American-Eurasian J. Agric. & Environ. Sci., 9 (2): 145-148, 2010
ISSN 1818-6769

Influence of *Parthenium hysterophorus* Ash on the Growth of *Phaseolus mungo*

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Abstract: The experiment was carried out to understand the effect of ash content of *Parthenium hysterophorus* on the growth performance of *Phaseolus mungo* burned in the agricultural field. In the study different concentrations of ash used and compared with control. The study revealed that higher concentrations of ash have negative effect on the growth of *P. mungo* than lower concentration. The study suggests that burning of *P. hysterophorus* should be avoided in the agricultural field to enhance over all productivity of *P. mungo*.

Key words: Allelopathy · Ash concentration · Growth · Radicle and plumule · Root and shoot

INTRODUCTION

Parthenium hysterophorus and its invasiveness have a capacity to destroy of its natural ecosystems. In Australia it has changed native habitat of grasslands, open woodlands, river banks and floodplains [1]. The released chemical compounds of *P. hysterophorus* in the soil play an important role in the determination of plant diversity, dominance, succession and plant productivity. Since beginning to till today, *P. hysterophorus* become a widespread weed in the Garhwal Himalaya and now become a major weed in the agriculture and other lands of this region. *P. hysterophorus* species grows before rainy season and within short period cover whole area of agriculture field, which suppress growth of other herbaceous species. In the fallow period between rabie and kharif crops, *P. hysterophorus* become aggressive in their peak growth period. During the ploughing people uproot *P. hysterophorus*, collect and burn in the agriculture field result in the ash of *P. hysterophorus* mixed in the soil. Due to climatic variability low moisture condition turn the soil into drier condition and forced people to prefer *P. mungo* is agriculture field. To understand the effect of ash on the growth performance of *P. mungo*, two different experiments were conducted one in the laboratory under control condition in the germinator and another in the polypot in natural field condition.

MATERIALS AND METHODS

Both the experiments (laboratory and field) were conducted in the Department of Forestry. The burned ash of *P. hysterophorus* was collected from the agriculture field. A powder ash of 1, 3, 5 and 7g was added each in 100 ml of double distilled water for 1, 3, 5 and 7% concentrations and left over night at the room temperature (22-25°C) to release chemical contents in the solution. The solutions were filtered with filter paper and stored in dark cool place for use. Ten seeds in each petri dish and polyopots with three replicates were used of each concentration and aqueous extracts were used regularly to moisten the seeds. A separate series of control was set up using distilled water. The experiment was conducted for 7 days and a further experiment was stopped.

The polypot study was conducted in the month of October 2009. The temperature ranges from 20-25°C. Water was maintained regularly to avoid any damage to the plants. The experiment was established for short duration (10 days) to observed primitive growth performance of *P. mungo*.

The aim of the study was to aware farmers of the ill effect of burned as of *P. hysterophorus* on the *P. mungo* and suggests the possible measures.

RESULTS AND DISCUSSION

Laboratory Experiment: The germination of seeds in 1%, 3% and control was 100 % (Fig. 1). The highest values of radicle and plumule length of *P. mungo* were in the control followed by 1% and 3%. Onward 3% no germination, plumule and radicle length was recorded (Fig. 1).

Polypot Experiment: The germination in polypot was the highest (86.33%) in 1% ash concentration followed by 83.33 % in 3%, 46.67% in 5% and the lowest 40% in

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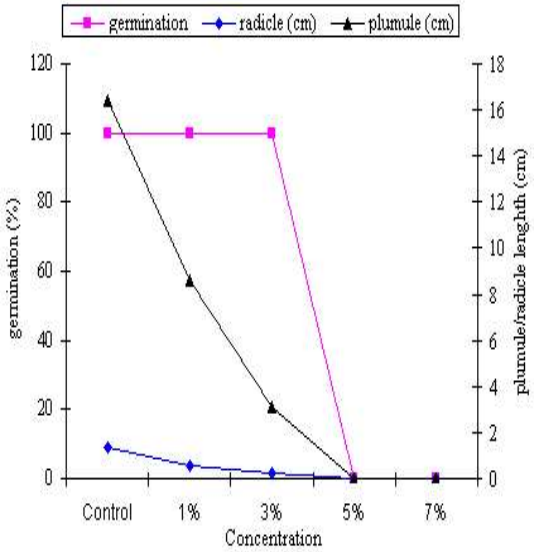


Fig. 1: Germination, radicle and plumule length of *P. mungo* in different concentration of *P. hysterophorus* ash in laboratory

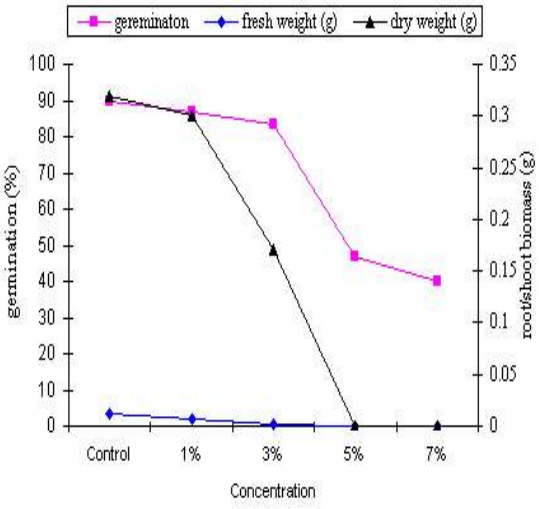


Fig. 2: Germination, fresh weight and dry weight, (root/shoot biomass) of *P. mungo* in different concentration of *P. hysterophorus* ash in polypot

the 7% concentration. All concentrations compared to control (90%) were toxic to the germination of *P. mungo* (Fig. 2). The biomass (fresh weight and dry weight) of root and shoot is shown in Fig. 2.

The root and shoot length of *P. mungo* was maximum in 1% which reduced in 3%, 5% and the minimum in 7 % (Fig. 3). However, root and shoot length in each concentration reduced over control.

Both experiments (laboratory and field) revealed that the ash content of *P. hysterophorus* has negative effect on the growth of *P. mungo*.

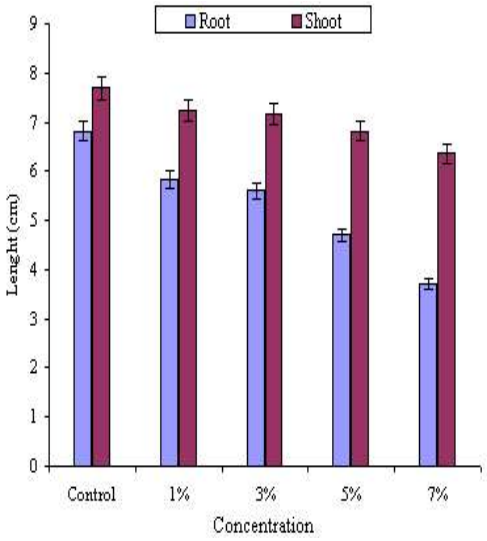
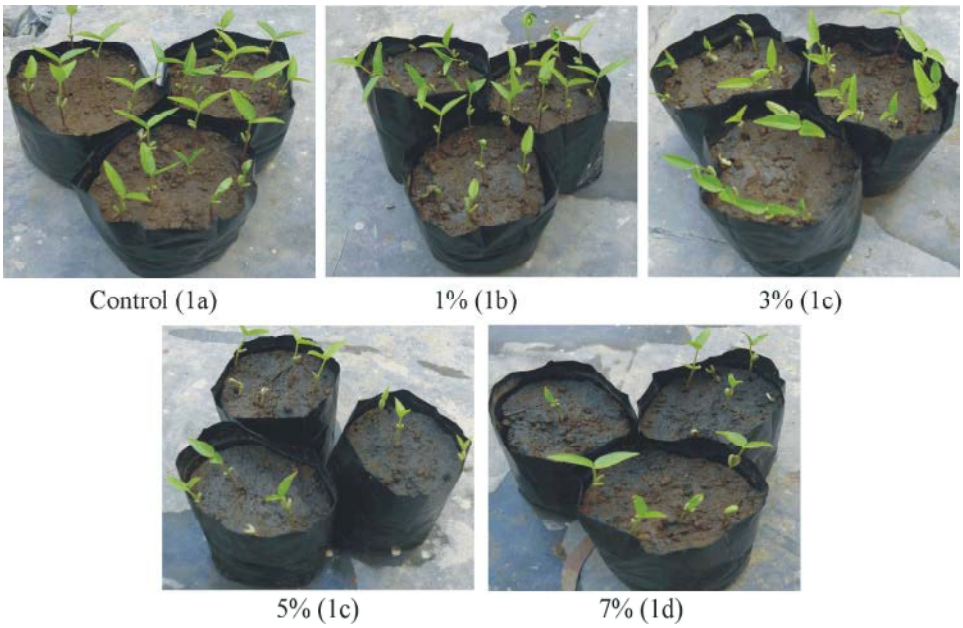


Fig. 3: Root and shoot length of *P. mungo* in different concentration of *P. hysterophorus* ash in polypot

Photographs of polypot (Photo 1a to1e), clear show that the lower concentration has less effect on the growth of *P. mungo* however, increasing concentration was more toxic.

The allelopathic nature of *P. hysterophorus* has been well documented. The water soluble phenolics and sesquiterpene lactones have been reported from the roots, stems, leaves, inflorescences, pollen and seeds [2]. Rajan [3] and Kanchan [4] 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. 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.* [5] reported that aqueous extracts of leaves and inflorescences of *P. hysterophorus* inhibited the germination and seedling growth of barley, wheat and peas crops. Kohli *et al.* [6] 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. The allelopathic effects of *P. hysterophorus* on agricultural crops: rice, wheat, black gram and chickpeas [7]; green gram and wheat [8]; barley and *Cassia tora* [9]; mung beans and guar [10]; various species of Indian forage crops, pulses and oil seeds [11]; maize, ragi (*Eleusine oracana*; Eragrostidae) and soybean [12]; 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.



Photographs show the growth of *P. mungo* in ash concentration of *P. hysterophorus* and control

CONCLUSION

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

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