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Research Article

ALLELOPATHIC EFFECT *ABUTILON INDICUM* AND *PARTHENIUM HYSTEROPHORUS* ON SEED GERMINATION AND SEEDLING GROWTH OF RICE

Rajendra Kumar*

Lecturer in Botany, Department of Botany, Dr. Bhim Rao Ambedkar Govt. College Sri Ganganagar, Rajasthan, India

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*Corresponding Author: **Dr. Rajendra Kumar**
Lecturer in Botany, Department of Botany, Dr. Bhim Rao Ambedkar Govt. College Sri Ganganagar, Rajasthan, India-335001 Mobile: 09414500898

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 rice (*Oryza sativa* L. variety P R106). Seeds were allowed to grow in petri-dishes containing 3% leaf extracts of *A.indicum* and *P.hysterophorus.* The results 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*. This effect created due allelochemicals which released by allelopathic plants.

Keywords: Allelopathy, leaf extract, agroecosystem, allelochemicals.

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 allelopathy[1]. Allelopathy refers the effects of one plant on another due to chemicals released by them, or the breakdown products of their metabolites[11]. The allelochemicals are produced by all kinds of plants and plant parts although roots and leaves are mainly responsible for their production and release[2]. 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 weeds 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 rice.

MATERIALS AND METHODS

Fresh leaves of *A.indicum* and *P.hysterophorus* in its vegetative stage were collected from agricultural field near Dr. Bhim Rao Ambedkar Government College, Sri ganganagar. Three grams of leaves of *A.indicum* were macerated in Pestle and Mortar, and added 100 ml of distilled water and left for 24 h in dark at the room temperature (average during day: 20ºC) for extraction. It was filtered thereafter in two layers of filter paper twice. 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 for surface sterilization.

The seeds were germinated in distilled water (control) and leaf extracts (*A.indicum* and *P.*hysterophorus) in sterilized petri-dishes lined with double blotting papers and kept at room temperature and diffused light during 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 rice is presented in Table 1. The results indicated that *A.indicum* significantly increased seedling growth while *P.hysterophorus* significantly decreased germination and seedling growth. 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% of control 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*. These allelopathic plants found inhibitory allelopathic impact of leaf extract more powerful in comparison to other vegetative parts[10]. Phytochemical analysis had already reported high accumulation of growth inhibitors in leaves of *P.hysterophorus*. Earlier works have also reported that foliar leachates of *P.hysterophorus* reduced root and shoot elongation of rice, wheat[7],maize and soyabeans[3] as well as some common Australian pasture grasses[1]. This indicates the availability of the inhibitory chemicals in higher concentration in leaves than in stem and roots. The aqueous extracts of leaves and inflorescences inhibited the germination and seedling growth of barley, wheat and peas[8]. The present study also verified that leaf aqueous extracts of *P.hysterophorus* exhibited significant inhibitory effects on seed germination and seedling growth of rice. Results indicated that root elongation was affected more than of the shoot (Table 1, Fig. 1).Similar effect of aqueous extract of leaves of *P.hysterophorus* was reported on *Eragostis* sp. and wheat. 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. This plant releases a number of water soluble allelochemicals such as phenolic acid and sesquiterpene lactones, particularly parthenin[9].Phenolics found in the leaves also exhibited inhibitory effects on the growth of nitrogen fixing and nitrifying bacteria. In allelopathic species phenolics are the most common and widely distributed water soluble allelochemicals[6]. The escape of these chemicals into the environment occurs through various mechanisms such as leaching from live or dead plant parts, volatilization as well as root exudation. These chemicals were reported to have had allelopathic potential on various agronomic crops and weeds and vegetable crops. The parthenin is isolated 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[5]. 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: Impact of aqueous extract of leaves of *A.indicum* and *P. hysterophorus* on seed germination and seedling growth of rice

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

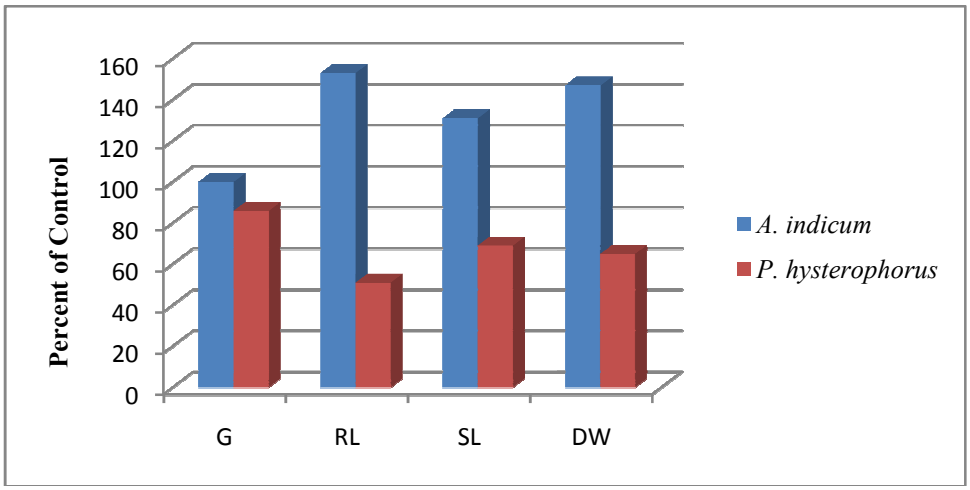

Figure 1: Impact of aqueous extracts of *A. indicum* and *P.* hysterophorus on rice
G- %Germination, RL- Root length (cm), SL- Shoot length (cm), DW- Dry weight

CONCLUSION

This study indicates inhibitory potential of *P.hysterophorus* and promotive potential of *A.indicum* on seed germination and seedling growth of rice.The study also shows that allelopathy has great potential to regulate the growth of crops through secretion of allelochemicals which should be investigated in detail. By adopting eco-friendly techniques harmful impact of hazardous chemicals can be avoided.

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