Phytosociology of *Parthenium hysterophorus* and its possible management through some potential Bio-agents

Knox Jai¹*, Bhalerao SA¹ and Paul MS²

¹Department of Botany, Wilson College, University of Mumbai, Mumbai- 400 007.
²Department of Botany, St. John’s College, Dr. B. R. Ambedkar University, Agra- 282 002.

*Corresponding author e-mail: jaijai@rediffmail.com | Cell no.: +91-9920081094

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**ABSTRACT**

*Parthenium hysterophorus* a noxious weed of today has its effect on human and animal health. This weed is known to cause asthma, bronchitis, dermatitis and hay fever in human and livestock. In a sample survey conducted in Bangalore, India it was recorded that 70% of the population suffers from allergic rhinitis due to pollen and 47% suffered from nasobranchial allergies. At present there is no effective treatment of dermatitis, other than exclusion of the weed but azathioprine therapy shows promising potential. Studies were undertaken to assess the phytosociology of *Parthenium hysterophorus* with other weeds growing in its vicinity and its control by some potent bio-agents. Studies were also undertaken to assess the chlorophyll content and percentage nitrogen of *Parthenium hysterophorus*. Maximum significant inhibition in chlorophyll content and percentage nitrogen was observed in shoot leacheates of *Cassia occidentalis* and *Calotropis procera*, respectively.

**Key Words:** Allelopathy, Botanic agents, Congress grass.

**INTRODUCTION**

*Parthenium hysterophorus* L. is commonly known as carrot weed in the Hindi speaking belt but known as Congress grass in other parts of India. The weed has spread throughout India after its noticeable occurrence in Pune (Maharashtra) in 1955. Now it has achieved the status of the countries “worst weed” owing to its allelopathic effects on agricultural crop production and harmful effects on people and animals. During the 1980s, *Parthenium* weed used to be considered a weed of fallow and wasteland but now it has become a weed of every crop and also into the forested land. The severity of the *Parthenium* weed problem has compelled researchers and people to from various action groups and societies to provide a forum for those in need and affected by *Parthenium* weed. The severe infestation of *Parthenium* weed has reduced the availability of palatable grasses to herbivores in Van Vihar National Park in Bhopal, Madhya Pradesh which has compelled the park authorities to undertake a large scale uprooting program. But the 3 year uprooting program, requiring a great deal of money, has not produced the desirable reduction in *Parthenium* weed density. *Parthenium* weed has become a problem in forest nurseries in Madhya Pradesh. In Karnataka, *Parthenium* weed along with *Lantana*, *Chromolaena* and some other exotic weeds have threatened the palatable vegetation availability to elephants. This situation has compelled the Supreme Court of India to instruct the states and central governments to constitute a task force to manage these weeds.
Preparation of aqueous leachates

The upper parts of shoot tips were collected from the selected plants. 100 g of shoot tips were soaked in 500 ml of double distilled water each under aseptic conditions for 10 days and placed in conical flasks in a refrigerator at 8 °C. The aqueous leachates were filtered through three layers of muslin cloth/cheese cloth to remove debris. The filtrate was then re-filtered through one layer of Whatman No.1 filter paper. Leachates 100% concentration were prepared with sterilized distilled water and used for bioassay.

Chlorophyll estimation

Chlorophyll content of *Parthenium hysterophorus* was estimated according to Arnon (1949). 40 mg (0.04 g) of *Parthenium* leaves were treated with 100% of shoot leachates of botanic agents for 72 h. After 72 h the treated *Parthenium* leaves were placed in black plastic bottles containing 10 ml of 80% acetone and then it was sealed with adhesive tape at its mouth so that acetone may not get evaporated and kept undisturbed in a refrigerator for 5-6 d at 8±1°C temperature. After 6 d optical density was recorded by spectrophotometer at different wavelength i.e. 480, 510, 630, 645, 652, and 665 nm.

Nitrogen estimation

Nitrogen was estimated by following the method of Snell and Snell (1955). 100 mg (0.1 g) of *Parthenium* leaves were treated with 100% of shoot leachates of botanic agents for 72 h. Then the treated *Parthenium* leaves were placed in 50 ml conical flask and mixed with 2 ml of conc. H2SO4 and then it was heated on hot plate at 40°C. When volume reduces to half of the original volume, 1.5 ml of 30%H2O2 was added. Then the solution was heated gently at 10-20°C till the clear extract was obtained. The content was then transferred in 100 ml volumetric flask and the volume was made up to the mark with distilled water. After preparation of acid extract of plant material, the nitrogen was estimated as follows: 1.0 ml of prepared acid extract from plant material was taken in 50 ml volumetric flask. The upper parts of shoot tips were collected from the selected plants. 100 g of shoot tips were soaked in 500 ml of double distilled water each under aseptic conditions for 10 days and placed in conical flasks in a refrigerator at 8 °C. The aqueous leachates were filtered through three layers of muslin cloth/cheese cloth to remove debris. The filtrate was then re-filtered through one layer of Whatman No.1 filter paper. Leachates 100% concentration were prepared with sterilized distilled water and used for bioassay.

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Table 1: Phytosociological analysis of Parthenium hysterophorus and associate flora

<table>
<thead>
<tr>
<th>Site</th>
<th>Name Of Plant</th>
<th>Total No. of Individual Species</th>
<th>Total No. of Quadrat in which Species Occur</th>
<th>Total No. of Quadrat Studied</th>
<th>Frequency %</th>
<th>Density</th>
<th>Abundance</th>
<th>Relative Frequency</th>
<th>Relative Density</th>
<th>Relative Dominance</th>
<th>IVI†</th>
<th>SDR††</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>PH</td>
<td>12±(0.54)</td>
<td>10±(0.00)</td>
<td>60±(1.15)</td>
<td>1.2±(0.09)</td>
<td>2.0±(0.08)</td>
<td>21.4±(0.46)</td>
<td>19.0±(0.37)</td>
<td>33.4±(1.44)</td>
<td>73.9±(1.36)</td>
<td>24.6±(0.73)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>13±(0.61)</td>
<td>10±(0.00)</td>
<td>70±(0.00)</td>
<td>1.3±(0.08)</td>
<td>1.8±(0.10)</td>
<td>25.0±(0.20)</td>
<td>20.6±(0.40)</td>
<td>13.3±(1.96)</td>
<td>59.0±(1.96)</td>
<td>19.6±(0.85)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO</td>
<td>02±(0.01)</td>
<td>02±(0.00)</td>
<td>90±(1.00)</td>
<td>3.2±(0.05)</td>
<td>3.5±(0.90)</td>
<td>32.1±(0.10)</td>
<td>50.7±(0.15)</td>
<td>44.6±(1.00)</td>
<td>127.5±(1.20)</td>
<td>42.5±(0.41)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DS</td>
<td>02±(0.65)</td>
<td>02±(0.00)</td>
<td>30±(0.81)</td>
<td>0.2±(0.00)</td>
<td>1.0±(0.50)</td>
<td>10.7±(0.25)</td>
<td>4.7±(0.50)</td>
<td>5.59±(1.18)</td>
<td>21.0±(1.40)</td>
<td>7.0±(0.64)</td>
<td></td>
</tr>
<tr>
<td>II.</td>
<td>PH</td>
<td>13±(0.65)</td>
<td>10±(0.00)</td>
<td>60±(0.91)</td>
<td>1.3±(0.07)</td>
<td>2.1±(0.85)</td>
<td>18.1±(0.36)</td>
<td>14.6±(0.25)</td>
<td>18.5±(0.96)</td>
<td>51.3±(1.20)</td>
<td>17.1±(0.52)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO</td>
<td>48±(0.20)</td>
<td>10±(0.00)</td>
<td>100±(0.00)</td>
<td>4.8±(0.05)</td>
<td>4.8±(1.02)</td>
<td>30.3±(0.11)</td>
<td>53.9±(0.10)</td>
<td>47.5±(0.91)</td>
<td>131.7±(0.96)</td>
<td>43.9±(0.37)</td>
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<tr>
<td></td>
<td>CP</td>
<td>07±(0.05)</td>
<td>10±(0.00)</td>
<td>60±(0.00)</td>
<td>0.7±(0.01)</td>
<td>1.1±(0.09)</td>
<td>18.1±(0.34)</td>
<td>7.86±(0.18)</td>
<td>6.96±(1.02)</td>
<td>33.0±(1.22)</td>
<td>11±(0.51)</td>
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<tr>
<td></td>
<td>DS</td>
<td>05±(0.00)</td>
<td>04±(0.01)</td>
<td>40±(0.85)</td>
<td>0.5±(0.02)</td>
<td>1.2±(0.46)</td>
<td>12.1±(0.28)</td>
<td>5.61±(0.21)</td>
<td>5.71±(1.19)</td>
<td>23.4±(1.20)</td>
<td>7.8±(0.56)</td>
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<tr>
<td>III.</td>
<td>PH</td>
<td>70±(0.47)</td>
<td>10±(0.00)</td>
<td>100±(0.00)</td>
<td>7.0±(0.00)</td>
<td>7.0±(0.01)</td>
<td>31.2±(0.15)</td>
<td>53.8±(0.18)</td>
<td>46.1±(1.10)</td>
<td>131.1±(1.00)</td>
<td>43.7±(0.50)</td>
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</tr>
<tr>
<td></td>
<td>CO</td>
<td>46±(0.21)</td>
<td>08±(0.05)</td>
<td>80±(0.91)</td>
<td>4.6±(0.04)</td>
<td>5.7±(0.01)</td>
<td>25.0±(0.20)</td>
<td>35.3±(0.18)</td>
<td>44.6±(1.01)</td>
<td>105.0±(0.98)</td>
<td>35.0±(0.46)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DS</td>
<td>03±(0.01)</td>
<td>03±(0.00)</td>
<td>30±(0.20)</td>
<td>0.3±(0.00)</td>
<td>1.0±(0.54)</td>
<td>9.37±(0.25)</td>
<td>2.30±(0.25)</td>
<td>3.24±(1.54)</td>
<td>14.9±(1.10)</td>
<td>4.97±(0.68)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>03±(0.00)</td>
<td>03±(0.00)</td>
<td>30±(0.59)</td>
<td>0.3±(0.01)</td>
<td>1.0±(0.61)</td>
<td>9.37±(0.19)</td>
<td>2.30±(0.19)</td>
<td>1.45±(1.20)</td>
<td>13.2±(0.75)</td>
<td>4.37±(0.52)</td>
<td></td>
</tr>
</tbody>
</table>

All the values are mean of 10 replications.
Values within parentheses indicate standard error of mean.
†Importance Value Index ; †† Sum-Dominance Ratio ; PH= Parthenium hysterophorus, CP= Calotropis procera, CO= Cassia occidentalis, DS= Datura stramonium

Table 2: Effect of shoot leachates of selected botanic agents on biochemical activity of Parthenium hysterophorus at 100% dose. The negative control group had distilled water. CD= critical difference at the 5% level of significance

<table>
<thead>
<tr>
<th>Bio-agents</th>
<th>Concentration (%)</th>
<th>Chlorophyll (%)</th>
<th>Nitrogen(%)</th>
<th>Protein(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>-</td>
<td>30.52</td>
<td>6.39</td>
<td>39.93</td>
</tr>
<tr>
<td>Cassia occidentalis (BA1)</td>
<td>100</td>
<td>4.55</td>
<td>0.20</td>
<td>1.25</td>
</tr>
<tr>
<td>Calotropis procera (BA2)</td>
<td>100</td>
<td>10.67</td>
<td>1.15</td>
<td>7.18</td>
</tr>
<tr>
<td>Datura stramonium (BA3)</td>
<td>100</td>
<td>14.78</td>
<td>1.95</td>
<td>12.18</td>
</tr>
</tbody>
</table>

Fig 1. Graphical representation of biochemical analysis of bio-agents on Parthenium hysterophorus
RESULTS AND DISCUSSION

Of the total flora studied, different species exhibited different competitive abilities. Among all the weeds, Cassia occidentalis showed the strongest competitive ability against Parthenium (Table 1). Data recorded in Table 1 show that at Site III Parthenium was a dominant species having a number of 70 individual species, closely followed by Cassia, which was 46 in number. At Site I and II Cassia occidentalis was a dominant species having a value of 32 and 48 against Parthenium, which was only 12 and 13 in number. The highest sociability of Parthenium was observed at Site III and the relative frequency, relative density and relative dominance of Parthenium at Site III was found to be 31.25, 53.84 and 46.10, respectively followed by Cassia having sociability of 25.00, 35.38 and 44.66. Out of the three sites, two sites had Cassia as a dominant species with a maximum sociability of 30.30, 53.93 and 47.52 versus Parthenium, which had only 18.18, 14.60 and 18.54 sociability at Site II. The highest SDR was recorded at Site II i.e. 43.91 of Cassia occidentalis against Parthenium hysterophorus which was only 17.10. Table-2 depicts maximum inhibition in chlorophyll by C. occidentalis i.e. 4.55 and was found to be significant, followed by C. procera in which 10.67 chlorophyll was observed. Minimum inhibition was observed in D. stramonium in which 14.78 chlorophyll was observed. Control received distilled water and was found to be 30.52. Maximum inhibition in nitrogen percentage was by shoot leachates of C. occidentalis i.e. 0.20 and was found to be significant followed by C. procera and D. stramonium in which 1.15 and 1.95 nitrogen percentage was observed. Protein content also depicts the same pattern with highest inhibition by C. Occidentalis (Fig.1). Some plants are already known to have potential in combating Parthenium hysterophorus. Anjum et al., (2005) concluded that an aqueous extract of Imperata cylindrica may restrict germination and seedling growth. The herbicidal potential of leaf leachates of plants such as Cymbopogon citratus, Withania somnifera and Calotropis procera have been assessed before; the effects of C. citratus were pronounced (Knox & Paul 2007). Foliar leachates of Cassia and then Rumex were the most effective in reducing levels of various leaf chemicals (Jaggi et al. 2008). Aqueous extracts of Ocimum americanum significantly inhibited the germination and seedling growth of Parthenium (Singh & Thaper 2002).

CONCLUSION

This study concluded that the 100%, 9th day aqueous shoot leachates of Cassia occidentalis have significant activity against Parthenium hysterophorus and offers an alternative tool for the control of this obnoxious weed thus proving the concept of allelopathic or biomolecular interactions amongst the plant species as a natural replacement method.

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