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Parthenium hysterophorus L. – A NOXIOUS ALIEN WEED

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ABSTRACT

Parthenium hysterophorus L. is a fast maturing annual native to the subtropics of North and South America. The survey of various districts of Punjab reveals that this weed is spreading rapidly in rain fed districts of Punjab viz. Sialkot, Gujranwala, Shekhupura, Lahore, Kasur, Hafizabad, Rawalpindi and Islamabad. The districts of southern Punjab viz. Multan, Bahawalpur and Bahawalnagar are either free or have very little infestation of this weed. This weed is very common along the roadsides, around the agricultural fields and on wastelands. The weed is rapidly replacing the local flora. The weed starts growing in February and remains dominant species in wastelands till winter. During winter the weed population becomes negligible. The allelopathic grasses like Desmostachya bipinnata Stapf. and Imperata cylindrica (L). Beauv. restrict the spread of this weed. So far this weed is not a problem of common crops like rice, wheat, maize and others. Nevertheless it invades the fields of some vegetables like Citrullus vulgaris where crop density is low especially when cropping is done on ridges. It was found that cows, buffalos and sheep do not eat this weed while goats do. This weed can be used as a green manure for maize and wheat.

Key words: Parthenium , distribution, Pakistan, Punjab, allelopathy

INTRODUCTION

Parthenium hysterophorus L. is an upright annual herb of 30-150 cm of family Asteraceae. It is native to subtropics of North and South America (Adkins *et al.*, 1996) and was accidentally introduced in subcontinent in 1955 through imported food grains. The weed has been rapidly spread in last twenty years and now it occurs widely along the roadsides, wastelands and sometimes in crop fields. The high dominance of *Parthenium* is attributed to its fast growth rate, high reproductive potential, adaptive nature and interference by allelopathy (Kohli and Rani, 1994). *P. hysterophorus* establishes only from seeds, which can germinate anytime of year given suiTable-moisture levels. Plants flower when they are 4-8 weeks old and may flower for several months (Dhawan and Dhawan, 1996). An individual plant may produce 15,000-25,000 seeds (Navie *et al.*, 1996). The weed lacks natural enemies in Pakistan.

P. hysterophorus posses a serious health risk. The chemical analysis has indicated that all the plant parts including trichomes and pollens contain toxins called sesquiterpene lactones. The major components of toxin being 'Parthenin' and other phenolic acids such as caffeic acid, vanillic acid, anisic acid, chlorogenic acid and parahydroxy benzoic acid are lethal to human beings and animals (Oudhia, 1998). In addition to health hazards a lot of available data also highlights its impact on agriculture

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as well as natural ecosystems (Chippendale and Panetta, 1994; Evans, 1997). The weed is rapidly spreading in Pakistan. The present study reports the distribution of *P. hysterophorus* in wastelands and agricultural fields, effect of allelopathic grasses on distribution of *P. hysterophorus* and grazing response of cattle towards *P. hysterophorus.*

MATERIALS AND METHODS

Surveys of different districts of the province Punjab were undertaken during the years 2003-2005 to study the distribution of *P. hysterophorus.* In the surveyed areas *P. hysterophorus* distribution was studied on wastelands, along the roadsides, and along the sides and inside of the fields of various agricultural crops. In order to study the impact of *P. hysterophorus* on the distribution of native weeds, data was collected from undisturbed localities along the side of BRB canal near Daska, district Sialkot using 1x1 m^2 quadrate. Frequency and density of *P. hysterophorus* and other weed species was estimated by applying the following formulas:

$$\text{Absolute frequency (AF) (\%)} = \frac{\text{Number of quadrates in which species occurs}}{\text{Total number of quadrates}} \times 100$$

$$\text{Relative frequency (RF) (\%)} = \frac{\text{Absolute frequency value for a species}}{\text{Total absolute frequency values for all species}} \times 100$$

$$\text{Absolute density (AD)} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates}}$$

$$\text{Relative density (RD) (\%)} = \frac{\text{Absolute density for a species}}{\text{Total absolute density for all species}} \times 100$$

Effect of other weed species especially perennial grasses on distribution of this weed species was also studied. The liking of animals including cows, buffalos, sheep and goats to *parthenium* was studied by observing these animals grazing in the pastures.

RESULTS AND DISCUSSION

Distribution of *P. hysterophorus* in wastelands

A general survey revealed that *Parthenium* has established itself in rain-fed districts of the province Punjab viz. Sialkot, Gujranwala, Lahore, Kasur, Shekhupura, Gujrat, Jehlem, Rawalpindi/Islamabad. It is also spreading up hills from Islamabad towards Murree. However, the districts of southern Punjab viz. Bahawalpur, Multan and Bahawalnagar were either free of *Parthenium* colonization or there was a little infestation of this weed. Low rain fall and salinity could be the possible regions of low *Parthenium* colonization in these areas. The weed is also spreading in Kashmir.

Most of the wastelands were found colonized by *P. hysterophorus.* Data collected from various localities in district Sialkot reveals that this weed was dominating the local flora at these sites with highest absolute frequency (AF) of 80%. The rest of the weed species showed 10–60% frequency of occurrence. *Achyranthes aspera,*

Carthamus oxycantha, *Malvestrum coromandelianum* and *Cynodon dactylon* were found more frequent with 40-50% AF, than rest of the weed species with 10-30% AF. The highest relative frequency (RF) of 18.6% was exhibited by *P. hysterophorus* followed by *C. dactylon* (13.9%), *M. coromandelianum* (11.6%), *C. oxycantha* (11.6%) and *A. aspera* (9.3%), respectively. The rest of the weed species exhibited less than 7 RF (Table-1).

The highest absolute density (AD) of 41 was exhibited by *P. hysterophorus* followed by *C. dactylon* (39), *M. coromandelianum* (11.8) and *C. oxycantha* (5.9). The rest of the weed species showed an AD of less than 5. The relative density (RD) of *P. hysterophorus* and other weed species also exhibited a pattern similar to that of AD (Table-1). The domination and rapid spread of *P. hysterophorus* in wastelands with gradual reduction of local flora could be attributed to its invasive capacity, allelopathic properties, high growth rate, short growth cycle and large number of seed production (Srivastava *et al.*, 1985; Evans, 1997; Oudhia, 1998). It has been reported as causing a total habitat change in native Australian grasslands, open woodlands, riverbanks and flood plains (McFadyen, 1992; Chippendale and Panetta, 1994). Similar invasions of *Parthenium* in National Wildlife Park in Southern India has also been reported (Evans, 1997).

Effect of perennial allelopathic grasses on distribution of *P. hysterophorus*

There was a very high infestation of *P. hysterophorus* in herb zone. The frequency and density of *P. hysterophorus* in this zone was 80 and 40, respectively. Both *Desmostachya bipinnata* and *Imperata cylindrica* colonization markedly reduced the distribution of this weed. The frequency and density of *P. hysterophorus* in *D. bipinnata* and *I. cylindrica* zone were reduced to 30 and 20, and 5 and 3, respectively (Figs. 1 & 2). This reduced frequency and density of *P. hysterophorus* in *D. bipinnata* and *I. cylindrica* dominating zones could be attributed to the release of water soluble allelochemicals released from roots and shoot of these grasses (Javaid *et al.*, 2005; Anjum *et al.*, 2005).

Invasion of *P. hysterophorus* in agricultural fields

Heavy infestation of *P. hysterophorus* was found along the boundaries of the fields of agronomic and horticultural crops. However, *P. hysterophorus* was not found in the fields of economically important crops like rice, maize and wheat (Fig. 3). A careful observation over a period of one year revealed that the weed start to germinate in the fallow fields but later agricultural practices and crop competition generally eliminate it from the fields. It generally grows in field when crop is grown on ridges and furrows. It grows only on ridges. The weed can also grow in a field when a comparatively less competitive crop that does not cover the soil completely is sown as *Citrullus vulgaris* (Fig. 3D). Very few plants of *P. hysterophorus* were found growing in the fields of *Trifolium alexandrinum* only on the ridges. It seems probable that *P. hysterophorus* is unable to compete with most of the crops especially cereals. Furthermore, it is unable to cope with the agricultural practices and generally grows outside the agricultural fields. It is a common observation that *P. hysterophorus* does not grow on damp soils. Since it generally grows only on ridges in the fields, it is likely that irrigation schedule of the agricultural crops does not suit to *P. hysterophorus*. However, there are reports that this weed has become a problem in agricultural fields in India (Evans, 1997). It could be attributed to the difference in agricultural practices in the two countries. The failure of *Parthenium* to establish itself in our agricultural fields seems to be due to wetland rice cultivation.

Grazing response of cattle towards *P. hysterophorus*

During surveys of various grazing pastures, it was found that cows, buffalos and sheep do not graze *P. hysterophorus* while goats readily grazed it (Fig. 4). Similar findings have also been reported earlier from India (Narasimhan *et al.*, 1977). However, earlier workers have reported that in artificial feeding tests cattle accepted the weed alone or in mixtures with green fodder, with severe consequences. The majority developed severe dermatitis and toxic symptoms and lesions were found subsequently in the gastrointestinal tract, liver and kidneys (Narasimhan *et al.*, 1977). Changes in blood chemistry and inhibition of liver dehydrogenases, as well as degenerative changes in both the liver and kidneys, have been reported in buffalo and sheep (Ahmad *et al.*, 1988; Rajkumar *et al.*, 1988). The milk of cattle may also be tainted by *Parthenium* (Towers and Rao, 1992).

Table-1. Frequency and density of *P. hysterophorus* and other weeds in district Sialkot, Pakistan.

Weed species	AF	RF	AD	RD
Parthenium hysterophorus L.	80	18.6	41	37.4
Achyranthes aspera L.	40	9.3	3.9	3.5
Alhagi maurorum Desv.	10	2.3	0.2	0.18
Cannabis sativa L.	10	2.3	0.1	0.09
Carthamus oxycantha Bieb.	50	11.6	5.9	5.3
Cenchrus pennicitiformis Hochst	10	2.3	0.5	0.45
Chenopodium album L.	30	6.9	0.9	0.82
Croton sparsiflorus Morong.	30	6.9	3.6	3.2
Cynodon dactylon L. Pers.	60	13.9	39	35.6
Dicanthium annulatum Staph.	10	2.3	0.5	0.45
Euphorbia prostrata L.	10	2.3	0.5	0.45
Imperata cylindrical (L). Beauv.	10	2.3	1	0.91
Malvestrum coromandelianum L.	50	11.6	11.8	10.7
Oxalis corniculata L.	10	2.3	0.3	0.27
Solanum nigrum L.	10	2.3	0.1	0.09
Trianthema monogyna L.	10	2.3	0.2	0.18

AF: Absolute frequency **RF**: Relative frequency

AD: Absolute density **RD**: Relative density

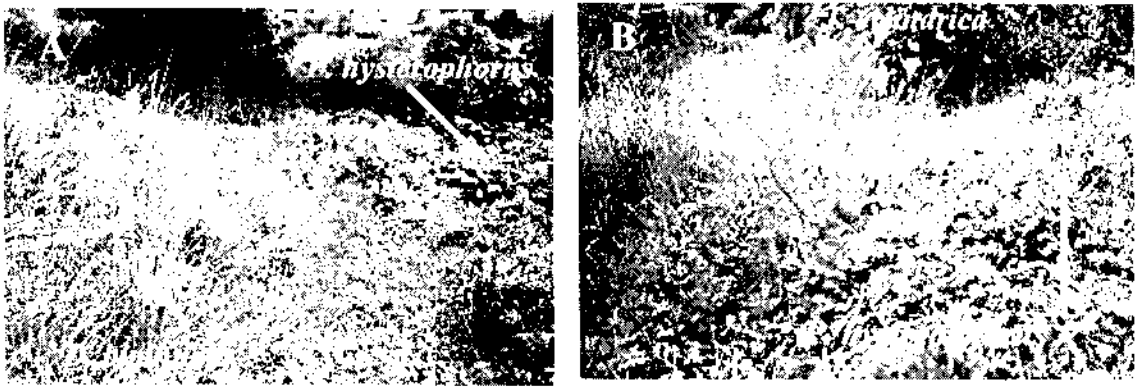
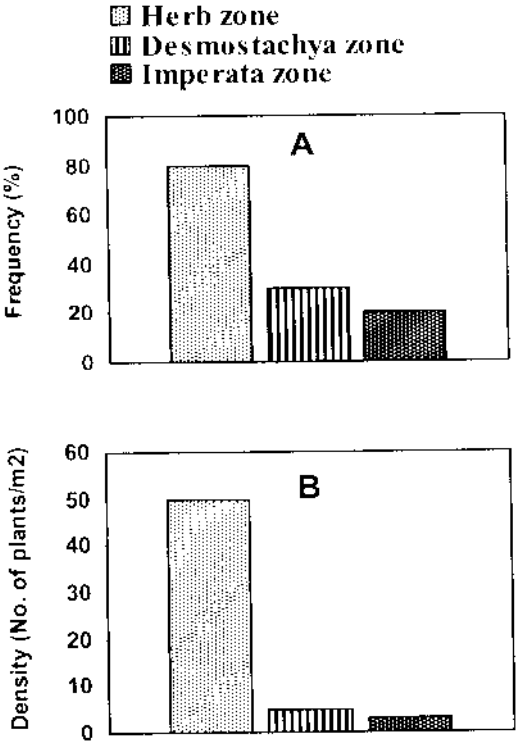
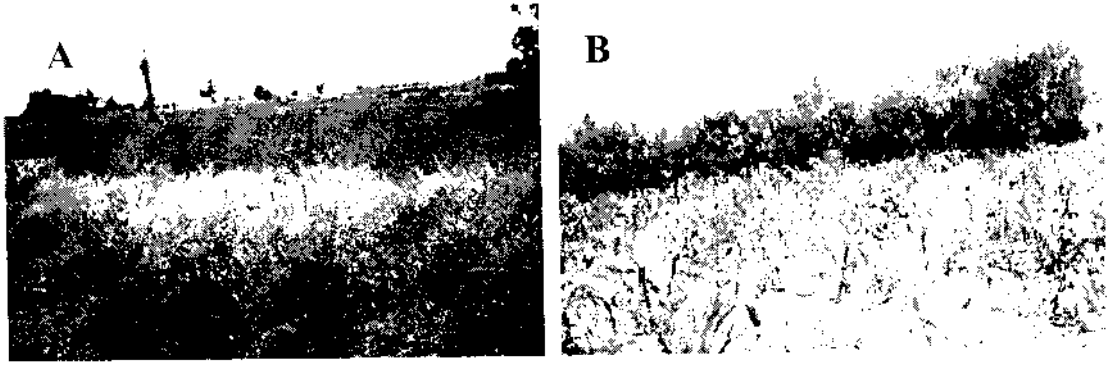


Fig. 1 Allelopathic grasses *Desmostachya bipinnata* (A) and *Imperata cylindrica* (B) restrict the growth of *P. hysterophorus*.



2: Frequency and density of *P. hysterophorus* in herb zone, *Imperata* zone and *Desmostachya* zone.



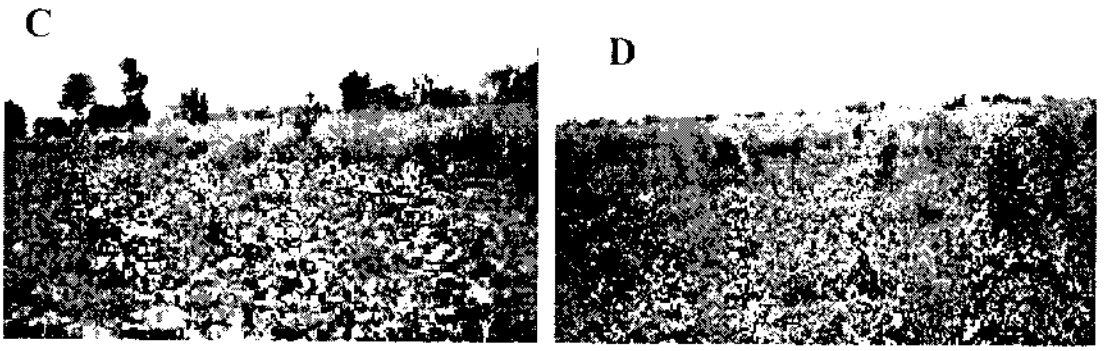


Fig. 3: *P. hysterophorus* growing along the fields of rice (A), maize (B) and *Bennincasa cerifera* (C), and in the field of *Citrullus vulgaris* (D).

Fig. 4: Goats eating *P. hysterophorus*.

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