EFFECT OF AQUEOUS EXTRACTS OF ALIEN WEED
PARTHENIUM HYSTEROPHORUS AND TWO NATIVE
ASTERACEOUS SPECIES ON GERMINATION AND
GROWTH OF MUNGBEAN, VIGNA RADIATA L. WILCZEK

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ABSTRACT

A study was carried out at the Institute of Mycology and Plant Pathology, University of Punjab, Lahore, Pakistan during 2007 to investigate the phytotoxic effects of an alien weed Parthenium hysterophorus L. in comparison with two native Asteraceous weed species viz. Ageratum conyzoides L. and Sonchus oleraceous L. on mungbean (Vigna radiata L. Wilczek) germination and growth. The highest concentration of Parthenium leaf extract (15% w/v) reduced mungbean germination by 26 percent as compared to 11 and zero percent reduction due to same extract concentration of S. oleraceous and A. conyzoides, respectively. Shoot length of mungbean seedlings was reduced by 17–52 percent and 23–52 percent, and shoot biomass by 26–36 percent and 2.4–58 percent due to various extract concentrations of parthenium and A. conyzoides, respectively. Shoot length was stimulated by extract of S. oleraceous. In general, extracts of all three test weed species stimulated the root growth of mungbean. The results conclude that aqueous extracts of alien weed Parthenium exhibited more phytotoxic effects on germination of mungbean as did by two test native weed species belonging to same family.

KEYWORDS: Vigna radiata; Parthenium hysterophorus; allelopathy; Ageratum sp.; Sonchus sp.; germinability; Pakistan.

INTRODUCTION

Reductions in native plant biodiversity in natural and agro-ecosystems, caused by alien invasive weeds are now being recognized as some of world’s major emerging problems. Such alarming threats are also being noticed in Pakistan. Parthenium weed (Parthenium hysterophorus L.) is an annual weed, which originated either in the Gulf of Mexico or in Central South America (7). Through accidental introductions it has shown considerable adaptability and spread to Eastern and South Africa, Southern USA,

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Pakistan, Bangladesh, Nepal, South China Region, Vietnam, South Pacific and has become a serious weed of agriculture in India, Ethiopia and Australia (6,9,12,13). Because of this standing, it is recognized in the world’s top ten weeds (7).

Parthenium weed not only competes with desirable crop and pasture species but also causes skin allergy in farmers and stock animals while in contact with it (5). The weed is normally unpalatable to cattle and sheep, but these animals may feed on it when feed is scarce or when fodder is contaminated with this weed. Consumption of its large amounts will produce taints in mutton or milk and may kill stock. In addition, many parts of this weed plant are allelopathic, exhibiting strong competitiveness for soil moisture and nutrients while inhibiting the germination and growth of neighboring plant species (1). Parthenium weed is thus the causative agent for serious economic, health and environmental problems (2).

The present study was planned to check the competitiveness of Parthenium weed against mungbean in comparison with two native Asteraceous plant species viz. Ageratum conyzoides and Sonchus oleraceous.

MATERIALS AND METHODS

Fresh shoots of A. conyzoides, S. oleraceous and P. hysterophorus were collected from University of Punjab, Quaid-e-Azam Campus, Lahore, Pakistan during 2007. These were washed under tap water and then air dried to remove the water from surface. Fifteen grams fresh plant material of each test species was blended in 100 ml of sterilized distilled water. The blended material was allowed to stand for 24 hours at room temperature. After that, materials were passed through a muslin cloth followed by filtration through Whatman No. 1 filter paper to obtain 15 percent w/v (on fresh weight bases) stock solutions. The lower concentrations of 5 and 10 percent extracts were prepared by adding appropriate quantities of distilled water to stock solution.

Ten seeds of mungbean were placed on a filter paper bed in 9 cm diameter Petri plates. Three milliliter of extract of each concentration was added to each Petri plate. Control received the same quantity of distilled water. Each treatment was replicated thrice. Petri plates were incubated for ten days in a growth chamber at 27±2 °C. Emergence of radicle was recorded as criterion for germination. Seedling length, root fresh weight and shoot fresh weight were taken at the end of experiment. Data regarding the various parameters of germination and root and shoot growth were analyzed by analysis of
Effect of alien weed aqueous extracts on mungbean

variance followed by Duncan multiple range test (P ≤ 0.05) to separate the treatment means (11).

RESULTS AND DISCUSSION

Germination percentage

In general, aqueous extracts of all three test species showed variable phytotoxicity against mungbean. The results (Fig. 1) indicate that germination was decreased gradually with increase in extract concentration of *Parthenium* weed. The highest concentration of *Parthenium* extract (15%) reduced mungbean germination by 26 percent (Table). In case of *A. conyzoides*, effect of aqueous extracts was not much pronounced with 0-11 percent reduction. However, the lowest concentration (5%) of *S. oleraceuos* extract enhanced the mungbean germination by 8 percent while its higher concentrations (10 and 15%) had adverse effect as compared to control (Table). These results showed that *Parthenium* suppressed the germination of mungbean more than that of two local *Asteraceous* species.

Shoot length

Shoot length was consistently reduced with increasing concentration of both *P.hysterophorus* and *A.conyzoides* extracts with maximum suppression of shoot length recorded in higher concentration of *P.hysterophorus* extract (15%) as compared to control (Fig.2A). Similarly, a higher decline in Table. Percentage increase/decrease due to aqueous extracts of three *Asteraceous* plant species on seed germination and seedlings growth of mungbean.
Test species  | Concentration(%) | Increase(+)/decrease(-) over control (%) | Germination | Shoot length | Shoot biomass | Root length | Root biomass |
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<tr>
<td><em>P. hysterophorus</em></td>
<td>5</td>
<td>-3</td>
<td>-29</td>
<td>-26</td>
<td>+31</td>
<td>+53</td>
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<tr>
<td></td>
<td>10</td>
<td>-11</td>
<td>-17</td>
<td>-36</td>
<td>+47</td>
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<tr>
<td></td>
<td>15</td>
<td>-26</td>
<td>-52</td>
<td>-26</td>
<td>+42</td>
<td>+28</td>
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<tr>
<td><em>A. conyzoides</em></td>
<td>5</td>
<td>-11</td>
<td>-52</td>
<td>-58</td>
<td>+4</td>
<td>-14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0</td>
<td>-23</td>
<td>-2</td>
<td>+77</td>
<td>+3</td>
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<tr>
<td></td>
<td>15</td>
<td>0</td>
<td>-31</td>
<td>-19</td>
<td>+121</td>
<td>+78</td>
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<tr>
<td><em>S. oleraceous</em></td>
<td>5</td>
<td>+8</td>
<td>+57</td>
<td>+7</td>
<td>+72</td>
<td>+14</td>
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<td></td>
<td>15</td>
<td>-11</td>
<td>+26</td>
<td>-22</td>
<td>+25</td>
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Shoot length (-52%) was observed due to 5 percent concentration of *A. conyzoides* (Table). Different concentration of *S. oleraceous* leaf extract enhanced the shoot length of *P. hysterophorus* seedlings by 26-57 percent. The data recorded on fresh biomass revealed a similar pattern as observed in their corresponding shoot lengths (Table, Fig. 2B). In general, adverse effect of *Parthenium* extracts on shoot growth of mungbean was more consistent than two native Asteraceous species. In a previous study (14) in Ethiopia, *Parthenium* significantly suppressed the growth and yield of sorghum crop. In another study (10) aqueous extracts and residue incorporation of *Parthenium* significantly reduced shoot growth of different...
species of *Brassica*. Similar adverse effects of *Parthenium* have also been reported in chickpea and radish (3). The phytotoxic effects of *Parthenium* due to presence of parthenin and phenolic acids such as caffeic acid, vanillic acid, anisic acid, chlorogenic acid and parahydroxy benzoic acid, are lethal to human beings and animals (4,8).

**Root length**

Root length of mungbean was generally enhanced by aqueous extracts of different test *Asteraceous* species. Stimulatory effect was more pronounced in extract of *A. conyzoides*. Different concentrations of *Asteraceous* species enhanced root length of mungbean seedlings by 4-121 percent over control (Table). However, effect of highest concentration of *A.conyzoides* on root length was significant. Similarly aqueous extracts of *Parthenium* and *S.oleraceous* enhanced the root length of mungbean by 31-47 percent and 15-72 percent, respectively (Table). Different concentrations of aqueous extracts of *Parthenium* enhanced root biomass by 28-53 percent. The highest increase (78%) in root biomass was recorded in 15 percent extract of *A.conyzoides* (Table, Fig.3).

The results conclude that adverse effect of aqueous extracts of *Parthenium* on germination and shoot growth of mungbean is more consistent than extracts of two native *Asteraceous* weed species. At present, *Parthenium* has invaded only few crops especially vegetables which are generally grown with sufficient space among the plants. However, this weed grows luxuriantly along the sides of agricultural fields as well as on nearby waste and grazing
lands posing a threat to crops in future. It is high time to eradicate *Parthenium* to save crops and grazing pastures from its further invasion.

**REFERENCES**


