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ALLELOPATHIC EFFECTS OF AQUEOUS EXTRACT OF LEAVES OF ABUTILON INDICUM (L.) SWEET AND PARTHENIUM HYSTEROPHORUS L. ON SEED GERMINATION AND SEEDLING GROWTH OF BARLEY

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ABSTRACT

Allelopathic effect of 3% aqueous extracts of fresh leaves of *Abutilon indicum* (L.) Sweet and *Parthenium hysterophorus* L. were studied on seed germination and seedling growth of barley (*Hordeum vulgare* L. local var. RD 2035). Seeds were allowed to grow in petri-dishes contains 3% leaf extracts of *A. indicum* and *P. hysterophorus.* The result indicated that seedling growth was promoted by *A. indicum* while suppressed by *P. hysterophorus*. Seed germination was not affected by *A. indicum* whereas inhibited by *P. hysterophorus*.

KEY WORDS: **Allelopathy, leaf extracts, germination, growth**

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INTRODUCTION

A successful establishment of a weed 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 allelopathy9. Allelopathy concerns the effects of one plant on another due to chemicals released by them, or the breakdown products of their metabolites19. The allelochemicals are produced by all kinds of plants and plant parts although roots and leaves were mainly responsible for their production and release2. Allelopathy plays a major role in influencing the productivity of agroecosystem through inhibitory or stimulatory interactions. *Abutilon indicum* (L.) Sweet (family: Malvaceae) and *Parthenium hysterophorus* L. (family: Asteraceae) are prominent weed of canal irrigated area of North-West Rajasthan. Therefore an experiment was conducted to investigate the allelopathic effect of leaf extracts of *A. indicum* and *P. hysterophorus* on seed germination and seedling growth of barley.

MATERIALS AND METHODS

Fresh leaves of *A. indicum* and *P. hysterophorus* in its vegetative stage were collected from agricultural field near government college, Nohar. Three grams of leaves of *A. indicum* was ground, mixed with 100 ml distilled water and left for 24 h in dark at the room temperature (average during day: 25ºC) for extraction. Aqueous extract was obtained as filtrate of the mixture and final volume was adjusted to 100 ml, this gave 3% aqueous extract. The same procedure was repeated for obtaining 3% aqueous extract of *P. hysterophorus.* Seeds were soaked in 2% sodium hypochlorite for 15 minutes and thoroughly washed with distilled water. The seeds were germinated in distilled water (control) and leaf extracts (*A.indicum* and *P.* hysterophorus) in sterilized petri-dishes lined double with blotting papers and kept at room temperature and diffused light during the day for one week with three replications. Ten seeds were taken in each replicate. After one week, number of germinated seeds were counted and, the root and shoot length were measured. All seedlings from each petri-dish were oven dried at 70ºC for 48 h to get dry weight of seedlings. Significance of the difference in germination, root and shoot length of seedlings under different treatments was tested and compared using Analysis of Variance (ANOVA) by direct method.

RESULTS AND DISCUSSION

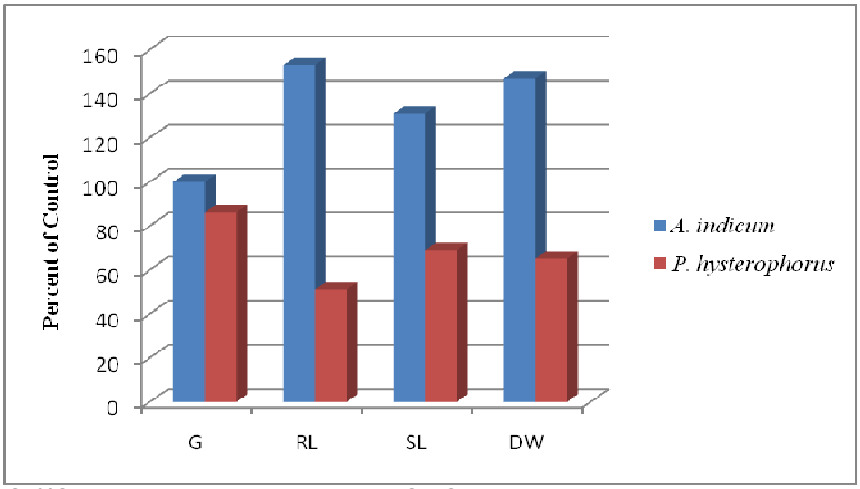
The effect of leaf extracts of *A. indicum* and *P. hysterophorus on* seed germination and seedling growth of barley is presented in table 1. The results indicated that *A. indicum* significantly increased seedling growth while *P. hysterophorus* significantly decreased germination and seedling growth.

Table 1
Impact of aqueous extract of leaves of A. indicum and P. hysterophorus on seed germination and seedling growth of barley

Growth parameters	Control	*A. indicum*	*P. hysterophorus*
Germination (%)	96.66	96.66	86.50*
Root length (cm)	5.71±0.09	8.72*±0.09	2.94**±0.05
Shoot length (cm)	8.05±0.02	10.53**±0.04	5.56**±0.06
Total dry weight (g)	0.223±0.004	0.328**±0.01	0.146**±0.002

Mean ± SE, * - Significant at 5% level, ** - Significant at 1% level

Figure 1
Impact of aqueous extracts of A. indicum and P. hysterophorus on barley



G- %Germination, RL- Root length (cm), SL- Shoot length (cm), DW- Dry weight

The % germination was not affected by *A. indicum* while % germination was 86% of control in *P. hysterophorus.* The root length increased to 153% of control in *A. indicum* whereas, it remained only 51% in *P .hysterophorus*. In case of shoot the length was 131% and 69% of control in *A. indicum* and *P. hysterophorus* respectively. Likewise dry weight also increased to 147% in *A. indicum* while it remained only 65% of control in *P. hysterophorus* (Fig. 1). The present study confirmed the allelopathic potential of *A. indicum* and *P. hysterophorus*. Tefera18 found that the inhibitory allelopathic impact of leaf extract was more powerful than of other vegetative parts. Phytochemical analysis had already reported high accumulation of growth inhibitors in leaves of *P. hysterophorus*6. Earlier works have also reported that the foliar leachates of *P. hysterophorus* reduced root and shoot elongation of *Oryza sativa* and wheat14, maize and soyabeans3 as well as some common Australian pasture grasses1. This indicates the availability of the inhibitory chemicals in higher concentration in leaves than in stem and roots7. Srivastava *et al.*15 revealed that aqueous extracts of leaves and inflorescences inhibited the germination and seedling growth of barley, wheat and peas. The present study also verified that leaf aqueous extracts of *P. hysterophorus* exhibited significant inhibitory effects on seed germination and seedling growth of barley. Results indicated that root elongation was affected more than of the shoot (Table 1, Fig. 1). Similar effect of leaf aqueous extract of *P. hysterophorus* was reported by Tefera18 on *Eragostis tef* and Rajan12 on wheat. The strong inhibitory effects that *P. hysterophorus* had on root elongation might be due to direct contact of root with the extract and subsequently with inhibitory chemicals as described in early works with various crops and weeds4. The inhibitory effect of *P. hysterophorus* on seed germination and seedling growth of different plant species is due to presence of growth inhibitors (allelochemicals) in the extracts. Rajan12 and Kanchan6 were the first to report the presence of plant growth inhibitors in *P. hysterophorus*. This plant was releases a number of water soluble allelochemicals such as phenolic acid and sesquiterpene lactones, particularly parthenin6,16,17. Phenolics found in leaves also have inhibitory effects on growth of nitrogen fixing and nitrifying bacteria8. According to Rice13 phenolics are the most common and widely distributed water soluble allelochemicals. The escape of these chemicals into the environment occurs through various mechanisms such as leachation, volatilization and microbial decay of dead and fallen parts, as well as root exudation13. These chemicals were reported to have had allelopathic potential on various agronomic crops and weeds10,16 and vegetable crops10 . Patil and Hedge11 isolated parthenin in pure form from the leaves of *P. hysterophorus* and demonstrated that this compound significantly decreased germination of wheat seeds and adversely affected seedling growth. Ghose *et al.*5 reported that aqueous extracts of *Lantana camera*, *Digera muricata*, *Chenopodium album*, *Ageratum conyzoides*, *Ciscium arvense*, *Abutilon indicum* and *Cyperus rotundus* caused significant reduction in germination of seeds, shoot and root length of groundnut. Whereas *A. indicum* significantly increased both root length and shoot length. Compared to shoot growth, the stimulation was more in root growth. However it had no effect on % germination (Table 1, Fig. 1).

CONCLUSION

This study indicates inhibitory potential of *P. hysterophorus* and promotive potential of *A. indicum* on seed germination and seedling growth of barley.

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