to 53.20 and 155.65 to 83.04, respectively. The

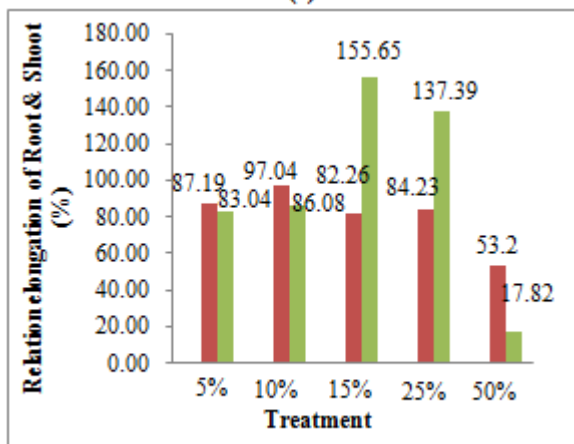
Table1: Effect of different concentrations of leaf extract of *Parthenium* on seed germination,root and shoot length(cm), Fresh weight (gm) of root and shoot, R/S ratio, Inibition(-) or Stimulation(+), Relation elongation of root & shoot and SVI values on *C.aeritinum*.

S No.	Treatment	Germination (%)	Radicle length (cm) ± SE & (% increment)	Plumule length (cm) ± SE & (%increase or 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	100	2.03±1.037	2.30 ±0.817	0.41	0.39	0.88	—	—	—	232.03
2	5%	100	1.77±0.984 (-87.19%)	1.91±0.701 (83.04%)	0.42	0.54	0.92	0	87.19	83.04	192.77
3	10%	96.66	1.97±1.314 (-97.04%)	1.98±0.873 (86.08%)	0.30	0.57	0.99	-3.33	97.044	86.08	199.97
4	15%	90	1.67±1.315 (-82.26%)	3.58±2974.64 (155.65%)	0.41	0.66	0.46	-10	82.26	155.65	359.67
5	25%	93.33	1.71±1.657 (-84.23%)	3.16±1.086 (137.39%)	0.42	0.79	0.54	-6.66	84.23	137.39	317.71
6	50%	70	1.08±1.161 (-53.20%)	2.71±0.82 (117.82)	0.27	0.44	0.39	-30	53.20	17.82	272.08

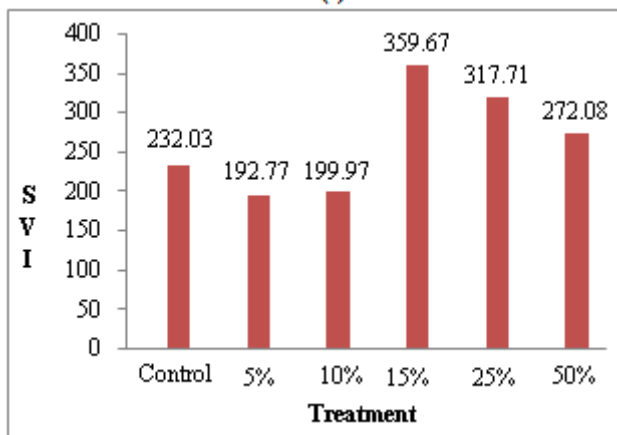




(e)



(f)



(g)

Figure 1: Germination rate and other growth parameters in *C. aeritinum* after treatment of various concentrations of leaf extract of *P. hysterophorus*

Cicer aeritinum a pulse crop which is very important crop in India. *Parthenium* is spreading in crop fields on very large scale. In the present study the effect of leaf extract of higher concentrations particularly 50% showed more inhibitory effect on the rate of seed germination, root length and fresh weight of root compared to lower concentrations of leaf extract. These values reduced by 30%, 53%, 65% and 44% compared to control condition, respectively. However the length of shoot and fresh weight of shoot increased by 117% and 112%, respectively in 50% treatment than the control condition. However the allelopathic impacts of leaf extract of *Parthenium* on seed germination have been reported on

Alysicarpus glumaceae and *Chloris gayana*, *Zea mays*, barley, wheat, peas, *Helianthus annuus*, *Glycine max*, *Phaseolus vulgaris*, sorghum, *Eragrostis tef.*, rice, Chickpea, soyabean, mustard, *Brassica*, green gram, black gram, moth bean, cow pea etc. (Clarence et al. 2013, Maharajan et al. 2007, Kumar and Gautam 2008, Netsere 2015, Netsere and Mendesil. 2011, Devi et al. 2014, Tefera 2002, Biswas 2010, Choesin and Boerner 1991, Singh et al. 2005, Bajwa et al. 2003, Purohit and Pandya. 2013, Rashid et al. 2008).

4. Conclusion

P. hysterophorus leaf extract particularly 10 to 50% inhibited the rate of seed germination of *C. aeritinum*. The higher concentration (50%) of leaf extract showed maximum inhibition in seed germination rate. It also inhibited the length of root but shoot length increased in higher concentration treatments. It clearly indicates that growth in root length and seed germination are more affected than the length of shoot in *C. aeritinum* by the allelopathic effect of leaf extract of *Parthenium*.

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