



Allelopathic influence of aqueous stem extract of *Parthenium* on growth of maize

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Since 1956 *Parthenium hysterophorus* has spread like wildfire throughout India. It occupies over 35 million hectares of land in the country and has become naturalized and is spreading at an alarming rate all over India (Sushilkumar and Varshney 2010). The easy establishment of *Parthenium* in any ecosystem is attributed to several reasons, such as high growth rate, high reproductive potential, adaptive nature and above all interference by resource depletion and allelopathy. Allelochemicals isolated from *Parthenium* could be used for weed management directly or their chemistry could be used to develop new herbicides. Maize (*Zea mays* L.) is one of the most important cereal crops of India. Hence, the main objective of this study was to determine the allelopathic effects of aqueous extract of stem of *P. hysterophorus* on seed germination and seedling growth of maize under laboratory condition.

A study was conducted to evaluate the allelopathic effect of *P. hysterophorus* on maize in Department of Botany, J. P. University, Chhapra (25° 36' - 26° 15' N latitude and 84° 25' - 85° 15' E longitude), Bihar in the month of May 2016. *P. hysterophorus* plants were collected and stem was cut into 2 - 4 cm pieces and air dried for two weeks. The dried stem was ground into powder using a mixer grinder, and 10 g powder was weighed separately and soaked in 100 ml of distilled water and was mixed thoroughly by glass rod and kept overnight at room temperature to dissolve allelochemicals contents into the solution. After 24 hrs of soaking, extracts were collected by plastic funnel through the filter paper and solution was kept in a conical flask. The stock solution was adjusted accordingly to obtain five different levels of concentrations *ie.* 15, 25, 50, 75 and 100%; and a control was maintained using only distilled water. Healthy seeds of maize (180) were pre-soaked in tap water for 10 hrs. Ten seeds in each Petri dishes of 10 cm diameter with three replicates were used for each concentration. The distilled water

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was used regularly for moistening the seeds. The germination of seeds, radicle and plumule length and fresh weight of seedlings were recorded after seven days.

The rate of seed germination, root: shoot ratio, inhibition in rate of seed germination, relation elongation of root and shoot and seed vigour index (SVI) were calculated. Mean±SE values were calculated. T-test was performed to compare the values of root and shoot length between the values for control condition with different concentrations of stem extract of *P. hysterophorus* such as 15, 25, 50, 75 and 100%. Linear regression equations were developed between values for control condition and in different treatments for root and shoot length. Correlation coefficient values were calculated between shoot and root length values of control condition with the values of different concentrations of stem extract of *Parthenium*.

The per cent seed germination values ranged from 3.33% to 96.7% in different concentrations and 100% in control condition. The values of radicle growth of maize ranged from 0.50 to 9.81 cm in different concentrations compared to 10.5 cm in control treatment. The values of plumule length ranged from 1.5 to 4.15 cm in different concentrations and 6.63 in control condition. The fresh weight of seedlings were 2.4 g in control condition and the maximum value 2.1 g was recorded for 15% and minimum value for 100% treatment (Table 1). The dry weight of seedlings was 0.75 g in control condition and the maximum value 0.66 g was recorded for 25% and minimum value 0 for 100% treatment. R:S ratio values ranged from 0.33 to 3.04 in different concentrations compared to 1.58 in control condition. The minimum value 0.33 was recorded for 100% and maximum value 3.04 for 25% concentrations. The inhibitory effect on seed germination ranged from -3.33 to -96.7% in different concentrations of stem extract. The minimum value was observed -3.33% in 15% and maximum value

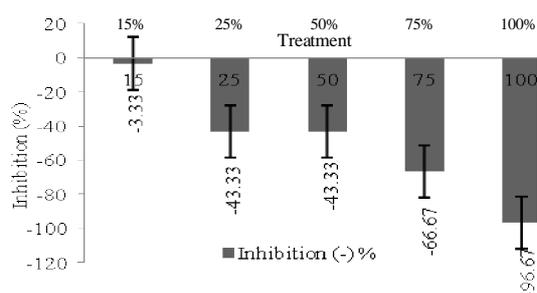


Figure 1. Inhibition (%) of maize

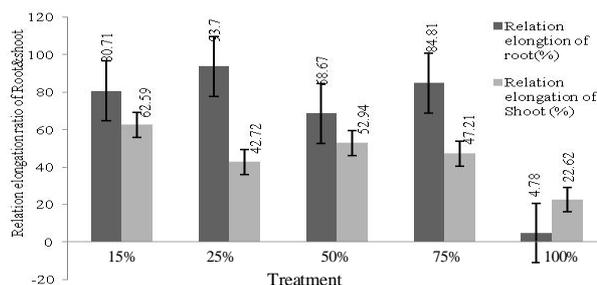


Figure 2. Relation elongation ratio of root and shoot of maize

Table 1. Effect of aqueous extract of *Parthenium hysterophorus* on germination, seedling length, fresh wt., dry wt., r:s ratio and SVI values of maize seeds

Treatment	Germination (%)	Radicle length (cm)	Plumule length (cm)	Fresh wt. (g)	Dry wt. (g)	Root:Shoot ratio	SVI
15%	96.67	8.45 ± 1.43	4.15 ± 1.02	2.07	0.61	2.04	409.63
25%	56.67	9.81 ± 1.4	3.23 ± 0.83	1.9	0.66	3.04	192.85
50%	56.67	7.19 ± 1.36	3.51 ± 0.97	1.40	0.25	2.05	206.10
75%	33.33	8.88 ± 2.54	3.13 ± 1.56	0.53	0.26	2.84	113.20
100%	3.33	0.5 ± 0	1.5 ± 1	0	0	0.33	5.49
Control	100.00	10.47 ± 1.41	6.63 ± 0.49	2.39	0.75	1.58	673.47

Table 2. Linear regression equations for different concentrations of stem extract and shoot and root length

Stem extract concentrations of <i>P. hysterophorus</i>	Root Y= a + bX	Shoot Y= a + bX
15%	8.39 - 0.03x	4.86 - 0.13x
25%	7 + 0.16x	3.62 - 0.11x
50%	2.53 + 0.16x	1.92 - 0x
75%	1.52 + 0.15x	1.23 - 0.07x
100%	-	-0.06 + 0.02x

-96.67% in 100% treatment (Figure 1). The relation elongation ratios of root and shoot were recorded in different concentrations which ranged from 4.78 to 93.70 and 22.62 to 62.59, respectively (Figure 2). The SVI values ranged from 5.49 to 409.63 in 15% to 100% treatments and 673.47 for control condition (Table 1).

The t-test values for root length between control and 15, 25, 50, 75 and 100% were 1.823, 6.01, 6.79 and 13.90, respectively. The values for 50, 75 and 100% were positively highly significant (p=0.001) but other values were not significantly related. The t-test values for shoot length between control condition and different concentrations (15, 25, 50, 75 and 100%) were 2.98, 4.723, 6.70, 8.44 and 11.90, respectively.

In the present study there were strong inhibition in seed germination and seedling growth of maize by stem extracts of *P. hysterophorus* (Table 2). Bajwa *et al.* (2003) have reported that germination of maize was reduced by 20-25% due to aqueous extract of *P. hysterophorus*. Devi *et al.* (2014) have shown the

seed germination and seedling growth of maize were significantly decreased by leaf and stem extract of *Parthenium*.

SUMMARY

An experiment was done to see the allelopathic effect of *Parthenium hysterophorus* on the seed germination and seedling growth of maize (*Zea mays*) in laboratory conditions. The results showed that seed germination was negatively affected by the aqueous stem extract of *Parthenium* in different concentrations (15, 25, 50, 75 and 100%) when compared to control condition. Seed germination in control was 100% whereas this value was 3.33% in 100% of stem extract. Stem extract of *P. hysterophorus* on shoot length was more affected than the root length. T-test values for root length between control and 50, 75 and 100% were positively and significantly different at p<0.001; and for shoot length these values for different treatments were significantly different at p<0.001.

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