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Dr. M.K. Yadav Tripti Gupta http:// <u>www.sasjournals.com</u> http:// <u>www.jbcr.co.in</u> jbiolchemres@gmail.com

RESEARCH PAPER

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Impacts of *Parthenium hysterophorus* on Vegetation of Aravalli Hills of Ajmer (Rajasthan)

Tripti Gupta and Manoj Kumar Yadav

Department of Botany, S.P.C. Government College Ajmer – 305001, Rajasthan, India

ABSTRACT

The Aravalli hills of Ajmer are located in the almost centre of the Rajasthan. The selected area has high endemic plant diversity which may also include some endangered species. The invasive species Parthenium hysterophorus commonly known as carrot grass is causing enormous threat to biodiversity of Aravalli hills. Phytochemical screening of extract of P. hysterophorus in different types of solvents showed the presence of various phytochemicals like triterpenoids, alkaloids, flavonoids, steroids and glycosides etc in very high amount. These phytochemicals play an important role in plant defense mechanism of herbivory but may also have negative impact on the native plant species by affect the germination and growth of other plant species. The results indicate that the P. hysterophorus has stronger impacts on native diversity.

Key Words: Aravalli Hills, Invasive Species, Biodiversity, Endemic and Phytochemicals.

INTRODUCTION

The spread of invasive species *Parthenium hysterophorus* is recognized as one of the most important global scale problems experienced by the natural ecosystems. Invasive alien species are causing enormous threat to biodiversity and agricultural system. Many of the species on the list of threatened and endangered species in the world are listed due to the impact of invasive species on their habitat. Invasive species may pose a threat to the economy. Arrival of non-native species may occur either through accidental introduction or purposeful import for human utility and the successful invasion of alien species depends on characteristics of the invaded habitat. *P. hysterophorus* has been included in the Global Invasive Species Database (GISD 2010). It has been listed as a noxious weed (prohibited plants that must be controlled). They serve no economic purpose and possess characteristics that are harmful to plants, animals, humans or the environment. *P. hysterophorus* is a species of flowering plant belongs to aster family, Asteraceae. It is commonly known as carrot grass, congress grass or gajar ghans. It is a highly branched, annual, erect and herbaceous plant that forms a basal rosette of leaves during the early stage of growth. It usually grows 0.5-1.5 m tall, but can occasionally reach up to 2 m or more in height.

It is a common invasive species in India (accidentally introduced through imported food grains) and many other countries and native to the subtropics of North and South America. The plant produces various allelopathic chemicals that suppress the growth of other plants species, and allergens that affect humans and livestock.

STUDY AREA

The present research was carried out in Aravalli hills of Ajmer district (Latitude is 26⁰ 27' 7.56" North and Longitude is74⁰ 38' 19.21" East) located in the almost centre of the state Rajasthan India. The selected area has high endemic plant diversity. The region also provides an interesting case study because of its topographic complexity, edaphic conditions and variability in climate.



Figure 1. Map showing the present study area.

Aravalli is a range of mountains running from Khedbrahma to Raisina Hills is 692 km from which 550 km (approximatey 80%) extension is in Rajasthan from Udaipur/Sirohi in south-west direction to Alwar district in north-east direction Rajasthan. It is extends from Khedbrahma, Palanpur (Gujrat) to Raisina Hills (New Delhi) via 16 Districts of Rajasthan. Ajmer is in the northwest of India and in middle Aravalli Range in Rajasthan. It is situated on the lower slopes of the Taragarh Hill of that range. To the northwest is the Nagapahar Range of the Aravalli hills which protects it from desertification from the Thar Desert. It has vast spectrum of flora and fauna due to the hilly track, is a treasure of the biodiversity.

According to Evans (1997), the invasive ability and allelopathic properties of *P. hysterophorus* possess a great risk to disrupt ecosystem. Hence, the present investigation was carried out with the aim to assess the impact of *P. hysterophorus* and subsequent removal of local plant community composition. The presence of invasive plant species *P. hysterophorus* effects local floral community composition and its diversity and ground vegetation cover due to increased competition for resources. This could be investigated by comparing the composition, diversity and ground vegetation of area invaded by *P. hysterophorus* with that which is un-invaded.

METHODOLOGY

The sampling was performed in 5 different sites respectively in Taragarh hills, Naagpahar, Goramji, Nasirabad valley and Nareli hills of Ajmer District and rough estimation of species content was made by observing the plant species at all the sample site. Surveys were undertaken two to three times in a season. The studies of different sites were done with the help of different quadrats. At each site vegetation was sampled in ten, 10 x 10 m quadrats. Numbers of individuals of each species were counted in these quadrats and the identification of flora was made with the help of "Flora of Rajasthan" (Sharma and Tiagi, 1979 and Shetty & Singh 1987) "Flora of Indian desert" (Bhandari M.M., 1990).

These data were analyzed for Importance Value Index (IVI). It depicts the sociological structure of a species in its community. IVI as a function of relative density, relative frequency and relative abundance was calculated to know dominance and association of species. (Cottom and Curtis, 1956)

IVI = Relative frequency + Relative density + Relative dominance

For the further study of the impact of *P. hysterophorus* on local phytodiversity, the phytochemical studies have also undertaken. The plant materials were collected from the investigation sites of Aravalli hills, Ajmer district.

The plant extract of *P. hysterophorus* were made by soaking 20 grams of the powdered each plant in 250ml of in different solvents (methanol, double distill water and chloroform) and kept in orbital shaker for 24hrs in a closed Erlenmeyer flask for continuous agitation. The extracts were then filtered using Whatmann No.1 filter paper. The solvent from the extracts were removed by using rotary vacuum evaporator. The extracts obtained were labeled and stored at 5°C for further use.

The Qualitative Phytochemical screening of extracts were done according to the standard methods of Harborne (1973); Mariajancyrani (2014); Tiwari *et al.* (2011); Trease and Evans (1989) and Sofowara (1993).

RESULTS AND DISCUSSION

The impact of *P. hysterophorus* on the vegetation of Aravalli hills of Ajmer district is shown in table 1. The invasive capacities of *P. hysterophorus* disrupt the natural ecosystems. Sometimes no any other vegetation can be seen in *P. hysterophorus* dominated areas. It can invade a wide range of area, and of particular concern is the invasion of native vegetation of Aravalli hills of Ajmer. The sites without *P. hysterophorus* had much appearance of *Alysicarpus vaginalis, Crotolaria medicagenia, Cassia absus, Cassia pumila, Indigofera tinctoria, Bidens biternata, Blainvillea acmella, Sclerocarpus africanus, Solanum nigrum, Heliotropium curassivicum, Amaranthus viridis, Euphorbia hirta and Ocimum canum* recognized as dominant associates. But all these species were found in very less in number or absent on sites with *P. hysterophorus*. It can therefore be, said that on sites with *P. hysterophorus* climax species and higher order serial species slowly deteriorate and disappear.

The success of *P. hysterophorus* is largely attributed to the high number of seeds: 10 - 25 thousand per mature plant produced and their efficient dispersal mechanisms (by wind, water, animals, vehicles, tools and machinery and on clothing). It is observed that *P. hysterophorus* starts branching vigorously. This makes other plants seedling establishment difficult as a result of a physical barrier created by branches. The invasive capacity and alleolopathic properties of *P. hysterophorus* disrupt the natural ecosystems.

The phytochemical analysis of extracts of *P. hysterophorus in different solvents* is shown in Table 2. The results shows the presence of very high amount of phytochemical like alkaloids, tannin, steroid, cardiac glycoside, flavonoids, terpenoids and phenolic compounds etc.

These phytochemicals effects of the seed germination and early growth of other native plants of Aravalli hills of Ajmer district and this kind of inhibitory effects of one plant on another plants is well known as Allelopathy. It is the detrimental effect of chemicals or exudates produced by one living plant species on the germination, growth or development of another plant species or microorganisms sharing the same habitat. As a result of this, the plant diversity including the number of individual plants of a species and the number of species around *P. hysterophorus* is affected by the allelo-chemicals.



Figure 2. Photographs showing impact of *Parthenium hysterophorus* on vegetation of Aravalli hills.

Plant	Invaded	Un-invaded		
Alysicarpus vaginalis	20.8	21.92		
Amaranthus viridis	11.15	18.1		
Andrographis echiniodes	-	4.35		
Bidens biternata	21.36	32.9		
Blainvillea acmella	47.5	48.2		
Cassia absus	-	8.8		
Cassia pumila	9.6	14.5		
Catharanthus pusilus	-	11.15		
Clitoria ternatea	1.1	2.4		
Crotolaria medicagenia	34.3	37.5		
Euphorbia hirta	26.5	27.8		
Heliotropium curassivicum	6.7	11.3		
Indigofera tinctoria	4.3	8.8		
Ocimum canum	12.3	23.1		
Pedalium murex	6.9	7.5		
Sclerocarpus africanus	-	2.3		
Solanum nigrum	6.7	7.2		

Table 1. Relative Importance Value Index of some selected plants.



Graph: Showing IVI of some selected plant of the areas invaded and un-invaded by *P. hysterophorus.*

Solvents	Methanol fraction	Water fraction	Chloroform fraction
Phytochemicals			
Alkaloids	+	+	+
Tannins	+	_	+
Saponins	+	_	+
Flavonoids	+	+	+
Terpenoids	+	_	+
Cardiac glycosides	+	_	+
Phenols	+	+	+
Steroids	+	+	+
Anthraquinones	+	+	+

Table 2. Phytochemical screening of *Parthenium hysterophorus* in different solvents.

(+ = Present; - = Absent)

CONCLUSION

Aggressive invasion of *Parthenium hysterophorus* results in suppression of native bio-diversity and species richness of habitats such as pastures, woodlands and arable lands. It is proven that *P. hysterophorus* survives in a wide range of environments and is one of the most successful invasive species. It has high amount of allelochemicals which hinder the germination and growth of other plants. It has now naturalized in the local ecology in major parts of Ajmer and has to be accepted as a dominant species. It can be considered as a major natural resource that needs to be well managed for maximizing its utility. It could be concluded that the allelochemicals present in *P. hysterophorus* is a big challenge to control because of its high regeneration capacity, production of large amount of seeds, high amount of seed germination and extreme adaptability to a wide range of ecosystems and our results indicate that this invader has substantially stronger impacts on native diversity.

The invasion of *P. hysterophorus* harmed native flora of Aravalli hills and it will proved dreadful. It was reported to cause a undesirably decline the herbaceous components of vegetation up to 90% due to its destructive nature of competition and allelopathic effect and cause great change of native habitat. Currently this invasive weed occupies million hectares of land and further continues to expand its establishment because of its high invasive potential. The control of this may help in protection and restoration of biodiversity.

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REFERENCES

- Bhuvaneshwari, K., Muiyappan, C., Priyadharshini, D., Sathyapriya, P., Rathika, S. and Ramesh, T.
 (2019). Allelopathic effect of *Parthenium hysterophorus* L. on germination and seedling growth of different field crops, *The pharma innovation Journal*, 8(7), 257-261.
- **Evans, H.C. (1997).** *Parthenium hysterophorus*: a review of its weed status and the possibilities for its control, *Biocontrol News and Information*, 18(3), 89-98.
- Harborne, J.B. (1973). Phytochemical Method, London, Chapman and Hall, Ltd, 49-188.
- Mariajancyrani, J., Chandramohan, G., Brindha, P., Saravanan, P. (2014). GC-MS analysis of terpenes from hexane extract of *Lantana camara* leaves, *International Journal of Advances in Pharmacy, Biology and Chemistry*, 3, 37-41.
- Nganthoi Devi, Y., Dutta, B.K., Sagolshemcha, R. and Singh N.I. (2014). Allelopathic effect of *Parthenium hysterophorus* L. on growth and productivity of *Zea mays* L. and its Phytochemical screening, *International journal of current microbiology and applied sciences*, vol.3 No. 7, 837-846.
- Patel, S., Patel, D.K. and Nayak, B. (2019). Pharmacognostical and physicochemical evaluation of *Parthenium hysterophorus* plant, *Journal of pharmacognosy and phytochemistry*, 8(3), 604-607.
- Singh, S. and Yadav, M. (2019). Phytosociological analysis of Raoli-Todgarh wildlife sanctuary of Ajmer, Rajasthan; Ph.D thesis.
- **Sofowara, A. (1993).** Medicinal plants and Traditional medicine in Africa, Spectrum Books Ltd, Ibadan, Nigeria, 289.
- Tiwari, P., Kumar, B., Kaur, M., Kaur, G. and Kaur, H. (2011). Phytochemical screening and extraction: a review, *Internationale pharmaceutica sciencia*, 1(1), 98-106.
- **Trease, G.E. and Evans, W.C. (1989).** Pharmacognsy. Brailliar *Tiridel Can. Macmillian publishers*, 11th Edn..

Corresponding author: Dr. Tripti Gupta and Dr. Manoj Kumar Yadav, Department of Botany, S.P.C. Government College Ajmer – 305001, Rajasthan, India. Email: tripti.gupta.1610@gmail.com and manojanupam1317@gmail.com