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Infestation of *Parthenium hysterophorus* in district Sialkot: a case study

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ABSTRACT

To investigate the infestation status of alien invasive weed Parthenium hysterophorus a detailed survey was conducted at waste lands, edges of agricultural fields, fallow lands and waterways in 53 sites of 3 tehsils of district Sialkot , Punjab during August- October 2009-10. Maximum infestation (60%) of P. hysterophorus was found along roadsides followed at along the crop fields (56%), fallow lands (54%), waste lands (50%) and in the water channels minimum 46% infestation. In tehsil wise maximum infestation of P. hysterophorus was found in tehsil Daska (94.74%) followed by Tehsil Sialkot (92.31%) and minimum 91.67%. in tehsil Pasroor.

Keywords: *Parthenium hysterophorus* infestation, Punjab, Sialkot, survey

Gajar gash (*Parthenium hysterophorus* L., Asteraceae) is an aggressive invasive alien weed species (Kohli *et al.,* 2006), native to the Americas but now widely spread in Asia, Africa and Australia (Dolai *et al*., 2013). *Parthenium* is an annual herbaceous member of the Asteraceae, with a deep tap root and an erect stem that spreading horizontally at the beginning later vertically and gradually changes into semi-woody with age. It branches itself out usually up to about 1-2 meter. It has bi-pinnated and pale green leaves covered with soft fine hairs (Prasanta *et al.,* 2005). *Parthenium* can grow and reproduce itself any time of the year. The weed affects not only the species diversity of native areas, but also their ecological integrity (Kohli *et al*., 2004). In Ethiopia, it was reported that individuals who remove *Parthenium* with hands in infested crops suffer from dermal allergy, fever, and asthma (Taye, 2002). It was reported that the photosynthetic characteristics of *Parthenium* leaf is mostly related to C_3 type pathway and exhibits a photosynthesis rate of 25-35 ^{0}C and a high CO_2 level (Pandey *et al*., 2003). Low temperature considerably reduces plant growth, mainly flowering and seed production by reducing leaf area index, relative growth rate, net assimilation rate, and leaf area duration (Navie *et al*., 1996; Pandey *et al.,* 2003). Tamado *et al*. (2002) reported that germination of *Parthenium* seed occurred at the mean minimum (10 $^\circ$C) and maximum (25 $^\circ$C) temperatures as well as over a wide range of fluctuating (12/2 $^\circ$C- 35/25 $^\circ$C) temperatures. The spread of seeds plus their ability to remain viable in the soil for many years pose one of the most complex problems for control and this fact makes eradication difficult for many seed producing weeds (Monaco *et al.,* 2001). Weed seeds may also move with surface water, runoff, in natural streams and rivers, in the irrigation and drainage channels, and in irrigating water from ponds (Monaco *et al.,* 2001).

The weed grows fast and comfortably on alkaline to neutral clay soils (Dale, 1981). However, its growth is slow and less prolific on a wide range of other soil types (Adkins *et al.,* 2005; Rezene *et al*., 2005). *Parthenium* is a prolific seed producer. For example, in a highly infested field in India, a single plant produced 200, 000 seeds/m^2 (Joshi, 1991). The germination process of the weed involves several steps required to change the quiescent embryo to metabolically active embryo (Buhler *et al.,* 2000). For a seed to germinate adequate water, suitable temperature and composition of gases (O_2/CO_2 ratio) in the atmosphere, and light should be available.

The successful spread of *Parthenium* in so many parts of the world has mainly been attributed to its allelopathic properties, which enables it to compete effectively with crops and pasture species (Singh *et al.,* 2003; Batish *et al.,* 2005a and b). *Parthenium* is considered a noxious weed because of its allelopathic effect (Kohli *et al.,* 2006), its strong competitiveness for soil moisture and nutrients and the hazard it poses to humans (Wiesner *et al.,* 2007) and animals (Narasimhan *et al.,* 1977). Allelopathy has been suggested as a mechanism for the impressive success of invasive plants by establishing virtual monoculture and may contribute to the ability of particular exotic species to become dominant in invaded plant communities (Hierro, 2003). Recent research was conducted in order to study Prevalence, absolute frequency, relative frequency, absolute density, relative density and importance value of *P. hysterophorus* and other weeds in district Sialkot and its surroundings.

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MATERIALS AND METHODS

Survey of the area

The present survey was carried out to study the extent of *Parthenium hysterphorus* infestation in District Sialkot, Pakistan. Total 53 sites were visited in three Tehsils to evaluate the extent of infestation of *Parthenium hysterphorus* during the period of Nov. to Dec. 2009 (Fig. 1 and 2; Table 1).

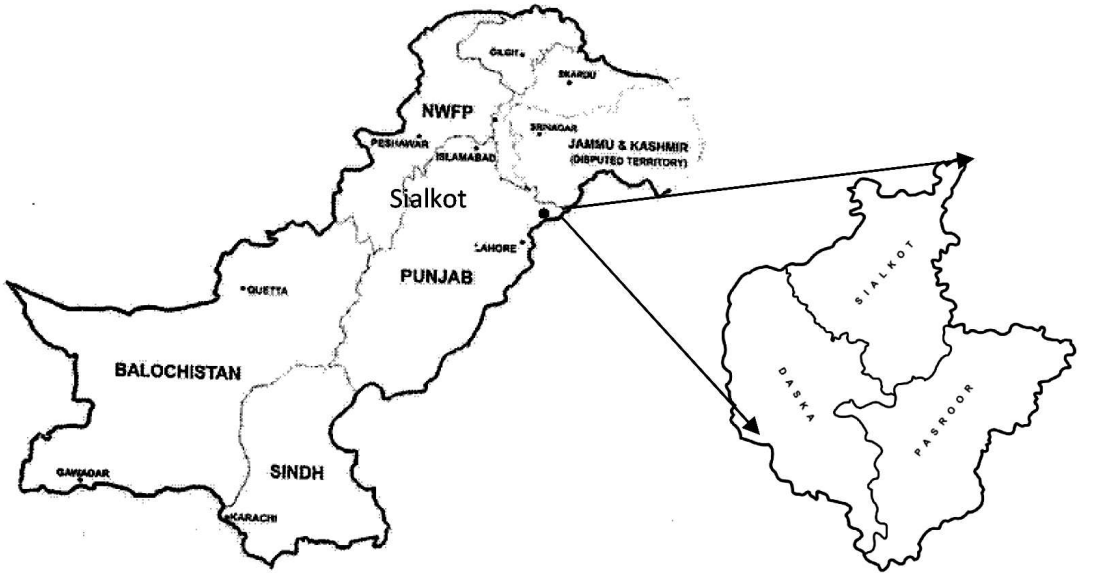

Fig. 1: showing location of Sialkot on the map of Pakistan

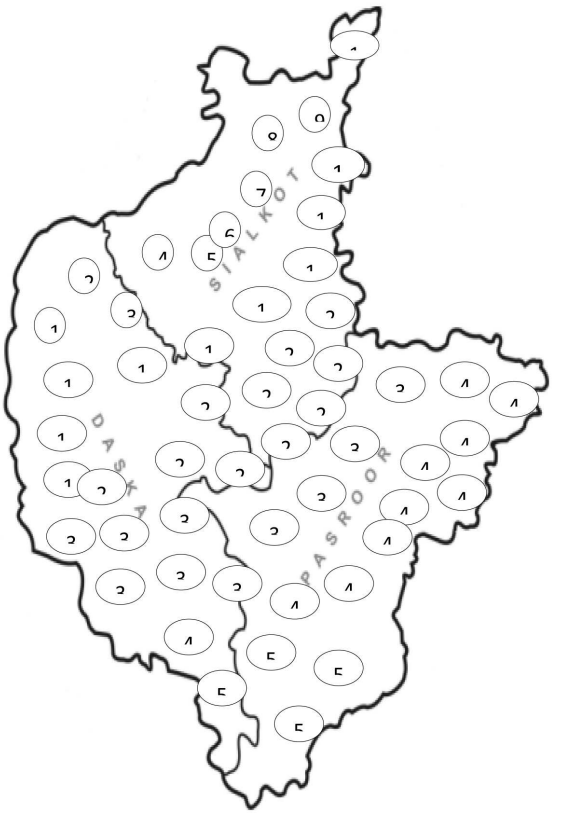

Fig 2: Representing surveyed sites

1. Galotian
2. Adamkey Cheema
3. Bharoki
4. Sahala
5. Shahkotmor
6. Uggoki
7. Sajeetgarh
8. Dalowala
9. Paki garhi
10. Kothibhuta
11. Sodhra
12. Thathi
13. Pathachowk
14. Bhawani
15. Sahalia
16. College road daska
17. Kotliloharan
18. Gohada
19. Machikhokhar
20. Bombawala
21. Kundan Sian
22. Daskakalan
23. Kundanpur
24. Bhelomahar
25. Dhabegwala
26. Pandorian
27. Kajlial
28. Mandimankay
29. Dhedowali
30. Dhadobasra
31. Jamkay Cheema
32. Bambanwala
33. Khajuriwala
34. Kuwainki
35. Kajau
36. Baba colony
37. Kotkoul ram
38. Satrah
39. Dalasidhowa
40. Siranwali
41. Satrah
42. Pinnahwala
43. Ahmadabad
44. Ada khohala
45. Gujargoraya
46. Narowal road
47. Khajuriwala
48. Adasuleman
49. Jaiserwala
50. Adamotra
51. Lalpul stop
52. Pikhisindowa
53. Ada jattan

The survey data about *Parthenium hysterophorus* and other weed species were recorded using 1x1 m quadrate. Ten quadrates were randomly thrown at each sampling site then the numbers of plants of all the species in a single quadrate were recorded. The percentage of prevalence of *Parthenium* was also calculated.

RESULTS AND DISCUSSION

P. hysterophorus infestation on waste lands

All waste lands from where data was recorded indicated average moderate infestation of 46%. Chichriali exhibited high *Parthenium* infestation (52%). Baigowala (27%), Sajeet garh (14%), Harna (19%) and Dongarpur (24%) showed low *Parthenium* infestation (Fig. 5). *P. hysterophorus* infestation on waste lands was calculated and represented in fig.-3a.

P. hysterophorus infestation along road sides

Roadsides of District Sialkot exhibited variable infestation frequencies with maximum value of 60% and minimum value of 2%. However average infestation of *Parthenium* was recorded as 34.07% (Fig. 3b, 6).

P. hysterophorus infestation along water ways

Variable infestation frequencies were recorded along the water ways in district Sialkot with maximum value of 46% and minimum value of 1% (Fig. 3c, 7). Water ways of District Sialkot exhibited lowest average *Parthenium* infestation (26%).

P. hysterophorus infestation along field edges

The crop fields of Sialkot have moderate *Parthenium* infestation (avg. 35%) but most of infestation was found on the edges of crops. Maximum *Parthenium* infestation was recorded in Malappar (56%) and Sodhera (49%) at the edges of rice field.Adha, Dala Sinduwa, Kotli loharan, Pikhi Sinduwa, Wazir abad bypass, Gohadpur and Nadir had moderate infestation of *Parthenium* ranged from 31-45%. At some sites invasion inside the maize field was also found while at all other sites *Parthenium* was found on the edges of rice and *Trifolium* sp. fields. In Daska, rice field bank of Machi-khokhar had low infestation (16%) of *Parthenium* and area of Bolawal had negligible infestation (1%) (Fig. 4a, 8).

P. hysterophorus infestation in fallow lands

The average *Parthenium* infestation upto 49% was recorded in fallow lands. Satrah located at Pasroor road and was highly infested site (54%). In Shairpur and Jaisarwala *Parthenium* invasion was moderate (31% and 44%) (Fig. 4b, 9)

The comparative result depict that maximum infestation of *Parthenium* was found in fallow lands with 49% infestation. Waste lands, crop fields and roadside represented 40%, 35% and 34% respectively (Fig. 10). Minimum infestation was found along the waterways which was 26%.

Fig. 3: Infestation of *P. hysterophorus*on in Sialkot (a) waste lands of (b) along roads (c) along water ways

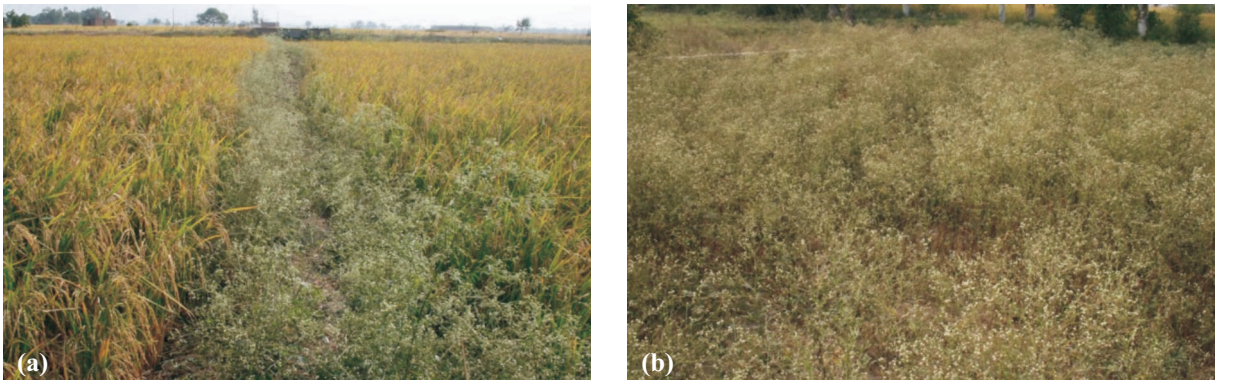

Fig. 4: Infestation of *P. hysterophorus*in in Sialkot (a) along field edges (b) fallow lands

Table 1: Table showing the surveyed sites from all the three Tehsils of Sialkot

Tehsils	Sites visited, district Sialkot				
	Wasteland	**Crop field**	**Along waterway**	**Fallow land**	**Along roadside**
Daska	Galotian, Adamkey Cheema, Bharoki, College road Daska.	Kotli loharan, Gohada, machi khokhar.	Bombawala, Kundan Sian, Daska kalan, Dhedo wali, Dhado basra.	Jamkay Cheema, Bambanwala, Khajuriwala, Kuwainki.	Kajau, Kuwainki, Adamotra, Jaiserwala.
Pasroor	Baba colony, Kot koul ram, Satrah.	Dala sidhowa, Siranwali,	Satrah, Pinnahwala, Ahmadabad.	Ada khohala, Gujargoraya. Narowal road.	Khajuriwala, Adasuleman, Lalpul stop, Pikhi sindowa
Sialkot	Sahala, shahkot mor, Uggoki, Sajeetgarh, Dalowala.	Paki garhi, Adamotra, Sodhra, Thathi, Pathachowk.	Uggoki, Bhawani, Uggoki, Sahalia, Kundan pur.	Bhelomahar, Dhabeg wala, Pandorian, Kajlial, Thathi.	Faiz pura, Mandi mankay, Marala, Paki garhi, Kothi bhuta.

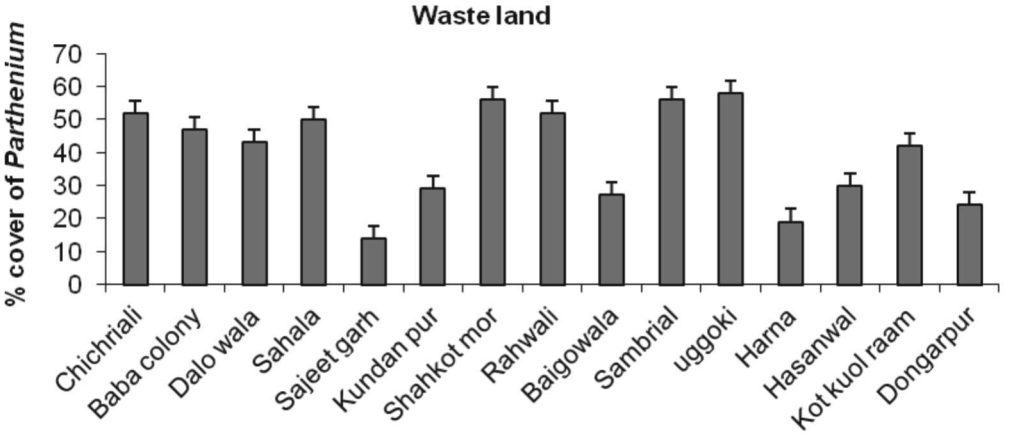

Fig. 5: Infestation of *P .hysterophorus*in waste lands of Sialkot

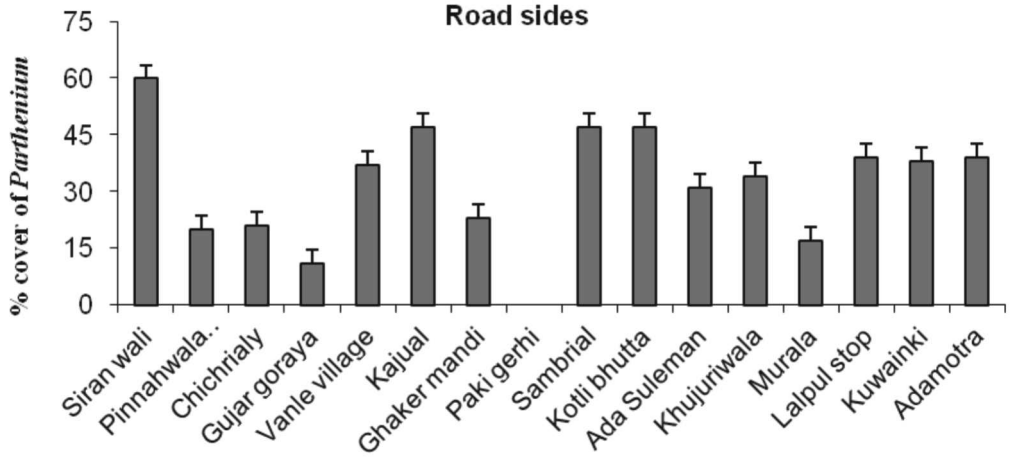

Fig.6: Infestation of *P.hysterophorus*along roads of Sialkot

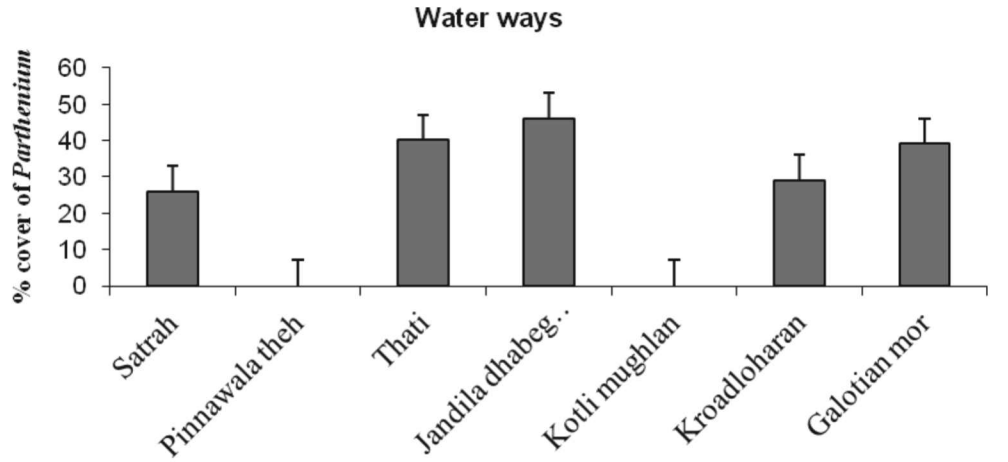

Fig. 7: Infestation of *P. hysterophorus*along water ways of Sialkot

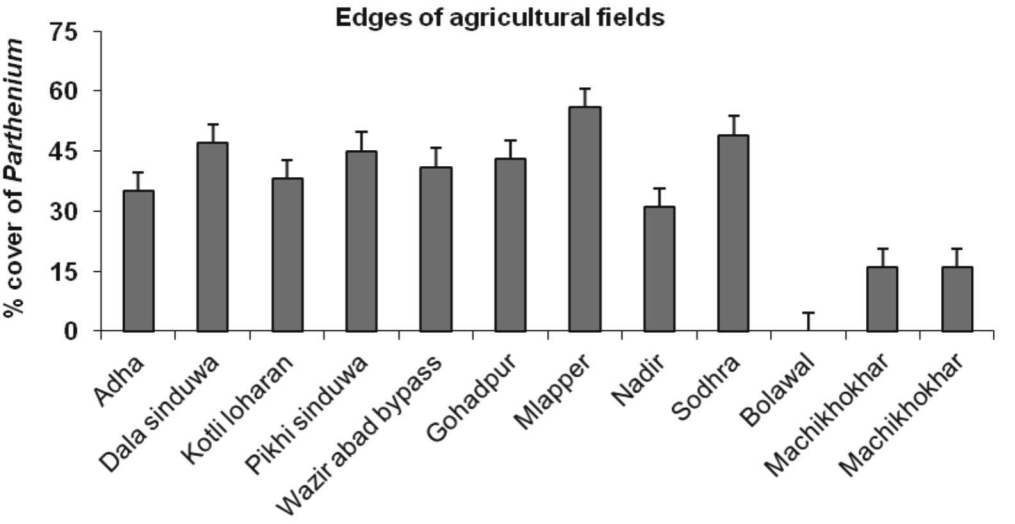

Fig 8: Infestation of *P.hysterophorus*in agro feilds of Sialkot

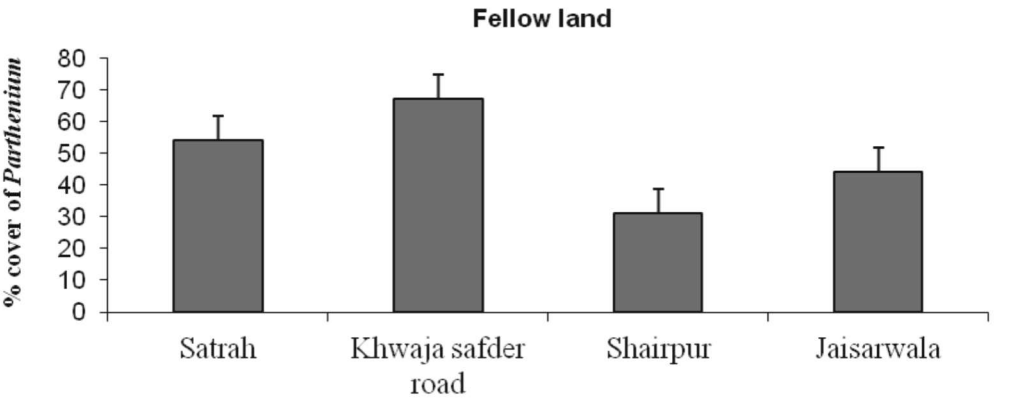

Fig. 9: Infestation of *P. hysterophorus*in fallow lands of Sialkot

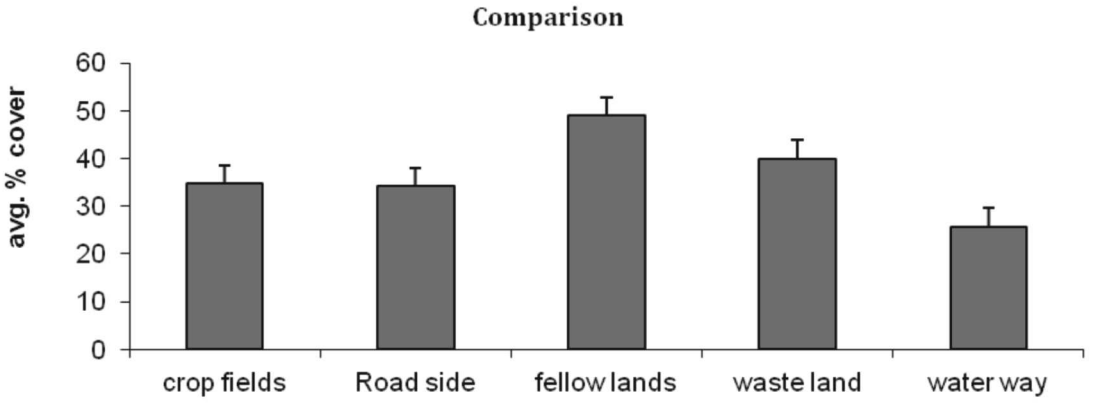

Fig. 10: Comparison of *P. hysterophorus* infestation at different locations

This study has revealed that *P. hysterophorus* has become a major weed of district Sialkot with 94% infestation. Similarly Javaid *et al*. (2009) found that the prevalence of *Parthenium* was 100% in surveyed localities of Lahore. *Parthenium* seeds are very light in weight, about 15-20,000 seeds per plant, mainly disperse through air and water.Infestation of *Parthenium* along the roadsides of Sialkot was 34% as Navie *et al.* (1996) has declared that seed dispersal of *Parthenium* is through mechanized farming and vehicles, which shows that *Parthenium* infestation along the roadsides may be due to this fact. It was also found that *P.hysterophorus* is dominating not only our roadsides but edges of crop fields, waterways, fallow lands and waste lands very aggressively. The highest dominance of this weed may be attributed due to its aggressiveness and allelopathic effect on neighboring plants (Adkins & Sowerby, 1996; Kohli, 1985). This survey has shown that P. infestation along edges of field crops in District Sialkot is 35%. Similarly Tamamdo & Milberg (2000) found that crop fields of eastern Ethiopia have 30 % cover of *P. hysterophorus*. Living plant parts and decomposing litter of *Parthenium* release allelochemicals which adversely affect the germination and growth of neighboring plants, consequently it soon establishes its own colonies 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). Allelochemicals such as water soluble phenolics including caffeic, vanicillic, ferulic, fumaric acids, and sesquiterpene lactones including parthenin and coropilin are found in all parts of *Parthenium* plant *viz.* root, stem, leaves and inflorescence (Venkataiah *et al.,* 2003; Belz *et al*., 2007). Navie *et al.* (1996) declared that ecology of this weed including the size and seed bank persistence in the soil, high viability of the buried seeds, quick germination rate and innate dormancy mechanism of its seed contributes towards its aggressiveness. The fallow lands and Waste lands found 49% and 40% infestation of *Parthenium* simultaneously. Joshi (1991) found that *P. hysterophorus* is a prolific seed producer with up to 25000 seeds per plant and it has massive seed bank in the abandoned fields. *Parthenium* seeds remain viable in the soil for a long time even after very harsh environmental conditions (Williams and Groves, 1980). Extensive spread and establishment are due to non-dormancy and extreme light weight of the seeds armed with pappus (Ramaswami, 1997). Infestation of *Parthenium* along the waterways was 26% in district Sialkot. It was noticed during the survey that *P. hysterphorus* generally invades those areas which are recently disturbed and where topsoil has been removed or eroded. This reduces competition from indigenous species and chances of exotic plant survival increases. It further reveals that this weed has aggressively colonized open lands, pasture lands and waste lands of Sialkot. Chippendale and Panetta (1994) have described that this weed had the potential to disrupt the natural ecosystem of Australia. Cannabis sativa another invasive weed species was once most dominant species amongst the herbaceous flora of Sialkot but now being replaced by *P. hysterophorus*. This research clarifies that *P. hysterophorus* should be managed in order to save indigenous flora of Pakistan because if established it will be devastating to our crops animals as well as humans.

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