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Impact Assessment of *Parthenium Hysterophorus* on Commercial Areas of Jalandhar, Punjab

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Abstract

An alien plant also referred to as exotic, introduced, foreign, non-indigenous or non-native, is one that has been introduced by humans intentionally or through human agency or accidentally from one region to another. Loss of plant species is due to these invasive plants. In India, many invasive exotic weeds have been reported but very little has been done on IAS in Punjab so far. Parthenium hysterophorus, one of the commonest weed of Punjab is considered for study as it causes decline in the amount of native species in the invaded area (commercial area). Impact assessment of Parthenium hysterophorus is done in roadside and wastelands of commercial areas of Jalandhar, Punjab (India) with the help of ground based mapping. There was significant increase in density of invasion, abundance and dominance in commercial areas and significant decrease in species richness (Margalef's index of Richness r_1) in invaded areas as compared to non-invaded areas. Total 75 species in commercial areas were noted in roadside and wastelands of Jalandhar. The invasion of Parthenium hysterophorus highly reduced the growth of other useful plant species in commercial areas as comparison to residential areas. They directly or indirectly become responsible for the loss of productivity and diversity of species in the invaded areas. So P.hysterophorus species drastically alters the structure, function and dynamics of invaded habitats. Thus, there is an urgent need for the management of these indigenous plants in the invaded areas under their natural habitats.

Key words: Invasive alien species (IAS); Important value index (IVI); Global impact studies project (GISP); Invasive exotic plants (IEP).

Introduction

The principle cause of habitat destruction is human activity and Invasive species are second only to habitat destruction as the cause of native species extinctions across the world. Extinction by the invasion of exotic species is like death by disease: gradual and insidious requiring scientific methods to diagnose. According to GISP: 'Invasive alien species are non native organisms that cause, or have the potential to cause, harm to the environment, economics or human health'. Thus establishment and spread of these species threatens ecosystems, habitats, or species with economic environmental harm [3]. Invasive exotic plants (IEP) are implicated as the decline of threatened and endangered species because they alter ecosystem processes, change community structure and displace native species [4, 7, 1]. In India, comprehensive studies on invasive species and plant invasion are still missing. Very little has been done on IAS in Punjab so far. In view of this, the present investigation was made to study invasiveness and impact of invasive plant on floristic composition of native species, to find the intensity of invasion of *P.*

hysterophorus and to understand impact of *P. hysterophorus* on the diversity of other species. Investigation to be carried in the residential and commercial areas of Jalandhar city of Punjab (India) on *Parthenium hysterophorus*.

Material & Methods

The study was conducted in Jalandhar, Punjab. Jalandhar is located on the intensively irrigated plain between Beas & Sutlej Rivers. The city is situated at 71 °31' East and 30 °33' North at a distance of 146 Km from state capital Chandigarh with an area of 3,401 sq.km. Present investigation was carried on *Parthenium hysterophorus* in the commercial areas of Jalandhar, Punjab. Commercial area - Sports & Surgical complex. The survey was conducted over a period of 2 months (August to September, 2009) on *Parthenium hysterophorus*. Ground based mapping/ survey approaches followed is of 2 types:-

1. **Windshield surveys-** This is the sighting or ocular survey. The method used for this approach is straightforward, which includes documentation of new populations of plants encountered. It includes parameters like species name, ocular estimates of area and density and location. It is used to develop more detailed sampling approaches required for systematic surveys.
2. **Systematic surveys-** This survey is to characterize invasive plant populations within the area of interest. The first step is to conduct a preliminary search to identify locations of invasive plants & thus, small areas are sampled randomly by use of a "quadrat".

All the plant species appeared in the invaded and non-invaded areas sampled, identified, and their invasiveness (i.e. characteristic of the species like distribution, reproduction, abundance etc. are specifically studied. Their various ecological indices (abundance, density, frequency, dominance & IVI) were calculated [5]. The plants were categorized according to their habits like tree, shrub, herb, sedges, climbers & vines.

Methods used for calculation of ecological indices are Population Density (per square meters), Species Abundance and Frequency of the species in study area, Basal area, Relative Dominance and Importance vale index (IVI). Various diversity indices of species richness were calculated as per the method given by Ludwig and Reynolds are Margalef's index of richness (r_1), Index of similarity (S) and Index of dissimilarity (Ds).

Results & Discussion

74 alien species were documented from the Residential and Commercial areas of Jalandhar city of Punjab during the survey conducted in the month of August, September (2009). These alien plants included various life forms such as herbs, shrubs, grasses, trees, vines, sedges and climbers. Most of the herbaceous plants were aliens as compared to other life forms. Asteraceae found to be the most dominant family among the alien species followed by Fabaceae, Poaceae and Lamiaceae. There were majority of alien species from American continent followed by Eurasia, Europe, Asia, Africa and Australia. Out of these species *P. hysterophorus* was included for study. This species is directly or indirectly affecting the ecosystem and function in the invaded habitats in Jalandhar city [6].

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The analysis of data collected from residential & commercial areas of Jalandhar indicated that most of the area was dominant with *P. hysterophorus* and which shows the high value for relative density, frequency and dominance in both roadside and wasteland. (Refer table no. I, II & III) [6].

Table I. Important value index (IVI) of *Parthenium hysterophorus* species in residential & commercial area.

S. No.	Date	Residential Area		Commercial Area	
		Road side	Waste land	Road side	Waste land
1	15 Aug,09	137.23	160.63	124.91	137.33
2	30 Aug,09	131.12	157.13	131.77	147.21
3	15 Sep,09	124.83	147.29	131.20	144.40

Table II. Relative Density, Relative Frequency & Relative Dominance of *Parthenium hysterophorus* species in residential area

S. No.	Date	Road side			Waste land		
		Rden (%)	Rfr (%)	Rdom (%)	Rden (%)	Rfr (%)	Rdom (%)
1	15 Aug,09	31.2	83.33	22.7	47.5	83.33	29.8
2	30 Aug,09	27.6	83.33	20.1	45.3	83.33	28.5
3	15 Sep,09	25	83.33	16.5	40.1	83.33	23.8

Table III. Relative Density, Relative Frequency & Relative Dominance of *Parthenium hysterophorus* species in Commercial area

S. No.	Date	Road side			Waste land		
		Rden (%)	Rfr (%)	Rdom (%)	Rden (%)	Rfr (%)	Rdom (%)
1	15 Aug,09	26.0	83.33	15.5	33.3	83.33	20.7
2	30 Aug,09	30.2	83.33	18.2	39.1	83.33	24.7
3	15 Sep,09	29.8	83.33	18.0	37.5	83.33	23.5

Impact Assessment of this plant shows that the overall loss in native species was found more in residential & commercial areas. The no. of plant species highly reduced in the areas invaded by *P. hysterophorus*. (Refer table no. IV) [2].

Table IV. Impact of *Parthenium hysterophorus invasion* on the plant diversity in commercial areas

S. No.	Commercial Area					
	Road side			Wasteland		
	Control	Invaded	% decrease over control	Control	Invaded	% decrease over control
1	46	20	(-)56.5	61	35	(-)74.2

The higher value of Margalef index of richness (r_1) in the uninvaded area shows that plant communities in the uninvaded areas are heterogeneous in nature and vice versa in the invaded areas. Decrease in the value of r_1 *P.hysterophorus* invaded habitats clearly signifies that these become less productive and stable as compared to invaded habitats (table V&VI) [2].

Table V. Margalef index of richness (r_1) for residential area showing impact of *Parthenium hysterophorus*

S.No.	Date	Control		*P. hysterophorus*		% decrease over control	
		Road side	Waste land	Road side	Waste land	Road side	Waste land
1	15 Aug,09	10.3	12.1	6.3	8.5	(-)38.8	(-)29.9
2	30 Aug,09	10.2	12.5	6.3	8.2	(-)38.2	(-)34.4
3	15 Sep,09	10.2	12.5	6.3	8.2	(-)38.2	(-)34.4
	Total					**(-)38.4**	**(-)32.9**

Table VI. Margalef index of richness (r_1) for commercial area showing impact of *Parthenium hysterophorus*

S.No.	Date	Control		*P.hysterophorus*		% decrease over control	
		Road side	Waste land	Road side	Waste land	Road side	Waste land
1	15 Aug,09	4.8	5.6	4.3	4.7	(-)10.4	(-)16.0
2	30 Aug,09	4.6	5.6	4.1	4.7	(-)10.8	(-)16.3
3	15 Sep,09	4.5	5.8	4.1	4.7	(-)9.2	(-)18.9
	Total					**(-)10.1**	**(-)17.0**

Comparing S & Ds of selected IEP in residential & commercial areas of Jalandhar, a maximum decrease in value of S &; maximum increase in Ds was found in residential areas than commercial areas which indicate dominance of selected IEP in residential areas than commercial areas of Jalandhar city (table VII).

Table VII. Similarity & dissimilarity index between residential & commercial areas of Jalandhar city.

S.No.	Parameters	Residential area	Commercial area
		Road side	Waste land
1	**Similarity index (S)**	33.33	30
2	**Dissimilarity index (D_S)**	66.67	70

Thus *P. hysterophorus* found to be a major plant species in the invaded areas of residential & commercial areas. The current study showed that the number of desirable species declined in both residential & commercial areas such a reduction

can lead to the increase in no. of *P.hysterophorus*. It also gives us an idea about the terrestrial IEP in two different areas of Jalandhar city and hence adding to the database of exotics in Punjab and highlights the need for effective management.

Conclusions

The present study was undertaken in the roadside & wasteland of residential and commercial areas of Jalandhar city, Punjab. The main objective was to study the invasiveness, intensity of invasion & impact assessment of IEP in Jalandhar with the help of ground based mapping. The salient features of this study are summarized as the Ground based mapping at both residential and commercial areas in Jalandhar shows the presence of IEP especially *Parthenium hysterophorus*. Intensity of invasion is measured & compared for residential and commercial areas. Relative Density and frequency of *P.hysterophorus* is more in residential areas than commercial areas. The number of species decreased in invaded areas and Species richness is reduced as compared with control in both residential areas and commercial areas. Total 41 species in residential areas & 75 species in commercial areas were noted in Jalandhar city. In commercial areas Margalef index of richness was reduced by 38.4% in roadside and 32.9% in wastelands of *P. hysterophorus* invaded areas to control. *P. hysterophorus* invaded areas, 26 species were found absent in roadside and 19 species were found in wasteland.

In conclusion the invasion of *P. hysterophorus* highly reduced the available habitats or niches for the growth of other useful plant species. They directly or indirectly become responsible for the loss of productivity and diversity of species in the invaded areas. So, *P. hysterophorus* drastically alters the structure, function and dynamics of invaded habitats. Thus, there is an urgent need for the management of this indigenous plant in the invaded areas under their natural habitats.

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