SPREAD OF AGGRESSIVE ALIEN WEED *PARTHENIUM HYSTEROPHORUS* L. IN DISTRICT OKARA, PAKISTAN

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ABSTRACT

Distribution of aggressive alien weed species *Parthenium hysterophorus* L. was studied in district Okara, Pakistan during September-October 2006. Eight waste and grazing lands, each of about 1 ha, were selected randomly in different parts of district Okara with 3–8 km distance between the two adjacent localities. *P. hysterophorus* was found in 7 out of 8 studied sites exhibiting 88% prevalence. The absolute and relative frequencies of *P. hysterophorus* were 36% and 2.56%, and absolute and relative densities were 0.56 and 2.71%, respectively. The frequency and density of *P. hysterophorus* were higher than 28 and 30 out of 38 weed species, respectively, identified from the studied areas.

Key words: Alien weed, distribution, Okara, Pakistan, *Parthenium hysterophorus*.

INTRODUCTION

Naturally *Parthenium hysterophorus* L., occurs throughout the tropical and subtropical America from the southern United States of America (USA) through to southern Brazil and northern Argentina (Dale, 1981). *P. hysterophorus* weed has also spread to southern China, Taiwan and Vietnam in Asia (Nath, 1981), is present in several Pacific islands, and has invaded several African countries including South Africa, Mozambique, Ethiopia and Kenya, and (Njoroge, 1989; Tamado *et al*., 2002). 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. It is rapidly spreading in Pakistan and is now a serious weed of wastelands and grazing lands, especially in rainfed districts of Central and Northern Punjab (Javaid and Anjum, 2005). It is a potential major weed for agro-ecosystems in Pakistan (Adkin and S.C. Navie, 2006). It is considered a noxious weed because of its allelopathic effect against the associated plant species (Swaminathan *et al.*, 1990; Batish *et al*., 2002; Singh *et al*., 2002) by releasing allelochemicals such as parthenin, coronopilin, tetraneurin A, 2β-hydroxycoronopilin and hysterones A–D (Herz *et al*., 1962; Picman *et al*., 1980; Sethi *et al*., 1987; Ramesh *et al*., 2003). It is also notorious for its strong competitiveness for soil moisture and nutrients, and the hazard it poses to humans (Khosla and Sobti, 1979) and animals (More *et al*., 1982). There are reports of total habitat change in native Australian grasslands, open woodlands, river banks and floodplains due to *P. hysterophorus* invasion (McFayden, 1992; Chippendale & Panetta, 1994). Similar invasions of national wildlife parks have also been reported in southern India (Evans, 1997). The present survey was undertaken to study the distribution of *P. hysterophorus* in district Okara, Pakistan.

MATERIALS AND METHODS

Eight waste and grazing lands were selected in different parts of district Okara. The distance between two sampling sites ranged from 3 – 8 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. Prevalence, absolute and relative frequency, and absolute and relative density were calculated by applying the following formulae. The following formulae were used:

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

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

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

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

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

RESULTS AND DISCUSSION

Prevalence: A total of 38 weed species belonging to 15 families of angiosperms were identified from 8 studied sites of district Okara. Except for three species namely *Euphorbia pilulifera*, *Pullicaria crispa* and *Cassia*

oscidentalis, which exhibited 25, 63 and 63% prevalence, respectively, all other species exhibited 75% or above prevalence. The alien weed *P. hysterophorus* was recorded in 7 out of 8 studied sites and exhibited 88% prevalence (Table 1).

Frequency: The absolute and relative frequencies of various weed species ranged from 6 to 88% and 0.42 to 6.36%, respectively. *P. hysterophorus* showed 36 and 2.56% absolute and relative frequencies, respectively. The frequency of *P. hysterophorus* was higher than 28 out of 37 local weed species. Its frequency was only lower than *Calotropis procera, Achyranthes aspera, Amaranthus viridis, Cynoglossum lanceolatum, Cypreus rotundus, Malvestrum tricuspidatum, Cenchrus biflorus* and *Tribulus terrestris.* The most frequently occurring species in the district were *A. aspera, C. rotundus, C. biflorus* and *M. tricuspidatum* with absolute frequency above 70% (Table 1).

Table 1: Prevalence, frequency and density of *P. hysterophorus* and other weeds in a waste and grazing lands in district Okara, Pakistan

Species	Family	P (%)	AF (%)	RF (%)	AD	RD (%)
Parthenium hysterophorus L.	Asteracaea	88	36	2.56	0.56	3.06
Ageratum conyzoides L.	″	88	23	1.63	0.26	1.42
Launea nudicaulis Less.	″	100	34	2.42	0.45	2.46
Pullicaria crispa	″	63	30	2.13	0.21	1.15
Xanthium strumarium L.	″	75	19	1.35	0.25	1.36
Achyranthes aspera L.	Amaranthaceae	100	84	5.98	0.19	1.04
Amaranthus viridis L.	″	100	64	4.55	1.52	8.32
Digera arvensis Forsk	″	100	33	2.35	0.41	2.26
Calotropis procera Br.	Asclepiadaceae	100	40	3.12	0.5	2.73
Cynoglossum lanceolatum Forsk.	Boraginaceae	88	49	3.49	0.88	4.81
Coronopus didymus (L.) Sm.	Brassicaceae	88	21	1.49	0.27	1.47
Cassia oscidentalis L.	Caesalpiniaceae	63	06	0.42	0.07	0.38
Chenopodium album L.	Chenopodicaeae	88	35	2.49	0.28	1.53
C. ambrosioides L.	″	88	13	0.92	0.15	0.82
Kochia indica Wight	″	100	28	1.99	0.37	2.02
Sueda fruticosa Forsk.	″	100	31	2.56	0.22	1.2
Convolvulus arvensis L.	Convolvulaceae	88	19	1.35	0.38	1.08
Cypreus rotundus	Cyperaceae	100	84	5.98	2.45	13.41
Croton sparsiflorus Morong	Euphorbiaceae	88	24	1.79	0.25	1.36
Euphorbia pilulifera L.	″	25	09	0.64	0.08	0.43
E. prostrata L.	″	100	34	2.42	0.43	2.35
Oxalis corniculata Ait.	Geraniaceae	100	21	1.49	0.02	0.10
Malvestrum tricuspidatum A. Gray	″	100	73	5.19	1.47	8.05
Malva parviflora L.	″	88	14	0.99	0.13	0.71
Boerhaavia diffusa L.	Nyctaginaceae	100	26	1.85	0.26	1.42
Brachiaria ramose (L.) Stapf	Poaceae	100	29	2.06	0.32	1.75
Cenchrus biflorus Roxb.	″	100	71	5.05	1.38	7.55
Dactyloctenium aegyptium Beauv.	″	100	43	3.06	0.96	5.25
Dicanthium annulatum Stapf.	″	100	30	2.13	0.48	2.62
Eragrostis poaeoides Beauv.	″	88	36	2.56	0.53	2.90
Imperata cylindrica (L). Beauv.	″	100	23	1.63	0.21	1.15
Sorghum helepense Pers.	″	100	14	0.99	0.14	0.76
Urochloa panicoides Beauv.	″	88	20	1.42	0.25	1.36
Datura alba Nees	Solanaceae	100	33	2.35	0.41	2.24
Solanum nigrum L.	″	88	28	1.99	0.27	1.47
Solanum xanthocarpum Schrad.	″	100	21	1.49	0.22	1.20
Withania somnifera Dunal.	″	100	29	2.06	0.35	1.91
Tribulus terrestris L.	Zygophyllaceae	100	49	3.49	0.68	3.72

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

Density: Absolute density of different plant species ranged from 0.02 – 2.45 and relative density 0.10 – 13.41%. Absolute and relative densities of *P. hysterophorus* were 0.56 and 3.06%, respectively. Density of *P. hysterophorus* was higher than 30 out of 37 weed species. The weed species that showed higher density than *P. hysterophorus* were *Amaranthus viridis, Cynoglossum lanceolatum, Cypreus rotundus, Malvestrum tricuspidatum, Cenchrus biflorus, Dactyloctenium aegyptium* and *Tribulus terrestris* (Table 1).

The occurrence of *Parthenium* at 7 out of 8 studied sites represents its distribution and spread in almost all parts of the district Okara. The frequency of *Parthenium* at different studied sites was higher than 28 out of 37 weed species. Similarly density of *Parthenium* was higher than 29 out of 37 local weed species. Although density of *Parthenium* was lower than 7 local weed species in the 8 studied site, however, plant height and spread of *Parthenium* is much higher than all of these species. Hence in most of the waste and grazing lands in the district, *Parthenium* has attained a dominating status. 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 and many other parts of the world. Firstly, *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). These 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). Secondly, 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. Thirdly, *Parthenium* inhibits the germination and growth of other plants by allelopathy. Various allelochemicals such as water soluble phenolics including caffeic, ferulic, vanicillic, anisic and fumaric acids, and sesquiterpene lactones including parthenin and coronopilin, have been identified from the weed (Kanchan 1975; Jarvis *et al* 1985; Picman & Picman 1984). Fourthly, generally animals do not eat *Parthenium.* Lastly the lack of natural enemies of this weed in Pakistan is also contributing to a large extent in the rapid spread of this weed in this country. There is an urgent need to take measures to control the further spread of this aggressive alien weed in the country.

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