The Journal of Animal & Plant Sciences, 20(2), 2010, Page: 90-93
ISSN: 1018-7081

PREVALENCE OF INVASIVE PARTHENIUM WEED IN DISTRICT HAFIZABAD, PAKISTAN

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ABSTRACT

Surveys of waste and grazing lands from 10 localities of the district Hafizabad were undertaken during March-April, 2009 to study the distribution of an alien invasive weed parthenium (*Parthenium hysterophorus* L.) in comparison of the weeds of the area. A total of 67 weed species belonging to 25 angiospermic plant families were found growing in the district. Parthenium was found to be growing in nine out of ten studied sites exhibiting 90% prevalence. The absolute frequency of occurrence of parthenium was 51%. Out of 67 recorded weed species in the area, only 14 weeds showed absolute frequency of 50% or above including parthenium. Parthenium was found among the densely populated weed species with absolute density of 1.55. Only 7 weed species namely *Ageratum conyzoides* L. *Cichorium intybus* , *Cirsium arvense* (L.) Scop., *Sueda fruticosa* Forsk., *Cenchrus pennisetiformis* Hochest, *Cynodon dactylon* Pers., *Dicanthium annulatum* Stapf., and *Rumex dentatus* L in the studied area showed absolute density greater than parthenium. The present study concludes that parthenium is rapidly colonizing waste lands of district Hafizabad. Urgent efforst are necessary to control its further spread in the area.

Key words: Alien weed, Hafizabad, *Parthenium hysterophorus*.

INTRODUCTION

Parthenium weed (*Parthenium hysterophorus* L.) has spread throughout the tropical, subtropical areas from the southern United States of America (USA) through to Southern Brazil and northern Argentina. This alien weed has also spread to Southern China, Taiwan and Vietnam, Pakistan, India, Bangladesh in Asia, Pacific Islands, South Africa, Mozambique, Ethiopia and Kenya (Njoroge, 1989; Tamado *et al*., 2002). It is considered a noxious weed because of its allelopathic effect against the associated plant species by releasing allelochemicals (Batish *et al.*, 2002; Ramesh *et al*., 2003). The allelopathic potential of this weed is mainly attributed to the release of parthenin (Reinhardt *et al.*, 2009). This weed 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). In Australian grasslands, open woodlands, river banks and floodplains habitats have been changed due to *P. hysterophorus* invasion (McFayden, 1992; Chippendale and Panetta, 1994). Similar invasions of national wildlife parks have also been reported in southern India (Evans, 1997).

Parthenium is thought to be accidentally introduced to Indian sub-continent in the mid-1950s through imported food grains (Chandras and Vartak, 1970). The weed is spreading in various parts of Pakistan and has become a serious weed of wastelands and grazing lands, especially in rain fed districts of Central and Northern Punjab, and replacing the local flora (Javaid and Anjum, 2005; Javaid and Riaz, 2007; Javaid *et al*., 2009; Riaz and Javaid, 2007, 2009). Parthenium is has also been reported growing in gladiolus fields of Punjab (Riaz *et al.*, 2009). The present survey was undertaken to study the distribution of *P. hysterophorus* in district Hafizabad, Pakistan.

MATERIALS AND METHODS

The city of Hafizabad is located at latitude 32^0.20 N latitude and longitude 73^0.12-73.46 E. It. is located in the 300 km from the Federal Capital Islamabad. Its total area is 2367 km^2 and is one of the districts of division Gujranwala. The climate of the region presents extremes of heat and cold. The area receives highest rainfall during monsoon months of July and August.

Field surveys of different areas in district Hafizabad were conducted during the March and April of 2009. Ten localities including Kasooki, Dera Tooran, Mubarik Pur, Pindiwala, Bhoon Kalan, Ahamdpur Chattha, Saagar Head, Main city, Pindi Bhattian and Sukhakee were selected for study of *Parthenium* weed distribution. At each of the 10 localities, 3-5 kilometers distances were selected for weed flora study. Sampling was done randomly using 1×1 m^2 quadrate. Data regarding prevalence, absolute and relative frequency, and absolute and relative density of weeds were recorded by applying the following formulas:

The Journal of Animal & Plant Sciences, 20(2), 2010, Page: 90-93
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$$\text{Prevalence (\%)} = \frac{\text{No. of sites in which a species occurs}}{\text{Total No. of sites}} \times 100$$

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

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

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

RESULTS AND DISCUSSION

A total of 67 weed species belonging to 25 families of angiosperms were identified from 10 studied sites of district Hafizabad. Parthenium was recorded in 9 out of 10 studied sites and exhibited 90% prevalence (Table 1). Similar high prevalence of this exotic weed has also been reported in other districts of the Punjab namely Sialkot, Lahore, Sheikhupura, Rawalpindi and Okara (Javaid and Anjum, 2005; Javaid and Riaz, 2007; Javaid *et al.*, 2009; Riaz and Javaid, 2007, 2009). The high prevalence of this exotic weed in different areas of the Punjab may be attributed to the very high adaptic nature of this weed species in different environmental conditions. Other highly prevalent weeds were *Ageratum conyzoides, Cirsium arvense, Conyza ambigua, Sonchus asper, Achyranthes aspera, Amaranthus viridis, Calotropis procera, Coronopus didymus, Chenopodium album, C. murale, Sueda fruticosa, Convolvulus arvensis, Cypreus rotundus, Croton sparsiflorus, Euphorbia prostrate, Oxalis corniculata, Salvia plebeian, Malvestrum tricuspidatum, Alhagi maurorum, Cenchrus pennisetiformis, Melilotus parviflora, Dicanthium annulatum, Digitaria timorensis, Eleusine indica, Eragrostis poaeoides, Imperata cylindrica, Sorghum helepense, Polygonum plebejum, Rumex dentatus* and *Mazus rugosus*, showing prevalence of 90% or above (Table 1).

The absolute and relative frequencies of various weed species ranged from 5 to 79% and 0.24 to 3.80%, respectively. *P. hysterophorus* showed 51% and 2.45% absolute and relative frequencies, respectively. The frequency of *P. hysterophorus* was higher than 55 out of 67 weed species of the area. Its frequency was only lower than *Ageratum conyzoides, Cichorium intybus, Cirsium arvense, Achyranthes aspera, Amaranthus viridis, Chenopodium album, Suaeda fruticosa, Convolvulus arvensis, Alhagi maurorum, Cenchrus pennisetiformis, Cynodon dactylon, Dicanthium annulatum* and *Rumex dentatus.* (Table 1).

Absolute density of different weed species ranged from 0.10–2.46 and relative density 0.12–5.26%. Absolute and relative densities of *P. hysterophorus* were 1.55 and 3.31%, respectively. Density of *P. hysterophorus* was higher than 59 out of 67 weed species. The weed species that showed higher density than *P. hysterophorus* were *Cichorium intybus, Cirsium arvense, Achyranthes aspera, Suaeda fruticosa, Cenchrus pennisetiformis, Cynodon dactylon, Dicanthium annulatum* and *Rumex dentatus* (Table 1). Although density of *Parthenium* was lower than 8 local weed species in the 10 studied sites, 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 Okara (Riaz *et al.*, 2007; Javaid and Riaz, 2007). 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. The 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. These seeds can germinate any time of the year given suitable moisture levels. Furthermore, seeds of parthenium remain viable for a long time and can thrive under very harsh environmental conditions (Williams and Groves, 1980). 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 and Picman 1984). The allelopathic nature of this weed precludes that other weed species in its vicinity and thus it spreads rapidly. 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 various parts of the country. There is an urgent need to take measures to control the further spread of this aggressive alien weed in the studied areas.

Table 1: Prevalence, frequency and density of Parthenium in District Hafizabad during 2009.

Weed Species	Family	P (%)	AF (%)	RF (%)	AD	RD (%)
Parthenium hysterophorus L.	Asteracaea	90	51	2.45	1.55	3.31
Ageratum conyzoides L.	″	100	69	3.32	2.08	4.45
Carthamus oxyacantha (M). Bieb.	″	30	06	0.28	0.10	0.21
Cichorium intybus L.	″	80	59	2.83	1.63	3.48
Cirsium arvense (L.) Scop.	″	90	58	2.79	1.63	3.48

Conyza ambigua DC.	″	100	37	1.78	0.80	1.71
Eclipta alba Hassk	″	50	23	1.10	0.22	0.47
Lactuca dissecta D. Don	″	50	20	0.96	0.34	0.72
Sonchus asper Vill.	″	100	37	1.78	0.73	1.56
Xanthium strumarium L.	″	40	15	0.72	0.34	0.72
Achyranthes aspera L.	Amaranthaceae	100	69	3.32	1.93	4.13
Amaranthus viridis L.	″	100	61	2.93	1.46	3.12
A. spinosus L.	″	40	07	0.33	0.10	0.21
Calotropis procera Br.	Asclepiadaceae	100	37	1.78	0.70	1.49
Coronopus didymus (L.) Sm.	Brassicaceae	100	45	2.16	1.32	2.82
Goldbachia laerigata L.	″	50	16	0.77	0.26	0.55
Malcolmia Africana L.	″	80	23	1.10	0.40	0.85
Sisymbrium irio L.	″	80	21	0.10	0.41	0.87
Stellaria media (L.) Vill.	Caryophyllaceae	80	16	0.77	0.20	0.42
Sagina apetala Ard.	″	40	05	0.24	0.06	0.12
Chenopodium album L.	Chenopodicaeae	100	52	2.50	1.02	2.18
C. ambrosioides L.	″	80	13	0.62	0.22	0.47
C. murale L.	″	100	23	1.10	0.49	1.04
Kochia indica Wight	″	90	25	1.20	0.39	0.83
Sueda fruticosa Forsk.	″	100	67	3.22	1.80	3.85
Convolvulus arvensis L.	Convolvulaceae	100	75	3.60	1.28	2.73
Cuscuta reflexa L.	″	60	15	0.72	0.19	0.40
Cypreus rotundus L.	Cyperaceae	100	40	1.92	0.67	1.43
Scirpus roylei (Nees) Parker	″	50	23	1.10	0.57	1.21
Chrozophora tinctoria (L.)A.Juss.	Euphorbiaceae	70	20	0.96	0.36	0.77
Croton sparsiflorus Morong	″	100	26	1.25	0.49	1.04
Euphorbia pilulifera L.	″	80	15	0.72	0.20	0.42
E. prostrata L.	″	90	31	1.49	0.82	1.75
E. heliscopia L.	″	60	13	1.63	0.40	0.85
Oxalis corniculata L.	Geraniaceae	100	35	1.68	0.47	1.00
Salvia plebeian R. Br.	Lamiaceae	90	24	1.15	0.39	0.83
Stachys arvensis (L.) L.	″	50	06	0.28	0.10	0.21
Malva parviflora L.	Malvaceae	100	36	1.73	0.88	1.88
Malvestrum tricuspidatum A. Gray	″	90	15	0.72	0.31	0.66
Boerhaavia diffusa L.	Nyctaginaceae	70	30	1.44	0.37	0.79
Orobanche indica L.	Orobanchaceae	30	17	0.81	0.17	0.36
Alhagi maurorum Medik.	Papillionaceae	90	52	2.50	1.40	2.99
Lathyrus aphaca L.	″	60	12	0.57	0.17	0.36
Medicago polymorpha L.	″	40	10	0.48	0.15	0.32
Melilotus parviflora L.	″	100	32	1.53	0.46	0.98
Plumbago zeylanica L.	Plumbaginaceae	80	13	0.62	0.23	0.49
Cenchrus pennisetiformis Hochest	Poaceae	100	76	3.65	2.19	4.68
Cynodon dactylon Pers.	″	100	72	3.46	2.22	4.75
Dactyloctenium aegyptium Beauv.	″	80	36	1.73	0.58	1.24
Dicanthium annulatum Stapf.	″	100	57	2.74	1.77	3.78
Digitaria timorensis (Kunth) Balansa	″	90	20	0.96	0.37	0.79
Eleusine indica Gaertn.	″	90	16	0.70	0.36	0.77
Eragrostis poaeoides Beauv.	″	100	38	1.82	0.27	0.57
Imperata cylindrica L.	″	100	27	1.29	0.97	2.07
Poa annua L.	″	80	34	1.63	0.53	1.13
Setaria glauca Beauv.	″	70	13	0.62	0.90	1.92
Setaria verticillata Beauv.	″	50	09	0.43	0.17	0.36
Sorghum helepense Pers.	″	90	23	1.10	0.17	0.36
Polygonum plebejum R. Br.	Polygonaceae	100	49	2.35	1.16	2.48
Rumex dentatus L	Polygonaceae	100	79	3.80	2.46	5.26
Ranunculus secleratus L.	Ranunculaceae	90	19	0.19	0.31	0.66
Ganophyllum falcatum Blume	Sapindaceae	80	23	1.10	0.21	0.44
Mazus rugosus Lour.	Scrophulariaceae	90	33	1.58	0.63	1.34
Veronica agrestis L.	″	70	14	0.67	0.28	0.59
Datura alba Nees	Solanaceae	40	10	0.48	0.15	0.32
Lantana camara L.	Verbenaceae	70	17	0.81	0.22	0.47
Tribulus terrestris L.	Zygophyllaceae	70	18	0.86	0.30	0.64

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

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