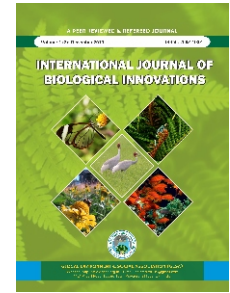




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Research Article

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Diversity of *Parthenium hysterophorus* and associated weeds in the Chitrakoot District

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Abstract: *Parthenium hysterophorus* L. (Carrot grass) is an annual herb of neotropical origin that now has a serious problem and pantropical distribution. It was first reported in India in 1950 at Pune (Maharashtra). This weed is very aggressive and commonly known as Congress grass and carrot grass in India. It has achieved major weed status in India within a relatively short period of time. *P. hysterophorus* is grown mostly in cultivated fields, fallow lands, pasture and along the roadsides. To analyse the distribution of this weed in Chitrakoot district an exhaustive survey was performed in the hilly place of Uttar Pradesh like Rajapur, Pahadi, Karwi and M.G.C.G.V. campus. During survey, the distribution of *P. hysterophorus* was measured in the agricultural lands, road side, river side and fallow lands. Moreover, the study also investigated the harmful effect of *Parthenium* upon native weeds and flora in the Chitrakoot district. Quadrates method (1mx1m) was used to collect the data of distribution and population of this weed. In this investigation, total 14 weed species were recorded belonging to 8 different families and 14 genera. The data were recorded by Absolute density (m²), relative density (%), absolute frequency (%), relative frequency (%) and importance value (%) of *Parthenium* and other associated weeds. The finding reveals that *Parthenium* weed is the most dominant species in comparison to other associated weeds. In conclusion, the *Parthenium* weed become a serious problem and replaces the entire native flora in the non-crop area. Due to no proper management and high growth rate, nowadays it becomes as super weed in the Chitrakoot district. So, the management of *Parthenium* weed requires the call attention from the Government Policy makers and proper quarantine inspection to conserve the native flora and fields crops to get maximum crop yield.

Keywords: Absolute density, Absolute frequency, Relative density, Relative frequency, Value, *Zygomorpha*.

INTRODUCTION

Parthenium hysterophorus is a short-lived annual herb with an erect shoot and an extensive root system. A mature plant of *Parthenium* can produce more than 15,000 flowers in its life cycle and each flower bearing 5 seeds. The optimum temperature for seed germination is 20 - 28°C. The whole plant cycle is completed within five months (Kushwaha and Maurya, 2012). This weed is native to tropical America, South America, Africa, Asia and Australia (Navie *et al.*, 1996). *Parthenium* weed is one of the noxious invasive and aggressive weeds (Adkins and Navie, 2006; Poudel, 2009;

Dahiya and Jakhar, 2015) that has made wide distribution globally affecting the growth of native species (Sushilkumar, 2009; Blackmere and Johnson 2010; Dogra *et al.*, 2015; and Shreshtha *et al.*, 2015). The neotropical weed *P. hysterophorus* (Asteraceae) is one of the top 10 notorious weeds in India (Joshi, 1991; Navie *et al.*, 1996 and Annapurna and Singh, 2003). *Cannabis sativa*, *Cassia occidentalis* and *Calotropis procera* are naturally growing plants which are being replaced by this weed (Khalid, 2000; Gazziero *et al.*, 2006; Knox *et al.*, 2010 and Kumari *et al.*, 2010). The main purpose of this investigation was to find out the diversity and

distribution of *P. hysterophorus* in the local areas of Chittrakoot district and to decipher the associated weeds. *Zygogramma bicolorata* (Mexican beetle), Pallister (Coleoptera: Chrysomelidae) is an effective bio-control agent of *P. hysterophorus* and introduced in 1983 from Mexico to Bangalore. Dhileepan, (2001) reported that *Z. bicolorata* had been tested and released as a classical biological control agent in 1980 in Queensland, Australia, where this biological control agent had significant effect on *Parthenium* weed. In many states of India, beetles have been established and contributing to control *Parthenium* very effectively and economically without causing hazards to the existing ecosystem (Anonymous, 2010). Tripathi and Chandra (2018) studied on conservation of *Z. bicolorata* as a biocontrol agent of *P. hysterophorus* and they recorded that the density and growth of *Parthenium* was declined after release of *Z. bicolorata*.

MATERIALS AND METHODS

A field survey was designed to investigate the distribution of *Parthenium hysterophorus* in the M.G.C.G.V. Campus and local areas of Chittrakoot district during July to September 2016-2018. Four different survey sites such as M.G.C.G.V. Campus, Karwi, Pahari and Rajapur were selected in Chittrakoot district. In the surveyed areas, *Parthenium* was mapped in distribution and occurrence of wastelands as well as crop fields. The experiment was conducted in order to study the influence of this weed on the native weeds inside the Agricultural lands, road side, river side, residential areas, fallow lands in M.G.C.G.V. campus and other local areas of Chittrakoot. For the data collection quadrates method was used. 10 quadrates (1x1 m) were randomly placed at each site and all species of plants within quadrates were recorded. Density and frequency of *Parthenium* weed and other plants species were estimated by using the parameters as adopted from Hussain, 1989 and Hussain *et al.*, 2004. Absolute density, Relative density, Frequency, Relative frequency, Importance Value and Importance Value Constancy Index were calculated.

In quadrates, the spaces among each quadrate depend on the availability of the areas along the field and any obstructions that was present. The identification of collected weed was done in the laboratory of Department of Biological Sciences, M.G.C.G.V. Chittrakoot, Satna (M.P.).

RESULTS AND DISCUSSION

On the basis of survey data, total 12 weeds species were recorded and identified belonging to 8 families and 12 genera. Distribution of weeds that found at the road side, agricultural lands and some founds in the fallow lands in higher and the lowest density. Moreover the study also shows that *P. hysterophorus* is susceptible to field disturbance due to their high infestation rate. The high infestation of *Parthenium* weed was recorded in the fallow lands. Overall the density and frequency of all identified weeds recorded.

Absolute density (m²)

The data illustrate that the variability in weed dynamics throughout 12 studied sites. According to survey, data show the utmost distribution of *Parthenium* (34.70m²) with mean

19.04m² at fallow land, Rajapur. However, except *P. hysterophorus*, the infestation of *Cynodon dactylon*, *Euphorbia helioscopia*, *Cyperus rotundus* and *Argemone mexicana* were found at every sites of Chittrakoot. *Parthenium* weed was observed in Agricultural land, fallow lands and road side at the every sites of Chittrakoot district. The minimum absolute density was found in University campus 5.40m². The minimum mean absolute density is 0.19 m² of *Dactyloctenium aegyptium*.

Relative weed density (%)

The relative density data (%) of all weeds were recorded, the highest density of *P. hysterophorus* is 61.68% at Rajapur in the fallow lands area, 55.12 at the Pahari (fallow lands), 52.57 at the Karwi (fallow lands), 49.57 at the road side and 44.86 in the M.G.C.G.V. campus. The lowest density (%) of *Parthenium* weed was 23.70 at the Pahari (Agricultural land). Data further showed that the *Cynodon dactylon* was the more occurred species with 17.51% relative density. The minimum relative density was represented by *Dactyloctenium aegyptium*.

Frequency of weeds in Chittrakoot District (%)

On the basis of infestation, *Parthenium* is grown in the every areas of Chittrakoot district having 76.66% mean frequency. The infestation and growth of *Parthenium* was so dense and found in most of the quadrates. The highest frequency (100%) of *P. hysterophorus* was recorded in fallow land and agricultural land at Rajapur and M.G.C.G.V. Campus while the minimum frequency (50%) was observed in the road side. *Cynodon dactylon*, *Euphorbia helioscopia*, *Cyperus rotundus* and *Argemone mexicana* observed in all surveyed areas having mean frequency of 73.33%, 40.83%, 70.00% and 38.33% respectively. The lowest mean frequency of *Calendula arvensis* was found in all sampling sites except M.G.C.G.V. Campus.

Relative frequency of weeds in Chittrakoot district (%)

The data related to relative frequency of *Parthenium* and other associated weeds showed that the highest relative frequency (25%) at road side, M.G.C.G.V. campus and minimum relative frequency was noted (9.43%) at agricultural land, Rajapur. The mean frequency of *Parthenium* weed is (17.63%) which is the highest in comparison to other associated weeds, followed by relative frequency 16.5% and 15.49% *Cynodon dactylon* and *Cyperus rotundus* respectively. *D. aegyptium* possessed the lowest relative frequency.

Importance value (%)

The importance value of weeds is a good indicator of the flora distribution in any area. In survey we found that the highest importance value of 40.84% for *Parthenium* weed at fallow lands in Rajapur closely followed by 40.31% at road side in Rajapur. *Parthenium* is the most prevalent weed at all highest with 30.32%. Data show that *Parthenium* and *Cynodon dactylon* are dominant in comparison to all other recorded 12 weeds and found in all study areas of Chittrakoot district. The highest infestation of *Parthenium* also confirmed by the Average Importance Value (AIV), Constancy and Importance value Constancy Index (IVCI).

Table 1: Importance value (%) of weeds in Chitrakoot district.

Sl. No	Botanical name of weeds	Common name	MGCGV Campus			Karwi			Pahari			Rajapur			AIV	Cons-tancy Classes	IVCI
			A 1	A 2	A 3	A 1	A 2	A 3	A 1	A 2	A 3	A 1	A 2	A 3			
1	<i>Parthenium hysterophorus</i>	Gajar ghas	24.37	34.34	28.76	23.60	33.66	34.31	17.21	35.46	31.44	19.54	40.84	40.31	30.32	12	363.82
2	<i>Cynodon dactylon</i>	Doobh ghas	11.06	21.51	23.04	13.49	15.85	11.17	14.62	14.28	9.82	9.65	16.58	16.66	14.81	12	177.73
3	<i>Euphorbia helioscopia</i>	Doodhi ghas	6.86	9.48	6.70	9.03	7.10	4.70	5.11	6.19	5.80	9.24	14.93	19.56	8.72	12	104.69
4	<i>Cbenopodium spp.</i>	Bathua	0.00	0.00	0.00	4.26	0.00	0.00	2.45	0.00	0.00	5.28	0.00	0.00	1.00	12	11.99
5	<i>Amaranthus viridis</i>	Chaurai	9.43	3.91	3.14	7.83	0.00	0.00	12.61	3.64	0.00	3.03	0.00	0.00	3.63	12	43.60
6	<i>Cyperus rotundus</i>	Motha	9.85	9.66	15.20	13.92	9.19	8.96	11.93	10.02	17.00	11.29	9.20	8.85	11.26	12	135.07
7	<i>Xantbium strumarium</i>	Chota Dhatura	0.00	0.00	0.00	0.00	7.60	3.09	0.00	4.06	3.25	0.00	2.22	7.43	2.30	12	27.66
8	<i>Dactyloctenium aegyptium</i>	Crow foot grass	0.00	0.00	0.00	0.00	0.00	0.00	10.20	0.00	0.00	0.00	0.00	0.00	0.85	12	10.20
9	<i>Rumex crispus</i>	Curly dock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.56	0.00	0.00	1.88	12	22.56
10	<i>Coronopus didymus</i>	Chick weed	0.00	0.00	0.00	8.26	0.00	0.00	0.00	0.00	0.00	3.45	0.00	0.00	0.98	12	11.71
11	<i>Argemone mexicana</i>	Satyanashi	4.32	6.19	9.20	3.94	1.92	7.55	5.81	10.24	13.64	2.85	5.87	7.20	6.56	12	78.71
12	<i>Calendula arvensis</i>	Field marigold	14.28	4.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54	12	18.50
13	<i>Poa annua</i>	Meadow grass	19.81	10.69	13.97	15.67	12.03	15.69	10.97	5.10	0.00	7.10	0.00	0.00	9.25	12	111.04
14	<i>Sorghum halepense</i>	Jhonsongrass	0.00	0.00	0.00	0.00	12.63	14.48	9.06	11.01	19.06	6.01	10.36	0.00	6.88	12	82.61

DISCUSSION

Although *P. hysterophorus* has been accidentally introduced in India yet in the present time it becomes a serious weed because it spread every states. The outcomes of this study indicate that this weed causes significant environmental problems, human health and loss in agricultural production. The high infestation of *Parthenium* affects crop productivity, biodiversity and health problems. This weed has the potential to spread all over the Chitrakoot district and now become a serious problem. Anon, 2004; and Usman *et al.*, 2010 confirmed that *Parthenium* weed contributes to social and economic instability, placing constraints on sustainable development, economic growth, poverty easement and food security.

Distribution of *Parthenium*

The present finding revealed that five weeds were common in all study areas i.e. *P. hysterophorus*, *Cynodon dactylon*, *Euphorbia helioscopia*, *Cyperus rotundus* and *Argemone*

mexicana. This investigation confirmed that *Parthenium* weed has become a serious and major problem of fallow lands, road side, river side and agricultural land in everywhere and well established in Chitrakoot district. Mahadevappa, 1997; and Navie *et al.*, 1996 reported that *Parthenium* is the most troublesome quite recently introduced and the data exhibits high relative density, relative frequency and importance value and confirmed that *P. hysterophorus* became the major noxious weed for the last 25 years in India and Australia, respectively. Huy and Seghal, 2004; and Shabbir and Bajwa, 2006 investigated that the extensive density along roadsides in different villages might be due to the road construction and transportation of soil, sands and gravels from *Parthenium* infested to non-infested areas. Data confirmed that *P. hysterophorus* was found in all surveyed areas of district Chitrakoot showing 100% occurrence. This weed has replaced previous native flora due to its effective adaptability to every climatic conditions.



Road side



River side



University Campus



Fallow land



Agricultural land

CONCLUSION

The finding of this investigation revealed that *P. hysterophorus* is well spread and established in every areas of Chitrakoot district due to its high rate of spreading and effective adaptability. In fact *Parthneium* has replaced our local flora and creating strong threat to our biodiversity. It is causing environmental problems, animal health problems, economic problems and food security of our country. Therefore, an appropriate *Parthenium* weed management strategy is necessary to stop potential spread and threats to biodiversity and economy of India.

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