Effect of *Parthenium hysterophorus* ash on growth and biomass of *Phaseolus mungo*

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Abstract: The aim of the study was to find the effect of *Parthenium hysterophorus* ash on germination, plumule and radicle length and biomass production of *Phaseolus mungo*. The study revealed that among the concentrations used 1% has enhanced germination, plumule and radicle length and biomass production and reduced with increasing higher concentration of aqueous solution. However, higher concentration over 3% suppressed all growth activities. Although the growth parameters when compared with control showed best in control. The study concluded that increasing concentration of ash has adverse effect on germination, radicle and plumule length, biomass of *P. mungo* than the control. Therefore, burning of *P. hysterophorus* should be avoided in the agricultural field to enhance over all productivity of *P. mungo* [Academia Arena, 2010; 2 (1):98-102]. (ISSN 1553-992X).

Keywords: Toxic effect, radicle, plumule, biomass

1. Introduction

Parthenium hysterophorus L. commonly known as carrot weed, white top, chatak chandani Congress grass, star weed. The plant belongs to the division Magnoliophyta, class: Magnoliopsida, Order: Asterales and family: Asteraceae. The species is distributed in Argentina, Australia, Bangladesh, China, Cuba, Dominican Republic, Ethiopia, Haiti, Honduras, India, Jamaica, Madagascar, Mauritius, Mexico, Mozambique, Nepal, New Caledonia, Pakistan, Papua New Guinea, Puerto Rico, South Africa, Sri Lanka, Swaziland, Trinidad, the United States of America, Venezuela, Vietnam and West Indies. *Parthenium* probably entered India before 1910 (through contaminated cereal grain), but went unrecorded until 1956. Since 1956, the weed has spread like wildfire throughout India. It occupies over 5 million hectare of land in the country. *Parthenium* grows well in wastelands, forestlands, agricultural areas, scrub/shrub lands, overgrazed pastures and along roadsides. It tolerates a wide variety of soil types and prefers alkaline, clay loam to heavy black clay soils. The well growth of plant occurs, where the annual rainfall is greater than 500 mm and falls dominantly in summer.

P. hysterophorus due to its invasive capacity destroyed its natural ecosystems. It has changed native habitat in Australian grasslands, open woodlands, river banks and floodplains (Mc Fadyen, 1992; Chippendale & Panetta, 1994). In national wildlife parks southern of India its invasiveness have been observed (Evans, 1997). From the emanation of allelochemicals, plants can regulate the soil microbial community in their immediate vicinity, affect herbivory, encourage beneficial symbiosis, change the chemical and physical properties of the surrounding environment, and directly inhibit the growth of competing plant species (Pedrol *et al.,* 2006).

Allelopathic compounds play important roles in the determination of plant diversity, dominance, succession, and climax of natural vegetation and in the plant productivity of agro ecosystems. Allelopathy also may be one of several attributes which enable a plant to establish in a new ecosystem (Callaway and Aschehoug 2000; Callaway and Ridenour, 2004).

The *P. hysterophorus* become a widespread weed in the Himalayan zone of Garhwal. Presently the weed is a major problem in the agriculture filed of Garhwal Himalaya. The species start their growth before rainy season and cover whole area of agriculture field, which suppressed the growth of other herbaceous vegetation also. Before Kharif crop *P. hysterophorus* remain covered with their peak growth in agricultural land. People through ploughing in agriculture uproot *P. hysterophorus* collect and burned in the agriculture filed. In the kharif crop due to climatic variability the rains are very less and people prefer to grow *Phaseolus moongo* in the many areas of the Garhwal Himalaya. The large scale burned ash of *P. hysterophours* remained with the sown crop in the agriculture filed. Before carried out the experiment the hypothesis was developed that; 1) is *P hysterophorus* ash has any effect on the germination, radicle and plumule and biomass production of *P. moongo*. Therefore the present study was aimed to find out effect of ash on seed germination, plumule and radicle and biomass production of *P. moongo*

2. Materials and Methods

The study was conducted in the Laboratory of Department of Forestry, HNB Garhwal University, Srinagar. The experiment was carried out in bioassay culture. In bioassay culture the collected naturally burned ash of *P. hysterophorus* form the agriculture filed was collected. A powder ash of 1g, 3g, 5g, 7g and 9g and was weighed and added each to 100 ml of double distilled water for 1%, 3%, 5%, 7% and 9% concentration and kept at room temperature (22-25 °C) for 24 hours. The solutions were filtered through Whatman No. 1 filter paper and stored in dark cool place for use. 10 seeds in each Petri Dishes of 15cm diameter (Fig.1) with three replicates were used for each concentration. The aqueous extracts were used regularly for moisten the seeds. A separate series of control was set up using distilled water. The germination of seeds, plumue and radicle length and biomass of seedling were counted every day for 7 days.

3. Results

The results of the study indicated that among the concentrations, the highest values of radicle and plumule growth of *P. moong*o were in the control. The concentration of 1% gave the second larger values of radicle and plumule length, which further reduced in 3% concentration. Onwards 3% concentration of ash aqueous solution no germination, plumule and radicle length was recorded (Table.1 Fig.1). Similar as radicle and plumule length, the biomass of seedling was also estimated for fresh weight and dry weight. Among the concentrations the highest moisture percentage was in 1% followed by 3 % however both the values were lower then the control. The biomass was also reduced with increasing concentration of aqueous Solution.

Table.1 Effect of *P. hysterophorus* ash on germination, plumule and radicle length and biomass of *P. mungo*

Control	Germination (%)	Radicle Length (cm)	Plumule Length (cm)	Biomass		Moisture (%)
				Fresh weight (g)	Dry weight (g)	
Control	100	9.28	16.40	3.33	0.32	90.99
1%	100	3.87	8.63	1.97	0.30	83.76
3%	100	1.64	3.13	0.47	0.17	62.79
5%	-	-	-	-	-	-
7%	-	-	-	-	-	-
9%	-	-	-	-	-	-

4. Discussion

The allelopathic nature of *P. hysterophorus* has been well documented and water soluble phenolics and sesquiterpene lactones have been reported from the roots, stems, leaves, inflorescences, pollen and seeds (Evans, 1997). Rajan (1973) and Kanchan (1975) were the first to report the presence of plant growth inhibitors in parthenium weed, and the latter identified parthenin, caffeic acid and *p*-coumaric acid as the primary inhibitors in stem tissues. Kanchan and Jayachandra (1979) also found that these inhibitors were present in root exudates and could be extracted from the leaves of *P. hysterophorus* (Kanchan & Jayachandra, 1980a). In addition, a range of phenolics, including caffeic acid, ferulic acid, vanicillic acid, anisic acid and fumaric acid were found in air-dried root and leaf material. Srivastava *et al.* (1985) reported that that aqueous extracts of leaves and inflorescences inhibited the germination and seedling growth of barley, wheat and peas. Kohli *et al.* (1985) suggested that two allelochemicals acting synergistically were responsible for the significant decrease in seed germination and subsequent growth of cabbage, when placed in leaf and inflorescence leachates from parthenium weed. Patil and Hedge (1988) isolated and purified parthenin from leaves of *P. hysterophorus* and demonstrated that this compound significantly decreased the germination of wheat seeds and adversely affected seedling growth. The allelopathic effects have been shown with foliar leachates of *P. hysterophorus* on a diverse range of agricultural and tree crops: cowpea, sunflower, *Casuarina*, *Acacia*, *Eucalyptus* and *Leucaena* (Swaminathan *et al.*, 1990); rice, wheat, black gram and chickpeas (Singh & Sangeeta, 1991); green gram and wheat (Agarwal & Anand, 1992); barley and *Cassia tora* (Singh *et al.*, 1992); mung beans and guar (Kohli & Rani, 1992); various species of Indian forage crops, pulses and oil seeds (Aggarwal & Kohli, 1992); sorghum (Ayala *et al.*, 1994); maize, ragi (*Eleusine oracana*; Eragrostidae) and soyabeans (Bhatt *et al.*, 1994); sunflower, french beans and cotton Madhu *et al.*, 1995); radish

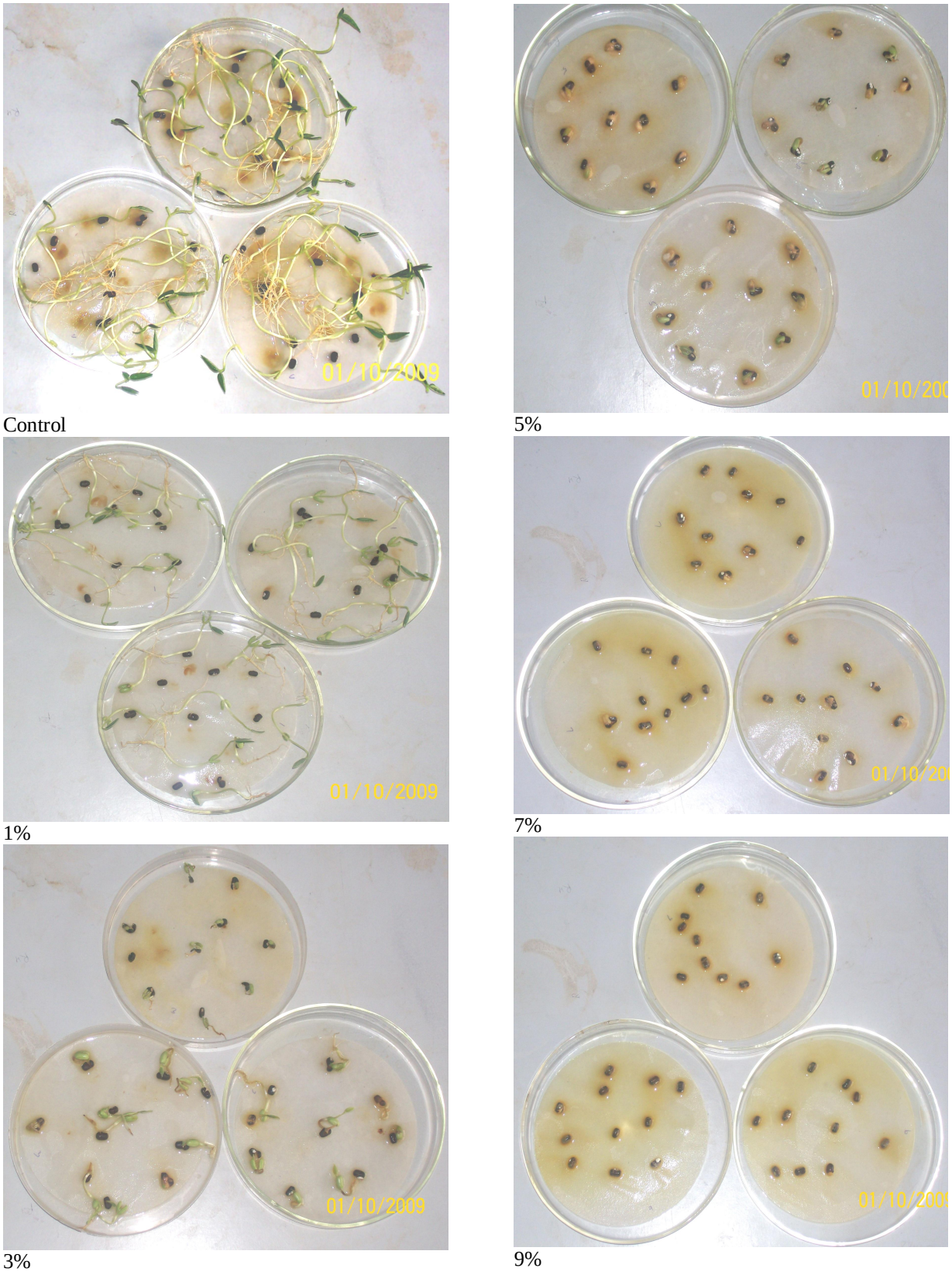

Figure. 1. Growth performance of *P. mungo* in different concentration of *P. hysterophorus* ash

(Mehta *et al.*, 1995); okra, chilli peppers and clover (Dhawan & Dhawan, 1995a), have demonstrated that the germination and yields of traditional Indian pulse crops (guar, black and green gram) were reduced when these were grown in soils previously infested by parthenium weed.

5. Conclusion

The study could be concluded that increasing concentration of ash reduced the germination, radicle and plumule length, biomass and moisture content of *P. moongo* than the control. Therefore, it is suggested that after ploughing *P. hysterophorus* should not be burned in the agricultural filed to reduce over all productivity of *P. moongo*.

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