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BIOLOGICAL CONTROL OF NOXIOUS ALIEN WEED *PARTHENIUM HYSTEROPHORUS* L. IN PAKISTAN

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ABSTRACT

Parthenium hysterophorus L., a native of tropical America, is rapidly spreading in Pakistan and replacing the local flora. Among the various causes of its rapid spread in the country, lack of natural enemies of this weed is perhaps the most important one. There is not any earlier report of fungal or bacterial pathogen, or insect pest of this weed from Pakistan. During field surveys of different *Parthenium* growing areas in the province of Punjab from 2003-2005, we found severe attack of a mealy bug species in an undisturbed area in Punjab University, Quaid-e-Azam Campus Lahore. The mealy bugs were found feeding on leaves, stems and flower heads of *Parthenium.* The infected plants first showed symptoms of dieback and ultimately dried to death. Five other weed species namely *Boerhavia diffusa* L., *Achyranthes aspera* L., *Malvestrum tricuspidatum* A. Gray, *Sida spinosa* L. and *Xanthium strumarium* L. were found to be attacked by the mealy bug. No field crop in Lahore was found to be attacked by the mealy bug.

Key words: *Parthenium hysterophorus*, biological control, mealy bug, Pakistan.

INTRODUCTION

Parthenium hysterophorus (hereafter referred to *Parthenium*) is an invasive alien weed in Pakistan. It is native to tropical America and has become widespread in North America, South America, the Caribbean, and many parts of Africa, Australia and Asia (Navie *et al*., 1996). The weed has been spreading in Pakistan for about last 20 years. It has now become a major wasteland weed and rapidly replacing the native flora in rain fed areas of the province Punjab and is also spreading in North Western Frontier Province and Kashmir (Javaid and Anjum, 2005). The weed is also found in some less competitive crops. However, in India and Australia it has also become a major problematic weed both in agricultural and wastelands (Evans, 1997). Apart from its negative impact on plants, the weed also causes health problems both for human being and livestock (Kadhane *et al*., 1992; McFadyen, 1995).

Fast growth rate, high reproductive potential, adaptive nature and interference by allelopathy (Kohli and Rani, 1994) are the major contributing factors for rapid spread and successful establishment of this weed in any ecosystem. Above all, 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. Over 260 phytophagous arthropod species were collected from *Parthenium* from its native homeland, although 144 species actually fed on the weed (McClay *et al*., 1995). Among these a defoliating beetle *Zygogramma bicolorata* Pallister (Chrysomelidae), a seed feeding weevil *Smicronyx lutulentus* Dietz (Curculionidae), a stem-galling moth *Epiblema strenuana* Walker (Tortricidae), a leaf mining moth *Bucculatrix parthenica* Bradley (Lyonetiidae), a sap-feeding plant hopper *Stobaera concinna* Stal (Delphacidae), a stem-boring curculionid weevil *Listronotus setosipennis* Hustache are the most important (Wild *et al*., 1992; Evans, 1997). Furthermore, a rust fungus *Puccinia abrupta* Diet. & Holw. Var. *partheniicola* (Jackson) Parmelee from Maxico is also known to severely damaging the *Parthenium* (Evans, 1987).

From 2003-2005 we conducted surveys of various *Parthenium* growing areas of Punjab in order to search for insect pests or fungal pathogens of *Parthenium* for biological control of the weed. Recently in June 2005, we observed mealy bug attack on this weed in an undisturbed area in Punjab University Lahore, Pakistan. The present paper describes the extent of damage of the *Parthenium* weed by mealy bug under natural conditions, and host range of the attacking species.

MATERIALS AND METHODS

Sampling site description

A 3 ha area in Quaid-e-Azam Campus, University of the Punjab Lahore, Pakistan, undisturbed for the last one and a half year, was selected for study (Fig. 1). The soil of the site was sandy loam with pH 7.5, total N 0.06%, available phosphorus 22 ppm, exchangeable potassium 190 ppm and organic matter about 1%. 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 viz. 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 average maximum and minimum temperatures and rain fall in different months of the year are given in Table 1.

Table 1. The average maximum and minimum temperature and rainfall in different months of the year in Lahore, Pakistan.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average highest temperature (˚F)	65	69	78	91	99	102	93	92	92	88	77	67
Average lowest temperature (˚F)	48	52	62	72	79	84	83	82	79	69	57	49
Average precipitation (inches)	1	0.9	1	0.6	0.7	1.5	6.1	5.3	2.5	0.4	0.1	0.5

Source: http://www.weatherbase.com/weather/weather-php3?s=0046148refer=

Effect of mealy bug on *Parthenium*, natural vegetation and field crops

Symptoms and damages of *Parthenium* by mealy bug were observed carefully. The attack of mealy bug attack on local flora was recorded. Agricultural fields of Lahore were also surveyed to know, if there is any mealy bug attack on crops of economic importance.

RESULTS AND DISCUSSION

Effect of mealy bug on *Parthenium*

The mealy bugs were found feeding on leaves, stem and flower heads of *Parthenium.* The infected plants first showed symptoms of dieback and ultimately dried to death. (Fig.2). The beetle was found attacking on *Parthenium* from April to mid December. A very severe attack of the mealy bug was recorded in October and November. In Lahore and many other parts of the province Punjab, *Parthenium* flourish and spared very rapidly in the months of July and August due to monsoon rains. In the following months of September to November it continues its growth and set a very large number of seeds. In the winter months of December and January the population of *Parthenium* remains very low. Its seeds again germinate at the end of February on the onset of spring. Mealy bug attack was most severe on *Parthenium* in October and November when the weed produced a large number of seeds for the next growing season. The mealy bug thus not only destroys the standing plants of *Parthenium* but also reduces the seed bank of the weed.

Fig. 1. A view of the sampling site.

Attack of mealy bug on natural vegetation

Mealy bugs were found feeding on five other weeds namely *A. aspera, M. tricuspidatum, Sida spinosa, B. diffusa* and *Xanthium strumarium* (Fig. 3). None of the weed has any known useful value in the area. *X. strumarium* is a weed of wastelands as well as of agricultural crops. It is especially abundant in moist localities. It causes damage on the crops like cotton, onion, sunflower and some vegetables, mostly during the summer (Kadioglu *et al*., 1993; Kadioglu, 1997). Cutler and Cole (1983) reported that potassium carboxyactractyloside and hypoglyaemic isolated from the residues of this weed strongly inhibited the hypocotyl of wheat and cause serious decaying and dwarfing in the corn seedlings. Recently Kadioglu (2004) found that this weed considerably reduced the germination in *Triticum vulgare* L., *Hordeum vulgare* L., *Lolium perenne* L. and *Avena sterilis* L. *A. aspera* is a very common weed of waste places and road-sides in Pakistan. The weed bears spiny fruits which provide a great hindrance in movement of both humans and animals. *M. tricuspidatum* is found frequently, however, the weed is not economically important with respect to grazing or any other useful purpose in the area. *S. spinosa* is a rarely occurring weed in the region and is not known for any useful purpose. B. diffusa is a moderately occurring weed and is not well known for any medicinal or grazing purpose.

Fig. 2 (A-D). Different stages of damage of *Parthenium* by mealy bug (white patches).

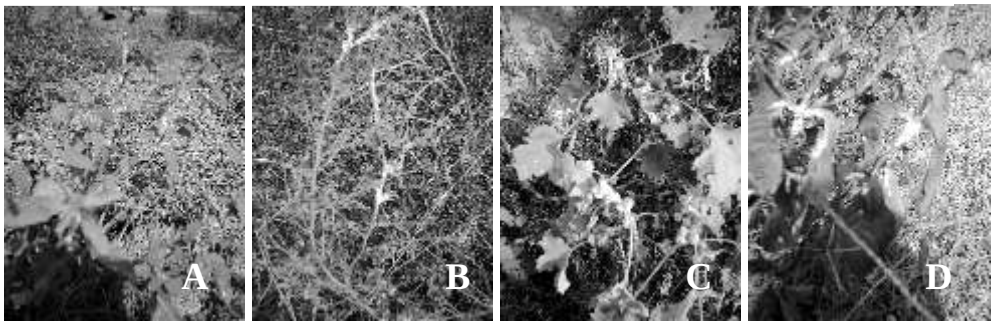

Fig. 3 (A-D). Attack of mealy bug (white patches) on *Malvestrum tricuspidatum* (A), *Sida spinosa* (B), *Xanthium strumarium* (C) and *Achyrathes aspera* (D).

Effect of mealy bug on field crops

None of the field crops in the area especially maize, rice and wheat was found to be attacked by the mealy bug. However, since this mealy bug species generally attacks on members of family Asteraceae and Malvacea, there is need to perform a thorough studies regarding the attack of mealy bug on sunflower and cotton before its recommendation as a biological control agent in Pakistan and elsewhere.

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