Studies on effect of *Parthenium hysterophorus* plants extract on germination and growth in certain pulses

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In the present study allelopathic effect of *Parthenium hysterophorus* leaf aqueous extract on the seed germination of three pulses *Cicer arietinum*, *Pisum sativum* and *Cajanus cajan* was studied. The results shows directly proportion to the concentration of leaf extract. If leaf extracts concentration increases the percentage of germination decreases in all three seeds of pulses showing the allelopathic effect on seed germination. The root length and shoot length also showed the inhibitory effect. Maximum inhibitory effect was observed in root length and shoot length (537.31% and 658.57% over control) of *Cajanus cajan* and minimum inhibitory effect was observed in root length and shoot length (150.83% and 161.42% over control) of *Pisum sativum*.

Key words: *Parthenium hysterophorus*, germination, allelopathy, *Cicer arietinum*, *Pisum sativum* and *Cajanus cajan*.

INTRODUCTION

Seed is defined as a fertilized ovule, or as a miniature plant surrounded by food reserve and protected by seed coat. From the seed, new generation of the plant begins. To fulfill this role, seed possesses some special physiological and biochemical properties. For example, it has very low water content and metabolic rate but remains viable and regain the normal metabolism required for growth and development into a plant, when it gets favorable condition for germination.

Seed germination - Only under favorable condition of moisture, temperature and air, the seed germinate. Seed imbibes water, swells and a positive pressure develops inside the seed, thus bursting the seed coat with the protrusion of radical. According to Seed Analysts ‘Germination is the emergence and development from the seed embryothat essential structure, which indicates the ability of seed to produce a normal plant under favorable conditions’. Factors affecting seed germination are moisture, air, temperature and light.

*Cicer arietinum*, *Pisum sativum* and *Cajanus cajan* belong to family *Fabaceae*. The legumes are next in importance to cereals as sources of human food. They contain more protein materials than any other vegetable product. The pulses are important part of food in India where the majority of the population is vegetarians. Carbohydrates and fats are also present in legumes. The protein occurs as aleuronic grains in the same cells with starch grains.

*Parthenium hysterophorus*—*Parthenium hysterophorus* L. (Asteraceae) popularly known as Congress or carrot grass. It is an herbaceous plant, and a native of Tropical America. It is an annual herb and has a deep tap root and erect stem, which becomes woody with age. *Parthenium* weed leaves are deeply lobed. It is pale green in colour and has soft hair. *Parthenium* flower is creamy white in colour. The weed has a large number of stems (Allolli and Narayananreddy, 2000). It has small (1-2mm long) black seeds with white scales. They are not visible to the naked eye. Congress grass is one of the world’s worst weeds for agriculture, environment, and human health. It is native to the subtropics of North and South America, and it was accidentally introduced to the Indian sub-continent in the mid-1950s through wheat grains (Chandra’s and
Vartak, 1970; Oudhia, 2000). It is notorious for its strong competitiveness for soil moisture and nutrients, the hazards that it poses to humans and animals, and its allelopathic effect in associated plant species (More et al., 1982; Gleissman, 1983). Jaleel et al., 2007 said “it is a poisonous, allergic and aggressive weed whose pollens float in air and cause eczema, asthma, dermatitis, hay fever (kalazar) etc in human beings,” and the pollens of the weed shed flowers of vegetables (tomato, chili, primal) and inactivate nitrogen fixing bacteria in pulses due to secretion of a chemical substance (sesquiterpene lactones). Not only in human beings, weed also cause dermatitis in animals like cows and goats. When they eat the weed, their milk becomes bitter and drinking such for long time may cause death (Wu et al., 2007).

Objectives of the study

1. To determine the effect of plant aqueous extract on seed germination.
2. To assess the tolerance limit of seeds to aqueous plant extract.

MATHEDOLOGY

Preparation of aqueous extract – *Parthenium hysterophorus* plants leaves were used to make the aqueous extract. Firstly the leaves were washed thoroughly with tap water and dried in the wind. After two hour 1kg plant leaves were grind and filtered and finally make the volume 1 liter with distilled water. This is our stock solution. After that 5%, 10%, 15%, 20%, 25%, 100% solutions were using stock solution. 50 seeds in triplicate of *C. arietinum* and *P. sativum*, and *C. cajan* were placed in separate Petri dish for germination in different concentration of solution. 1 control sample was also maintaining parellary with distilled water. Before putting the seeds in Petri dish one layer filter paper were placed inside the Petri dish and then 10 ml extract of concentration of plants *P. hysterophorus* were added in each Petri dish. Germination test was done in normal room light condition. The number of seeds germination was counted at 2nd to 12th day after germination initiation. After 12 days shoot and root length were measured.

### RESULT AND DISCUSSION

The seed germination of different crops *C. arietinum*, *P. sativum*, *C. cajan* are affected by aqueous extract of *P. hysterophorus*. Result shows significant decrease in percent germination. In general, the rate of germination delayed and decreased with the increase of leaf aqueous extract concentrations at each observation date. The results revealed that aqueous extract application significantly reduced the seed germination over control applied treatment (Table 1).

**Germination % of Cicer arietinum** – The maximum germination percentage was found in control followed by 5% to 25%, 5% to 100% and 5% to 100% aqueous extract, *Parthenium hysterophorus* is *Cicer arietinum*. The maximum inhibition in germination was found 80 and minimum was observed 10%.

**Germination % of Pisum sativum** – The maximum
Table 1: Showing % germination in selected pulses.

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<tr>
<th>S.No.</th>
<th>Concentration in %</th>
<th>Germination % in C. arietinum</th>
<th>Germination % in P. sativum</th>
<th>Germination % in C. cajan</th>
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<tr>
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Germination percentage were found in control followed by 5% to 30%, 5% to 100% and 5% to 100% aqueous extract, *Parthenium hysterophorus* is *Pisum sativum*. The maximum inhibition in germination was found 60% and minimum 10% in *Parthenium hysterophorus*.

Germination % of *Cajanus cajan* – The maximum germination percentage was found in control followed by 5% to 20%, 5% to 100% and 5% to 100% aqueous extract, *Parthenium hysterophorus* is *Cajanus cajan*. The maximum inhibition in germination was found 80% and minimum 20% in *Parthenium hysterophorus*.

Decrease % of shoot and root in *Cicer arietinum* – Maximum percentage decrease of *C. arietinum* over control found in *P. hysterophorus* (25% conc.) 193.76% (shoot), 238.33% (root) and minimum percentage decrease (conc. 5%) 7968% (shoot), 104% (root) in *P. hysterophorus*.

Decrease % of shoot and root in *Pisum sativum* – Maximum percentage decrease of *P. sativum* over control found in *P. hysterophorus* (30% conc.) 235.41% (shoot), 157.39% (root) and minimum percentage decrease (conc. 5%) 62.77% (shoot), 106.69% (root) in *P. hysterophorus*.

Decrease % of shoot and root in *Cajanus cajan* – Maximum percentage decrease of *Cajanus cajan* over control found in *P. hysterophorus* (20% conc.) 658.57% (shoot), 537.31% (root) and minimum percentage decrease (conc. 5%) 129.49% (shoot), 210.52% (root) in *P. hysterophorus*.

DISCUSSION

The seed germination of different pulses was affected by aqueous extract of *Parthenium*. All *Parthenium* extracts resulted in significant decrease in percent germination (Figure 1). Increasing concentrations from 5 to 10 percent resulted in higher reduction in root and shoot length (Figure 2). Increased concentration of extracts resulted in decreased percent germination of all seeds. The above data suggests that *Parthenium* extract reduced both root and shoot length, which indicates the deleterious effects of allelochemicals like parthenin on development of root and shoot. Similarly Chaudhary and Gupta (1995) reported significant reduction in radical and plumule length in green gram due to allelopathic effects of some crop seeds. Suman et al. (2002) also showed significant reduction of radical and plumule length of wheat due to
Figure 1: Showing % germination in selected pulses.

Figure 2: Showing % decrease in root and shoot growth at different aqueous extract concentration.

allelopathic effects of some weeds. This gradual decrease in germination percent was due to allelopathic effect of weed (*P. hysterophorus*) extracts from lower to higher concentration as compared to control the reduction in germination and growth are attributed to restrains cell division. Reduction in mineral, uptake, hinder or augments respiration, hamper the production of protein in certain crops and there by effecting the vegetation composition. The highest reduction in 100% concentration revealed that the allelochemicals in the aqueous extracts of leaves, which used the maximum reduction in root and shoot length several studies have indicated that the allelochemicals (e.g. Phenolics, terpenoids, alkaloids and their derivatives) are toxics which may inhibit shoot/ root growth, nutrient uptake or may attack a naturally accruing symbolic relationship thereby destroying the usable source of plants nutrient.

**CONCLUSION**

Despite allelopathy could theoretically exhibit the
inhibitory or the stimulatory effect of a plant onto another one, few studies reported this stimulatory effect. Our data revealed that leaf extracts have significant inhibitory effects on seed germination and growth of pulses. This finding is in agreement with that of Swaminathan et al., 1989 who reported a negative effect of leaf extracts on radical growth. Although not statistically significant, it should also be mentioned that in current results shoot and root growth of most target species were promoted at lower extract concentration. Hence, stimulatory and inhibitory effect of extract may be a function of concentration and also species-dependent. Further studies into determining the critical concentration of stimulatory or inhibitory effect and the interspecies allelopathy would permit further understanding of how allelopathic effects may have regulated the establishment of plant population and the organization of plant community.

REFERENCE


