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INVASION OF NOXIOUS ALIEN WEED *PARTHENIUM HYSTEROPHORUS* L. IN GRAZING LANDS OF LAHORE, PAKISTAN

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ABSTRACT

The present study reports the invasion of noxious, aggressive alien weed parthenium (*Parthenium hysterophorous* L.) in grazing lands of Lahore, Pakistan. Parthenium was found in all the five studied areas of Lahore exhibiting 100% prevalence. Out of total 53 weed species found in the surveyed areas, only 5 weed species other than parthenium showed 100% prevalence. Parthenium was found to be the second most densely populated weed species with absolute density (AD) of 16.8 and relative density (RD) of 15.59%, the first being the *Cynodon dactylon* Pers. with AD of 36 and RD of 33.4%. The other densely populated species with AD ranging from 1.5 – 5.78 were *Cypreus rotundus* L., *Croton sparsiflorus* Morong, *Euphorbia pilulifera* L., *E. prostrata* L., *Malvestrum tricuspidatum* A. Gray, *Brachiaria ramose* (L.) Stapf, *Dactyloctenium aegyptium* Beauv., *Digitaria timorensis* (Kunth) Balansa, *Echinochloa colonum* (L.) Link and *Eleusine indica* Gaertn. All other weed species showed AD below 1.0. The highest coverage was exhibited by *C. dactylon* (50%) followed by parthenium (30%).

Key Word: aggressive, noxious, parthenium, weed, relative density.

INTRODUCTION

Parthenium weed is native to the subtropics of North and South America. It is now widely distributed in a number of tropical and sub-tropical countries like Pakistan. Australia, India, China, Kenya and Ethiopia (Navie *et al.,* 1996; Javaid *et al.,* 2006). It accidentally introduced to neighboring country India in the mid-1950s through imported food grains. It is rapidly spreading in Pakistan for about last 20 years and has become a serious weed of waste and grazing lands, especially in rain fed districts of Central and Northern Punjab, NWFP and Kashmir (Javaid and Anjum, 2005; Riaz and Javaid, 2009). It is considered a noxious weed because of its allelopathic effect (Singh *et al.,* 2005), its strong competitiveness for soil moisture and nutrients, and the hazards it poses to humans (Khosla and Sobti, 1979), and animals (More *et al*., 1982). Chemical analysis of various parts of parthenium has indicated that it contains coronopilin, tetraneurin A, 2β-hydroxycoronopilin, hysterones A–D (Sethi *et al.,* 1987; Ramesh *et al.,* 2003), parthenin (Belz *et al*., 2007) and acetylated pseudoguaianolides (Das *et al*., 2007). In addition to health hazards a lot of available data also highlights its impact on agriculture as well as natural ecosystems (Batish *et al*., 2002; Singh *et al.,* 2005). There are reports of total habitat change in native Australian grasslands, open woodlands, river banks and floodplains due to parthenium invasion (Krickby and Romheld, 2004). Similar invasions of national wildlife parks have also been reported in southern India (Evans, 1997). The present survey was undertaken to study the invasion of this alien weed in different grazing lands in Lahore, Pakistan.

MATERIALS AND METHODS

Description of Sampling Area: The city of Lahore is located on latitude 31.57 N and longitude 74.31 E. The climate of the region presents extremes of heat and cold. There are four well defined seasons: winter (December - February); spring (March - April); summer (May - September) and autumn (October - November). The area receives highest rainfall during monsoon months of July and August. The soil of the area is generally loam or sandy loam in texture with pH 7.5 -8.0, average N 0.06%, available phosphorus 22 mg kg^{-1}, exchangeable potassium 190 mg kg^{-1} and organic matter below 1%.

***Phytsociological Study*:** The survey was conducted during September-October 2007. Five grazing land patches were selected in parts of the city Lahore viz., Quaid-e-Azam Campus of Punjab University, Johar Town, Thokar Niazbaig, Lahore Medical College, and BRB Canal side. The distance between the two adjacent sampling sites was 3–15 km. At each of the five selected sites, a 1 ha area was demarcated. Sampling was done with a $1m^2$ quadrate. Ten quadrates were randomly thrown at each sampling site. The following analytical attributes were calculated: prevalence, absolute density, relative frequency and percentage cover. The following formulae were used:

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$$\text{Prevalence (\%)} = \frac{\text{No. of sites in which a species occurs}}{\text{Total No. of sites}} \text{ x } 100$$

$$\text{Absolute density (AD)} = \frac{\text{Total No. of individuals of a species in all quadrates}}{\text{Total No. of quadrate}}$$

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

The percentage coverage of each weed species was determined on visual basis.

RESULTS AND DISCUSSION

A total of 53 weed species belonging to 20 angiospermic families were identified from the five grazing lands of the Lahore. Maximum number of species (18) belonged to family Poacea followed by Asteraceae (6), Amaranthaceae (5), Malvaceae (4), and Euphorbiaceae (3). Three families namely Chenopodicaeae, Solanaceae and Verbenaceae showed two species each. One species belonged to each of the rest 10 families namely Acanthaceae, Brassicaceae, Caesalpiniaceae, Convolvulaceae, Cyperaceae, Geraniaceae, Nyctaginaceae, Papilionaceae, Urticaceae and Zygophyllaceae (Table 1).

***Prevalence*:** *Parthenium* was found to be present at all the five surveyed localities exhibiting 100% prevalence. Among the rest 52 weed species only 5 species namely *Malvestrum tricuspidatum, Cynodon dactylon, Dactyloctenium aegyptium, Digitaria timorensis* and *Echinochloa colonum* showed 100% prevalence. Among these five species the last three species are annual rainy season grasses (Table I). Since the sampling was done during the month of September after rainy season thus their prevalence was likely to be high. *C. dactylon* is a perennial grass and is very common in the area. There was only one broadleaf weed species, *M. tricuspidatum* that was at par with parthenium in its prevalence in the surveyed area. Most of the local broadleaf weed species showed below 50% prevalence. The high prevalence of parthenium in the area may be attributed to many factors. Parthenium weed is an extremely prolific seed producer, with up to 25,000 seeds per plant (Navie *et al.,* 1996), and with an enormous seed bank, estimated at 200,000 seeds m^{-1} in abandoned fields (Joshi, 1991). Furthermore, seeds can germinate any time of year given suitable moisture levels. The seeds of parthenium remain viable for a long time and can thrive under very harsh environmental conditions (Williams and Groves, 1980). Non dormancy and extreme light weight of its seeds armed with pappus are the characteristics which help its extensive spread and establishment (Ramaswami, 1997).

Density: Parthenium was found to be the second most densely populated weed species with absolute density (AD) of 16.8 and relative density (RD) of 15.59%, the first being the *Cynodon dactylon* Pers. with AD of 36 and RD of 33.4%. The other weed species with fairly dense population were *M. tricuspidatum, Dactyloctenium aegyptium, Digitaria timorensis, Euphorbia pilulifera* and *Echinochloa colonum* with AD of 7.8, 7.3, 5.26, 5.48 and 3.12, and RD of 7.236, 6.773, 4.880, 5.084 and 2.969%, respectively. Most of the weed species exhibited AD below 1(Table I). Many factors are responsible for this high density of parthenium in the area. Firstly, weed has a very high reproduction potential producing up to 25,000 seeds per plant (Navie *et al*., 1996). Secondly, parthenium is an aggressive weed and its aggressive nature is attributed to allelopathic properties. All parts of plant viz. root, stem, leaves and inflorescence contain various allelochemicals such as water soluble phenolics including caffeic, ferulic, vanicillic, anisic and fumaric acids, and sesquiterpene lactones including parthenin and coronopilin, (Picman and Picman 1984; Venkataiah *et al.,* 2003; Belz *et al*., 2007). These chemicals are released from living plant parts or from decomposing litter and adversely affect the germination and growth of neighboring plants, consequently it soon establishes its own colony at the cost of other vegetation, and thus affects crop production, biodiversity, animal husbandry and even human health (Kholi and Rani, 1994; Navie *et al.,* 1996). Thirdly, it is a very fast maturing annual. Generally plants commence flowering when they are 4 to 8 weeks old and may flower for several months. Under unfavorable conditions such as under drought stress the weed can germinate, grow, mature and set seeds in four weeks. The weed also has a very high regenerative potential (Dagar *et al.,* 1976). Fourthly, generally animals do not eat *parthenium* and thus in the absence of any grazing pressure its population is increased unchecked. Fifthly, the lack of natural enemies of this weed in Pakistan is also contributing to a large extent in the rapid spread and dense population of this weed in this country. Over 260 phytophagous arthropods species have been collected from *parthenium* from its native homeland out of which 144 species actually fed on the weed (McClay *et al*., 1995). From Pakistan recently we have found a potential biological control agent i.e., the beetle *Zygogramma bicolorata* Pallister, feeding on the leaves of parthenium (Javaid and Shabbir, 2006). The beetle was first introduced to Australia from Mexico in 1980 (McFadyen and McClay, 1981) and subsequently was introduced to India

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Table 1: Frequency and density of *P. hysterophorus* and other weeds in a wasteland at University of the Punjab, Quaid-e-Azam Campus, Lahore.

Species	Family	P (%)	AD	RD (%)	C (%)
Parthenium hysterophorus L.	Asteracaea	100	16.8	15.59	30
Ageratum conyzoides L.	″	10	0.28	0.259	1
Conyza ambigua DC.	″	20	0.04	0.037	0.2
Eclipta alba Hassk.	″	20	0.02	0.018	0.4
*Sonchus asper*Vill.	″	20	0.12	0.111	0.8
Xanthium strumarium L.	″	80	0.54	0.501	2
Peristrophe bicalyculata Nees	Acanthaceae	40	0.28	0.259	1
Achyranthes aspera L.	Amaranthaceae	60	0.66	0.612	3
Alternanthera sessilis R. Br.	″	20	0.20	0.185	1.2
Amaranthus viridis L.	″	60	0.46	0.426	2
A. spinosus L.	″	20	0.02	0.018	0.1
Digera arvensis Forsk	″	20	0.06	0.055	0.2
Calotropis procera Br.	Asclepiadaceae	60	0.38	0.352	2
Coronopus didymus (L.) Sm.	Brassicaceae	20	0.06	0.055	0.3
Cassia oscidentalis L.	Caesalpiniaceae	80	0.46	0.426	3
Chenopodium album L.	Chenopodicaeae	40	0.12	0.111	2
C. ambrosioides L.	″	20	0.10	0.092	1
Convolvulus arvensis L.	Convolvulaceae	40	0.16	0.148	1.5
Cephalandra indica Naud.	Cucurbitaceae	40	0.10	0.092	0.5
Cypreus rotundus L.	Cyperaceae	60	2.6	2.412	5
Croton sparsiflorus Morong	Euphorbiaceae	60	3.9	3.618	4
Euphorbia pilulifera L.	″	80	5.48	5.084	3.5
E. prostrata L.	″	80	4.0	3.711	6
Oxalis corniculata Ait.	Geraniaceae	20	0.24	0.22	2
Abutilon indicum G. Don.	Malvaceae	20	0.04	0.037	0.5
Malvestrum tricuspidatum A. Gray	″	100	7.8	7.236	15
Sida spinosa L.	″	20	0.20	0.185	0.1
Urena lobata L.	″	20	0.20	0.185	0.2
Boerhaavia diffusa L.	Nyctaginaceae	40	0.66	0.612	1
Apluda mutica L.	Poaceae	20	0.12	0.111	0.3
Brachiaria ramose (L.) Stapf	″	60	1.58	1.465	5
B. reptans (L.) Gard. & Hubb.	″	80	2.2	2.041	6
Cenchrus biflorus Roxb.	″	20	0.04	0.037	0.8
C. pennisetiformis Hochest	″	40	0.28	0.259	1.5
Cynodon dactylon Pers.	″	100	36	33.40	50
Dactyloctenium aegyptium Beauv.	″	100	7.3	6.773	12
Dicanthium annulatum Stapf.	″	60	0.94	0.872	2
Digitaria timorensis (Kunth) Balansa	″	100	5.26	4.880	7
Echinochloa colonum (L.) Link	″	100	3.12	2.969	6
Eleusine indica Gaertn.	″	60	1.5	1.391	4
Eragrostis poaeoides Beauv.	″	40	0.30	0.278	0.7
Leptochloa chinensis Nees	″	40	0.30	0.278	0.6
Paspalum distichum L.	″	20	0.40	0.371	0.5
Setaria glauca Beauv.	″	60	0.26	0.241	1.8
S. verticillata Beauv.	″	60	0.08	0.074	0.8
Sorghum helepense Pers.	″	20	0.12	0.111	0.7
Urochloa panicoides Beauv.	″	40	0.20	0.185	0.7
Datura alba Nees	Solanaceae	20	0.06	0.055	1
Physalis minima L.	″	20	0.04	0.037	0.5
Cannabis sativa L.	Urticaceae	20	0.06	0.055	0.5
Lantana camara L.	Verbenaceae	20	0.20	0.185	1
Verbena officinalis L.	″	20	0.04	0.037	0.2
Tribulus terrestris L.	Zygophyllaceae	40	0.70	0.649	2

P: Prevalence, **AD**: Absolute density, **RD**: Relative density, **C:** Cover

in 1984 (Jayanth, 1987) and there are successful reports of parthenium biocontrol from both the countries (Evans, 1997).Unfortunately the population of this beetle is not large enough in Pakistan to control this noxious weed.

***Percentage Cover*:** The highest percentage cover of 50% was exhibited by *C. dactylon*, the most common grazing grass in the area. Parthenium was found to be the second in coverage area (30%). The other weed species with fairly good coverage of 5% or above were *M. tricuspidatum* (15%), *D. aegyptium* (12%), *Digitaria timorensis* (7%), *Echinochloa colonum* (6%), *Brachiaria reptans* (6%) and *B. ramose* (5%). Among the broadleaf weeds only *M. tricuspidatum* seems to be a good competitor of parthenium and found growing side by side with this alien weed (Table 1). Although the highest density and coverage was shown by the most common grazing grass *C. dactylon* and parthenium was second to it, yet parthenium has attained a dominant status in most of the grazing and waste lands in Lahore as well as in other areas like Islamabad (Shabbir and Bajwa, 2006), Shekhupura (Riaz and Javaid, 2007) and Okara (Javaid and Riaz, 2007). It is because *C. dactylon* is a creeping grass while parthenium is an upright broadleaf weed that may attain a height of up to 2 m under favorable conditions and shows its dominance.

Because of very conducive environment for its germination and growth, parthenium is rapidly spreading in Pakistan and has become an emerging threat to the plant biodiversity in the most parts of Punjab, NWFP and Kashmir. There is an urgent need to take integrated measures to manage the further spread of this noxious alien weed in the country.

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