



Allelopathic effect of *Parthenium* liquid extract on mung bean germination ability and early growth

Shah Khalid^{1*}, Imranuddin¹, Nadia¹, Faisal Nadeem⁵, Saddamullah⁴, M. Aamir³, Farman Ghani³

¹Department of Agronomy, The University of Agriculture Peshawar, Pakistan

²Department of Agronomy, Amir Muhammad Khan campus, Mardan, Pakistan

³Department of Horticulture, Amir Muhammad Khan campus, Mardan, Pakistan

⁴Department of Horticulture, The University of Agriculture Peshawar, Pakistan

⁵Livestock Research and Development Station, Surezai, Peshawar, Pakistan

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Abstract

Allelopathy is the most dangerous weapon acquired by most of the weeds plants to compete with crops, and suppressed their growth, but their level of toxicity and its effect is different (among crops to crops, weeds to weeds and part to part), so therefore to study the allelopathic effect of *Parthenium hysterophorus* on mung bean, a laboratory experiment was carried out at the university of Peshawar, Pakistan during 2016. Four different liquid extracts (2%, 4%, 8% and 10%) of three different parts (leaf, stem, and root) along with one control (only water) were used in the experiment as treatments along with control (water spray only). The treatments were repeated three times in complete randomized design. The results showed that all the treatments severely decreased germination %, stem, root length, seedling growth, percent stem and root elongation as compared to control (water spray only). Application of 10% liquid extract of all the three parts completely suppressed, all the studied parameters, germination (0), shoot (0), root length (0) and seedling growth (0), followed by 8%, 4%, 2% as compared to control where germination (95%), root (3.4cm), stem length (3.53cm), and seedling growth (6.93) was recorded. In case of different parts, leaf extract, shown higher inhibitory effect followed by root and stem in all parameters. From the results, it is concluded that *Parthenium* liquid extract negatively affected mung bean growth and should need to be eradicated, to ensure higher germination and seedling growth of mung bean.

*Corresponding Author: Shah Khalid ✉ khalidmashaal@aup.edu.pk

Introduction

Whenever there is a community of plants grown together, they compete with each other for different life sustaining requirements like sunlight, nutrients, water and air, this competition may be intraspecific or interspecific, among the interspecific competition many times one species released poisons chemical from their body to suffer the growth of the other neighbor species, this phenomena is known as allelopathy, among these species one of them is the *Parthenium hysterophorus* which have the capability to prevent the growth rate of the neighborcrop. *Partheniumhysterophorus*L is one of the worst weeds of family Asteraceae, which affecting the productivity of the crops. *Parthenium hysterophorus* is, native to tropical area of America and Mexico but it is now tremendously increase world widely especially in Pakistan and india. *Parthenium* is not only harmful for our but also create health problem foe the human being as well as their cattle. (Adkins and Navie,2006). It is one of the top ranking weed of the world (Singla, 1992). Is difficult to control because of it high growth rate, adoptability with wide range of soil type, high competitiveness.

The invasive capacity and its allelopathy characteristic is considered is a big treat to destroy the natural ecosystem Evans (1997). The intrusive nature of this alien weed is clear from the it capability to destroyed the other plant and create a big sole culture stand and none of the other crop to allowed to grow nearby (Riaz and Javaid, 2009). Allelochemicals are basically the plant secondary compound which are released to the surrounding by the process of the decomposition of the residues, vitalization, and or as exudates (Khalaj *et al.*, 2013). The most common effects of the allelochemicals on the plant are reduction in percent germination and rate of germination, reduction in root or/ and stem length injuring of the root tips, lack of chlorophyll, boost seminal root, decline dry matter accumulation, increased sterility in crop (Bhadoria, 2011).

For the natural ecosystem and native species, the most dangerousare the attacked of those species

which have the ability to produce a large number of seed, have high competitive effect as well as quickly adoption to new environment Kathiresan (2004). The aims of this study were to study the response of mung bean toward *Parthenium* extract and it most toxic level.

Materials and Methods

Experimental site

To investigate the effect of *P. hysterophorus* on germination and growth of leguminous crop (mung bean), a lab experiment was conducted at the Agriculture University Peshawar, Pakistan during 2016.

Materials collection

Fresh *Parthenium* plants were uprooted during flowering stage at the malaknddher research farm, The Agriculture University Peshawar, Pakistan. The uprooted *P. hysterophorus* plants were clean with tap water and divided into stem + branches, leaves and roots and keep in sunlight light for one week, to evaporate the excess water and become suitable to keep in an oven, after heating in an oven for 24 hours, the sample was taken out from the oven and grinded the samples separately by grinder machine. After that 10grams of grinded sample of each part was blended in 100ml of distilled water for 24hours, after that, blended materials of each parts were passed through a muslin cloth followed by filtration through Whitman No. 1 filter paper, to get 10% concentrated solution of stem, roots and leaves, after that the four different low concentrations (8%, 4% and 2%) of extract of each part was made from the stock material by adding proper amount of distilled water respectively. An experiment four different levels of extract of each part along with one control (which is the application of equal quantity of distilled water only). Fifteen seeds of mung bean of local verity was keep on bed of paper in 9cm diameter of cans. Five ml of liquid extract was sprayed on each petri dish. All the treatment was repeated three times. And keep in a germinator at room temperature, equal quantity of distilled water was applied to each petri dishes to prevent dryness.

Data collection

After one week the data was taken on the following parameters, germination %, root length, shoot length, seedling growth, percent stem and root elongation.

Results and discussion

Germination (%)

Data regarding germination percentage is shown in the Table 1. Statistical analysis of the data showed that all concentrations of each part of the *Parthenium* showed inhibitory affect as compared to control. Mean data revealed that increased in concentration of liquid extract of stem, root and leaves, a gradual decrease was occurred up to zero at 10% of liquid extract of each parts. Infect, all parts showed inhibitory effect on mung bean crop but the stronger

inhibitory effect was observed in case of leaf extract. Higher germination (95%) was observed in case of control (water spray only) followed by 2%, 4% and 8% extracts and no germination was recorded in 10% extract concentration of all parts. These results are in line with the results of Bajwa *et al.* 2004. The reduction in seed germination might be due the fact of presence of water soluble inhibitors (Hussain and Abidi, 1991). During seed germination metabolic activity increase and can be affected by different factors, one of them is the contamination by allelochemicals (Kolesnichenko and Aleikina, 1976), it might decrease the performance of the plant hormone and reduced photosynthetic process (Kefeli and Turetskayan, 1976) and (Barkosky *et al.*, 1999).

Table 1. Effect of liquid extract of *Parthenium* parts of various concentration on mung bean germination and growth parameters.

Plant parts	Germination(%)	Root length (cm)	Stem length (cm)	Seedling growth
Control	95.0a	3.53 a	3.4a	6.93 a
	78.3bc	2.0 d	0.36 cd	2.36 de
Leaf	57.3d	1.20 e	0.33 cd	1.53 g
	19.0 e	0.63 f	0.23 de	0.86 h
	0.00f	0.00 g	0.00 e	0.00 i
Stem	81.0 b	3.16 ab	0.76 b	3.93 b
	62.3d	2.53 c	0.36 cd	2.90 cd
	21.0e	1.76 d	0.26 de	2.03 f
	0.0 f	0.00 g	0.00 e	0.00 i
Roots	79.6b	2.83 bc	0.53 bc	3.20 c
	70.6c	1.83 d	0.40 cd	2.16 ef
	20.0e	1.00 ef	0.23 de	1.23 gh
	0.0 f	0.00 g	0.00 e	0.00 i
LSD	9.88	0.50	0.33	0.51

Root length (cm)

Data regarding root length is shown in table 1. Statically analysis revealed a big variation among treatments, higher root length (6.1cm) was recorded for control(water spray only), while lowest (0cm) was observed in 10% concentration of each part. Results showed that all the concentration showed a decrease in root length, the stronger inhibitory effect was observed with application of 10% concentration, followed by 8%, 4% and 2%. Among different parts,

leaf extract, cause severe reduction in root length, followed by roots while lower effect was observed in case of stem extract. The reduction in root length was also reported by (Shabbir and Javed 2010), they reported that increase in concentration, decrease occur inroot length. The reduction in root length might be due to reduction in mitotic division in the root system (Bukolova 1971) which may cause reduction in root length, the toxic effect of allelochemicals is due the existence of the

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electrophilic and nucleophilic system, which may change the configuration and activity of certain protein (Macias *et al.* 1992). Oudhia,(2000) also concluded that *Parthenium* extract had inhibitory effect on the root length.

Shoot length (cm)

Analysis of the shoot length showed that *Parthenium* extract were significantly affected the shoot length of mung bean. All plant parts concentration were significantly affected mung bean shoot length, stronger inhibitory effect on shoot length (0cm) was

observed when the 10% concentration was used, followed by 8% (0.23cm) and 6% (.37cm), while the longest shoot (3.5cm) was recorded with control (water spray only). Among different parts, leaf extract was generally showed high inhibitory effect on shoot length of mung bean as compared to root and shoot's extracts. These results are in line with Shinde, (2016), who reported that *Parthenium* extract have inhibitory effect on shoot length and also concluded that different parts of the plant have different level of toxicity.

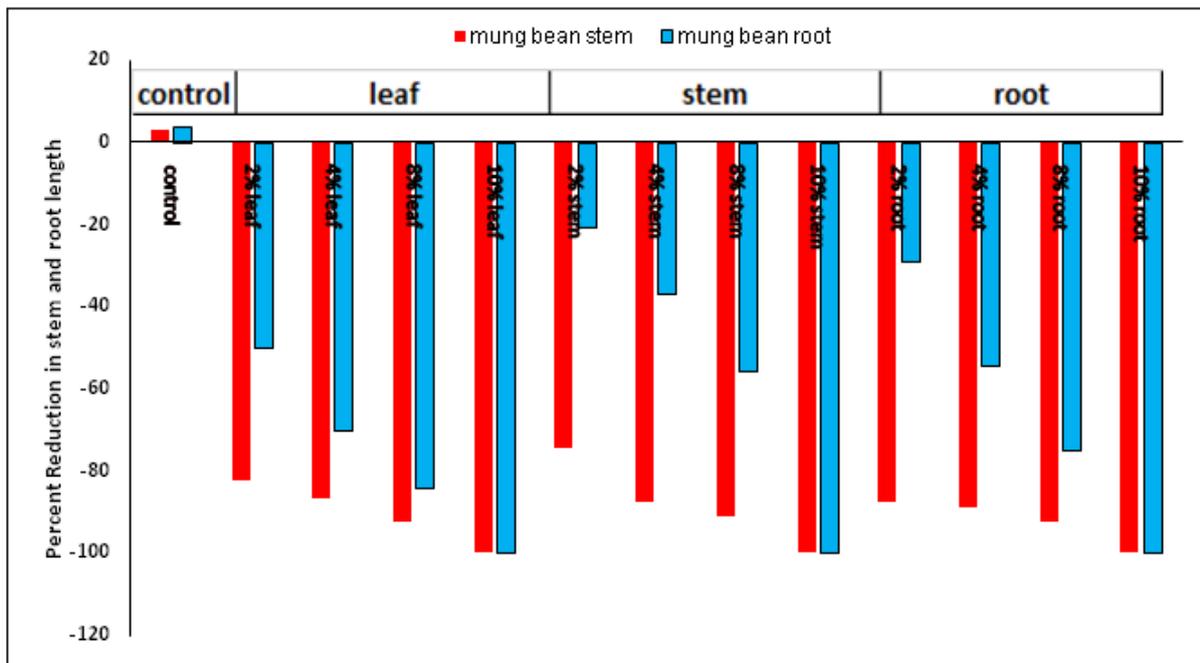


Fig. 1. Allopathic effect of *Parthenium* liquid extract (different level and parts) on percent stem and root length reduction.

Seedling growth

Data regarding seedling growth shown in the Table 1. Statistical analysis of the data revealed that *Parthenium* liquid extract, severely affected seedling growth as compare to control (water used only), the mean data showed that seedling growth was gradually decreased up to zero with increase in concentration of *Parthenium* extract. Seedling growth was decreased by all the concentrations but the effect of leaf extract was higher than that of roots and shoots extracts. The results in line with Netsere and Mendesil, 2011, they concluded that plant parts have different level of allopathic capacity. This might be due to the released

of the different kind of chemical compounds like lactones, phenolic, sesquiterpenes from the aerial as well underground parts of the plant exudation (Guzman, 1988) and leaching (Mersie and Singh, 1987; Evans, 1997; Belz *et al.*, 2007),

Shoot length reduction(%)

Data regarding percent shoot length reduction is shown in Fig. 1. The Fig. 1 revealed that all concentrations of all parts were negatively affected shoot length. Data showed that as the concentration increased as result shoot length decreased continuously, the highest % reduction

(100%) was observed in case of 10% concentrated liquid extract, followed by 8% and 4% while the lowest % reduction was recorded in case of 2% extract of each part of *Parthenium*. Fig.1 shown that leaf extract show more strong negative effect on the shoot elongation as compared to same concentration of shoot and roots. The findings are in line with Tefera (2002) and Maharajan *et al.* (2007) on soyabean (*Glycine max* L.) and haricot bean, (*Phaseolus vulgaris* L.), Eragrostistef respectively. They reported inhibitory effect of *Parthenium* extract on the shoot length. Singh *et al.* (2005) and Wakjira *et al.* (2005) also reported the inhibitory effect of *Parthenium* on Brassica, Soyabean and haricot bean on shoot length. Netsere and Mendesil (2011) reported that leaf extract have more inhibitory effect as compare to shoot and root extract.

Root length reduction (%)

Data on the percent reduction in root length is shown in Fig. 1. *Parthenium* spp. extract also severely affect the root length. A clear difference was observed in tram of root length among different concentration as compared to control(water spray only). Continuous reduction in root length was observed as the concentration was increased, highest percent reduction was observed incaseof10% extract application while the lowest effect was observed in incase of 2% extract application.

The fact behind the root reduction might be the more attachment of the root to the extract. These results are in line with Tefera (2002), Singh *et al.* (2005), Wakjira *et al.* (2005), Netsere and Mendesil (2011) they reported inhibitory effect of the *Parthenium* on Brassica species, Eragrostistefzucc, Soybean and Haricot bean root length.

Conclusion

From this experiment, it is concluded that *Parthenium hysterophorus* L. has strong allelopathic properties. All liquid extracts of leaf, stem and roots of *Parthenium hysterophorus* L. highly inhibit mung bean germination, root length, shoot length and seedling growth, especially by leaf extract.

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