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INVASION OF HOSTILE ALIEN WEED *PARTHENIUM HYSTEROPHORUS* L. IN WAH CANTT, PAKISTAN

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ABSTRACT

A survey of Wah Cantt district Rawalpindi was carried out in April 2007 to study the invasion and distribution of an alien invasive weed parthenium (*Parthenium hysterophorus* L.). Eight wastelands, each of about 1 ha area were selected in different areas of Wah Cantt. Sampling was done with 1 m^2 quadrate. Data regarding prevalence, absolute and relative frequency, and absolute and relative density of parthenium and other weeds of the area were recorded. A total of 44 weed species belonging to 24 families of angiosperms were recorded in the studied area. Parthenium was found in all the eight studied sites showing 100% prevalence. Parthenium was the second most frequently occurring weed in the study area with absolute frequency (AF) of 76% and relative frequency (RF) of 3.92%, after *Cannabis sativa* with 86% AF and 4.28% RF, respectively. Similarly *C. sativa* and parthenium were found the two most densely populated weeds with 1.82 and 1.63 absolute density (number of plants m^{-2}) and 6.68 and 5.99% relative density, respectively. The present study revealed that the parthenium has attained the second most frequently and densely occurring weed in the area. There is fear that because of its high reproductive potential, fast growth rate, allelopathic nature and high adaptability to the prevailing environmental conditions, it may attain the status of dominating weed in the studied and surrounding areas. Therefore, there is need for an urgent parthenium management strategy to stop further spread of this noxious alien weed in the area.

Key words: Absolute density; Alien weed; *Parthenium hysterophorus;* Relative density.

INTRODUCTION

Parthenium (*Parthenium hysterophorus* L.), an annual invasive weed of family Asteraceae, is native to tropical America while widespread in North America, South America, the Caribbean, and many parts of Africa, Asia, and Australia (Navie *et al.*, 1996). It is thought to be accidentally introduced to neighboring country India in the mid-1950s through imported food grains (Chandras and Vartak, 1970) and has since spread over most parts of the Indian sub-continent, including Pakistan. In Pakistan this weed is rapidly spreading in parts of Punjab, NWFP and Kashmir, and replacing the local flora. it is now naturalized in several parts of these area and can be seen growing luxuriantly in open spaces, grassland, wasteland and also sometimes in cultivated areas (Javaid and Anjum, 2005). The invasive nature of this weed is evident from its ability to form huge monocultural stands with no other plant in the vicinity. Parthenium is known to cause a number of environmental and agricultural problems, such as the loss of crop productivity, fodder scarcity, biodiversity depletion and health problems for livestock (Kohli and Rani, 1994; Evans, 1997). Parthenium is also a serious human health problem causing hay fever, skin problems, and asthma (McFadyen, 1995; Cheney, 1998).

Earlier research work regarding the distribution of parthenium has been carried out in plains of Punjab including district Lahore, Sialkot, Sheikhupura and Okara (Javaid and Anjum, 2005; Javaid *et al.* 2005, 2006, Javaid and Riaz, 2007; Riaz and Javaid, 2007). However, in Pothwar region a single study was undertaken by Shabbir and Bajwa (2006) who studied the distribution of parthenium in residential areas of Islamabad. Similar studies in other areas of the region are entirely lacking. The present survey was, therefore, undertaken to study the distribution of Parthenium in relation to the native vegetation in Wah Cantt.

MATERIALS AND METHODS

Description of sampling site: The city of Wah Cantt is located at latitude 31.57 N and longitude 74.31 E, north west of Federal Capital Islamabad at the distance of 50 Km. It is a valley surrounded by hills from all directions. Spread over a total area of 92 Km^2 and is one of the tehsils of district Rawalpindi. The climate of the region presents extremes of heat and cold. There are four well defined seasons viz. winter (December-February), spring (March - April), summer (May - September) and autumn (October - November). The area receives the highest rainfall during monsoon months of July and August.

Phytsociological study: Eight waste and grazing lands were selected in and surroundings of Wah Cantt, district Rawalpindi viz. Taxila More, Nawab Abad, Model

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Town, Lalarukh, Lalazar, Barrier 3, Mall Road and Wah Garden during April 2007. The distance between the two adjacent sampling sites was 2–6 km. At each of the eight 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. Data regarding prevalence, absolute frequency, relative frequency, absolute density and relative density of target weed *P. hysterophorous* L. and local weed flora were calculated by applying the following formulae:

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

$$\left[\text{Absolute frequency (AF) (\%)} = \frac{\text{No. of quadrates in which a species occurs}}{\text{Total No. of quadrate}} \times 100\right]$$

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

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

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

RESULTS AND DISCUSSION

A total of 44 plant species belonging to 24 angiospermic families were recorded in the study area. The maximum number of weed species (7) belonged to family Asteraceae followed by family Poaceae (5), Brassicaceae (4), Solanaceae (3), Amaranthaceae, Euphorbiaceae, Malvaceae Pappilionaceae, and Polygonaceae (2 each). There was one species of each of the rest 15 families (Table 1).

Prevalence: Parthenium was found in all the eight studied sites exhibiting 100% prevalence. Among other 43 species, 26 showed 100% prevalence and 12 others showed more than 70% prevalence. The species exhibited comparatively low prevalence included *Datura stramonium* (63%), *Mazus goodenifolia* (63%), *Medicago sativa* (63%), *Orobanche indica* (50%) and *Soghum helepense* (25%) (Table 1).

Absolute and relative frequency: *Cannabis sativa* was found to be the most frequently occurring species in the area with absolute frequency (AF) of 83% and relative frequency (RF) of 4.28%. The alien weed parthenium exhibited the second highest AF and RF of 76% and 3.92%, respectively. The other frequently occurring species with AF of 50–68% and RF of 2.59–3.5% were *Silybum marianum, Amaranthus viridis, Coronopus didymus, Cyperus rotundus, Euphorbia prostrate, Oxalis corniculata, Malva parviflora, Cenchrus biflorus, Cynodon dactylon, Rumex dentatus, Solanum nigrum, Tribulus terrestris* and *Verbena tenuisecta.* The moderately frequent species *Cirsium arvense, Conyza bonariensis, Sonchus asper, Capsella bursa-pastoris, Lepidium sativum, Sisymbrium irio, Opuntia monacantha, Chenopodium album, Convolvulus arvensis, Euphorbia helioscopia, Malvestrum tricuspidatum, Boerhavia diffusa, Melilotus sativa, Imperata cylindrica, Poa annua* and *Portulaca oleracea showed* AF of 31–49% and RF of 1.59–2.52%. Rest of the rarely and very rarely occurring species exhibited less than 30% AF. The least frequently occurring species in the area was *Sorghum helepense* with 4% AF and % RF (Table 1).

Absolute and relative density: The most densely populated weed in the area was *C. sativa* that exhibited an absolute density (AD) of 1.82 and relative density (RD) of 6.68%. Parthenium was found to be the second most densely populated weed in the surveyed area with AD of 1.63 and RD of 5.99%. The other densely populated weeds which showed AD 1.0 or above were *C. rotundus, O. corniculata, C. biflorus, R. dentatus* and *V. tenuisecta.* Other weed species with fairly high AD of more than 0.70 were *S. marianum, A. viridis, C. didymus, E. prostrata, C. dactylon, I. cylindrica* and *T. terrestris* (Table 1).

Among the 44 species, 7 asteraceous species exhibited 88–100% prevalence and AF frequency of 23-76% showing that the prevailing edaphic and environmental conditions of the area are highly conducive for the distribution and growth of members of this family. The environment is especially well suitable

for the alien weed parthenium that exhibited 100% prevalence, 76% AF and a high AD of 1.63 plants m^{-2}. Although parthenium was introduced in India in 1950s through imported food grains (Evans, 1997), however, its presence in different parts of the Punjab, Pakistan was noticed only during the last 15-20 years (Javaid and Anjum, 2005). During this short period it has become second most frequently occurring and densely populated weed in the studied area, and is only second to *C. sativa* which is growing in the area since long. Parthenium may

Table 1: Prevalence, frequency and density of alien weed parthenium and native weeds in Wah Cantt.

Species	Family	**P** (%)	**AF** (%)	**RF** (%)	**AD**	**RD** (%)
Parthenium hysterophorus L.	Asteraceae	100	76	3.92	1.63	5.99
Carthamus oxyacantha (M). Bieb.	″	88	23	1.18	0.25	0.91
Centaurea calcitrapa L.	″	88	26	1.34	0.37	1.35
Circium arvense L.	″	100	46	2.37	0.41	1.50
Conyza bonariensis (L.) Cronq.	″	100	45	2.32	0.47	1.72
Silybum marianum (L.) Gaertn.	″	100	50	2.59	0.78	2.86
Sonchus asper (L.) Hill	″	100	48	2.47	0.46	1.69
Achyranthes asper L.	Amaranthaceae	88	24	1.23	0.27	0.99
Amaranthus viridis L.	″	100	58	2.99	0.85	3.12
Calotropis procera Br.	Asclepiadaceae	88	31	1.59	0.42	1.54
Heliotropium indicum L.	Boraginaceae	75	23	1.18	0.30	1.10
Capsella bursa-pastoris(L.) Medik.	Brassicaceae	100	39	2.01	0.43	1.58
Coronopus didymus (L.) Smith	″	100	61	3.14	0.86	3.16
Lepidium sativum L.	″	88	41	2.11	0.55	2.02
Sisymbrium irio L.	″	100	49	2.57	0.60	2.20
Opuntia monacantha. Haw.	Cactaceae	88	38	1.96	0.66	2.42
Chenopodium album L.	Chenopodicaeae	88	49	2.52	0.57	2.09
Convolvulus arvensis L.	Convolvulaceae	100	48	2.47	0.53	1.94
Cyperus rotundus L.	Cyperaceae	100	66	3.40	1.01	3.71
Euphorbia. prostrata L.	Euphorbiaceae	100	58	2.99	0.82	3.01
Euphorbia helioscopia L.	″	100	43	2.21	0.61	2.24
Malva parviflora L	Malvaceae	100	58	2.99	0.66	2.20
*Malvestrum tricuspidatum (*A.) Gray	″	100	49	2.52	0.71	2.60
Boerhavia diffusa L.	Nyctaginaceae	100	48	2.47	0.61	2.24
Orobanche indica L.	Orobanchaceae	50	6	0.30	0.06	0.22
Oxalis corniculata L.	Oxalidaceae	100	66	3.40	1.13	4.15
Medicago sativa L.	Papillionaceae	63	18	0.92	0.10	0.36
Melilotus sativa L.	″	100	45	2.32	0.48	1.30
Cenchrus biflorus Roxb.	Poaceae	100	65	3.35	1.21	4.44
Cynodon dactylon Pers.	″	100	62	3.19	0.98	3.60
Imperata cylinderica (L.) Beauv.	″	100	45	2.32	0.78	2.86
Poa annua L.	″	88	44	2.27	0.65	2.38
Sorghum helepense L.	″	25	4	0.20	0.03	0.11
Polygonum plebegum L.	Polygonaceae	75	26	1.34	0.26	0.95
Rumex dentatus L.	“	100	68	3.50	1.06	3.89
Portulaca oleracea L.	Portulacaceae	100	48	2.43	0.48	1.30
Anagallis arvensis L.	Primulaceae	75	26	1.34	0.32	1.17
Mazus goodenifolia Horneum. (Penn.)	Scrophulariaceae	63	19	0.98	0.18	0.66
Datura stramonium L.	Solanaceae	63	14	0.72	0.13	0.47
Solanum nigrum L.	″	100	60	3.09	0.52	1.91
Withania somnifera L.	″	88	26	1.34	0.27	0.99
Canabis sativa	Urticacea	100	83	4.28	1.82	6.68
Verbena tenuisecta L.	Verbenaceae	100	60	3.09	1.17	4.29
Tribulus terrestris L	Zygophyllaceae	100	56	2.88	0.75	2.75

P = Prevalence **AF** = Absolute frequency **RF** = Relative frequency
AD = Absolute density **RD** = Relative density

attain a height of up to 2 meters under favorable conditions and its plant size is comparable to *C. sativa*, so it has become a second dominating weed in these areas. Similar domination of *Parthenium* at waste and grazing lands has also been reported in districts Lahore and Sialkot as well as in Capital city of Islamabad (Javaid *et al*., 2005, 2006; Shabbir and Bajwa, 2006). This weed is also reported to be rapidly spreading in parts of NWFP and Kashmir (Javaid and Anjum, 2005). Many factors are responsible for rapid spread of *Parthenium* in Pakistan. Firstly this 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). Secondly, being a very fast maturing annual, generally plants commence flowering when they are 4 to 8 weeks old and may flower for several months. Thirdly, parthenium exhibit allelopathic effects thus inhibits the germination and growth of neighboring plants by releasing various allelochemicals such as water soluble phenolics and sesquiterpene lactones including parthenin and coronopilin (Kanchan 1975; Jarvis *et al.*, 1985; Picman and Picman 1984). Fourthly, most of the animals do not eat parthenium.

Lastly, the lack of natural enemies such as insects and pathogens of this weed in Pakistan is also contributing to a large extent in the rapid spread of this weed in Pakistan. Due to its high reproductive and allelopathic potential, fast growth rate and lack of natural enemies, parthenium may attain the status of most dominating weed in the surveyed and surrounding Pothwar areas in near future. There is an urgent need of integrated parthenium management strategy to stop further spread of this alien weed in the region

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