

Allelopathic effect of aqueous leaf extract of *Parthenium hysterophorus* L. on seed germination and seedling emergence of some cultivated crops

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ABSTRACT:

Allelopathic effect of aqueous extract of *Parthenium hysterophorus* (L). were studied on seed germination and seedling emergence of some cultivated crops like *Triticum aestivum* (L), *Zea mays* (L), *Sorghum vulgare* PERS., *Gossypium hirsutum* (L). and *Glycine max* (L).. Seed germination of *Zea mays* (L). was completely inhibited at 2% leaf extract of *Parthenium hysterophorus* (L). and in *Triticum aestivum* (L) it was gradually reduced the seed germination up to the concentration of 10 %. While in *Sorghum vulgare* PERS. it was inhibited at 6 %. At 4 % aqueous extract the maximum inhibition occurred in *Glycine max* (L). and *Gossypium hirsutum* (L). The aqueous extract of *Parthenium hysterophorus* L. were having strong inhibitory effect on the growth of root and shoot development in the cultivated crops except *Triticum aestivum* (L). While on *Sorghum vulgare* PERS., it has shown moderate inhibitory potential.

Keywords:

Cultivated crops, waste weed leaf biomass, Allelopathy, seed germination, Seedling emergence.

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INTRODUCTION

The weeds are commonly dominant, unwanted, undesirable and plant that compete with cultivated crop for water, nutrient and sunlight and another several reasons such as, high growth rate, high reproductive rate and produce harmful allelopathical effect of cultivated crops. (Qasem and Foy 2001). Allelopathy is known as the direct or indirect hazardous or beneficial effects of one plant on the plants through the production of several phytochemicals into the environment (Brown et al. 1991). The allelopathic effect is one of an important mechanism for successful establishment of spreading of weeds (Ridenour and Callaway 2001). This allelopathy has been suggested as a mechanism for the impressive success of invasive plant by control virtual monoculture and may control the ability of particular spreading weed species to become dominants in particular crop plant communities (Hierro 2003, Kanchan and Jayachandra 1979).

Parthenium hysterophorus L. is native to tropical and subtropical America. This plant species is very invasive invader in large extent and it is threatened grassland ecosystem of Australia and India. This weed possesses many hazardous substances and it is very harmful to the surrounding flora, animals and also to human health. It has been already invaded in most of the useful field areas in urban and village. To explore allelopathic potential of *Parthenium hysterophorus* L. we have studied the effect of aqueous extract of leaves using different concentrations on seed germination and seedling growth of five cultivated crop species. The *Parthenium hysterophorus* L. is growing together with these crops and it is more common and dominant plant species.

MATERIALS AND METHODS

Species characters

Parthenium hysterophorus L., family: Asteraceae, Common name – Gajar gawat.

The plant is erect, profusely branched, leafy herbs. Stem hairy, fistular, striate, pubescent, leaves sessile, radical and alternate, hairs are present in both the side, pinnately divided, pubescent on both surface, inflorescence corymbase cymes, involucre bracts are present, two type of flowers are present – male floret on either side, marginal florets female, fertile with white, 3-dentate. Fruit achene's, obovate. This plant is native of tropical America, naturalized and now has become a troublesome weed throughout the region, flowers

and fruits produces in September to December.

Collection of plant Materials:

This weed has collected from Nanded district and plant species identified by using “The Flora of Marathwada”. Herbarium was prepared and stored in Herbarium Section in the Department of Botany, Yeshwant Mahavidyalaya, Nanded (M.S.). From the collected weed, leaves were separated and dried in shade, finely made powder using Mixer grinder. Ten gram of leaf powder was taken in Soxhlet extraction apparatus and extracted in distilled water for six hours. Finely this extract was evaporated and stored in refrigerator for further experiments.

Bioassay:

Different concentrations of aqueous extract of *Parthenium hysterophorus* L. (2, 4, 6, 8, and 10%) were made. One hundred uniform seeds of wheat were kept for germination in sterilized Petri dishes containing double layered blotting paper and seeds were treated with different concentrations of aqueous extracts (2 to 10 %). Each treatment had 3 replicas (total number of tested seeds + 100X 3=300) and one treatment was run as control with distilled water. The Petri-dishes were maintained under laboratory condition for 7 days. Equal volume of distilled water was added in the dishes when moisture content of the blotting paper declined. After 7 days number of germinated seeds were counted and the root and shoot length were measured.

Same procedure was followed to evaluate allelopathic effects of *Parthenium hysterophorus* L. on seed germination and seedling emergence of other selected crop plant i.e. *Zea mays* (L.), *Sorghum vulgare* PERS., *Gossypium hirsutum* (L.) and *Glycine max* (L).

RESULTS AND DISCUSSION

Germination:

The aqueous extract of *Parthenium hysterophorus* L. were studied on the seed germination of five crop plants and results are summarized in **Table No.1**. As concentration of plant extract increases, the percentage of seed germination get inhibited as compared to control in *Triticum aestivum* L. There were maximum inhibition in 10 % aqueous extract in wheat. In *Sorghum vulgare* PERS. the effect of aqueous extract at concentrations from 2 to 6 % seed germination shows inhibitory action. In *Zea mays* L., *Gossypium hirsutum* L., and *Glycine max* L. showing inhibition at the concentration of 2 to 4 %

Table No.1 Effect of aqueous extract of *Parthenium hysterophorus* L. on selected crop Plants

Sr. No.	Crop Plant species	Percent seed germination					
		Aqueous extract of <i>Parthenium hysterophorus</i> L					
		2 %	4%	6%	8%	10%	control
1	<i>Triticum aestivum</i> L.	93	80	53	19	10	95
2	<i>Sorghum vulgare</i> PERS.	66	20	04	-	-	83
3	<i>Zea mays</i> L.	52	-	-	-	-	100
4	<i>Gossypium hirsutum</i> L.	63	04	-	-	-	100
5	<i>Glycine max</i> L.	50	04	-	-	-	93

The results are presented are mean value N=3

while in 6 to 10 % extracts no results were shown at the same experimental conditions.

Seedling growth:

The effect of aqueous extracts of *Parthenium hysterophorus* L. were examined for root, shoot growth and results are summarized in **Table No. 2**. Among all the plant species the concentration of extract increases the root and the shoot length reduces as compare to control (distilled water). The control showing 15.1 and 10.3 cm for root and shoot length respectively. In *Triticum aestivum* L. the root length showing in range of 7.3 to 0.9 cm at the concentration of 2 to 10 % while for shoot length having results in range of 9.7 to 0.5 cm at the concentration of 2 to 4 %. In *Sorghum vulgare* PERS., *Zea mays* L., *Gossypium hirsutum* L. and *Glycine max*L. were showing inhibitory action at 2 to 6 % and there were no results at 6 to 10 % aqueous extract of *Parthenium hysterophorus* L. in the same experimental conditions.

The study demonstrated that leaf extract of *Parthenium hysterophorus* L. exhibited significant inhibitory effects on seed germination and seedling growth in selected plant species. Some earlier work have also reported that the *Parthenium hysterophorus* L. reduces root and shoot length of

Zea mays L. and *Glycine max* L.(Bhatt et al 1994).

Due to the presence of allelochemicals in aqueous extract of *Parthenium hysterophorus* L. showing inhibitory effect on different plant species (Rajan 1973) and the scientist Kanchan in 1975 was the first to reported that presence of plant growth inhibitors in *Parthenium hysterophorus* L. was the reason for alleopathic effect. This plant releases the number of allelochemicals to surround such as phenolic acids, sesquiterpene lactones especially parthenin (Kanchan 1975, Swminathan *et al.*, 1990). Studies also shown that the phenolics compounds found in leaf of *Parthenium hysterophorus* L. have inhibitory effect on nitrogen fixing and nitrifying bacteria (Kanchan and Jayachandra 1979). Present results showed that high concentrated aqueous extract of leaves of *Parthenium hysterophorus* L. inhibited seed germination and seedling emergence of selected crop plants.

CONCLUSION:

The *Zea mays* L. were more sensitive to inhibitory effects of the leaf extract of *Parthenium hysterophorus* L. at 2 to 4 % seed emergence while seed germinations were completely inhibited at 2%

Table No. 2 Effect of aqueous extract on root and shoot length of selected crop plant Seeds.

Treatment	<i>Triticum aestivum</i> L	<i>Sorghum vulgare</i> PERS.	<i>Zea mays</i> L.	<i>Gossypium hirsutum</i> L.	<i>Glycine max</i> L.
Root length (cm.)					
Control	15.1	10.5	18.5	16.2	8.2
2%	7.3	5.2	1.7	1.2	0.9
4%	5.2	3.4	-	0.6	0.3
6%	2.1	1.2	-	-	-
8%	1.7	-	-	-	-
10%	0.9	-	-	-	-
Shoot length(cm.)					
Control	10.3	8.5	16.1	12.4	5.4
2%	9.7	4.9	1.2	0.9	0.5
4%	4.8	2.5	-	0.4	0.5
6%	1.8	0.9	-	-	-
8%	1.2	-	-	-	-
10%	0.5	-	-	-	-

The results were presented in the mean value of n=3

concentration of plant extract. *Sorghum vulgare* PERS., *Zea mays* L., *Gossypium hirsutum* L., *Glycine max* L. seed germination was inhibited completely at 8 to 10 % extract. The extracts showing strong inhibitory effect on root and shoot elongation in *Zea mays* L., *Gossypium hirsutum* L. and *Glycine max* L. at 6 to 10 % aqueous extract. The *Parthenium hysterophorus* L. have potential to inhibit the seed germination and seedling emergence of different plants due to the presence of allelochemicals. In future this plant can be exploited as a good source of natural weedicide to control invasive plant species.

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