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Research Article

Record of diversity and abundance of insect pests and their natural enemies on *Parthenium hysterophorus* (L.)

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ABSTRACT: A roving survey was conducted to assess the diversity and abundance of insect pests and their natural enemies on *Parthenium hysterophorus* weed at the experimental farm of College of Agriculture, VNMKV, Parbhani, Maharashtra during 2021-22 and 2022-23. The results revealed that seventeen insect pests belonging to five orders and fourteen families were observed on *Parthenium*. Insects from the orders Hemiptera and Lepidoptera were found in maximum abundance. A total of eleven natural enemies of insect pests belonging to five orders and seven families were found on *Parthenium*. Predators from the Coleoptera and Araneae were most dominant.

KEYWORDS: Alternate host, diversity, insect pests, *Parthenium*

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INTRODUCTION

Parthenium weed (*Parthenium hysterophorus* L.) is also known as Congress grass or carrot grass belonging to the family Asteraceae is an annual herbaceous plant with multiple branches that grows quickly. The plant may start bloom 35 days after germination (Navie *et al.*, 1996; Dhileepan, 2012). Adkins and Shabbir (2014) report that the plant can reach a height of 2.5 meters. There are now 16 species of the native North and South American genus *Parthenium* (Marwat & Fazal, 2015; Thomas *et al.*, 2015). Since *P. hysterophorus*'s first taxonomic identification in 1753, when it was discovered on the island of Jamaica, it was believed that its natural range was the West Indies and nearby coastal regions of south-central South America or North and South America (Rollins, 1950). The Indian Botanical Garden in Calcutta provided the earliest documentation of the plant in 1810 (Tiwari *et al.*, 2005; Paul, 2010).

Traditional medicine has employed the decoction of *P. hysterophorus* to treat a variety of conditions, including fever, diarrhoea, neurological diseases, urinary infections, dysentery, and malaria, and as an emmenagogue (Surib *et al.*, 1996). According to ethnobotany, certain tribes utilise it to cure inflammatory ailments, including eczema, skin rashes, herpes, rheumatoid arthritis, colds, heart issues, and gynaecological diseases. (Maishi *et al.*, 1998). A high amount of anticancer activity was seen in the flower's methanol extract, and T cell leukaemia, HL-60, and Hela cancer cell lines were all sensitive to parthenin's cytotoxic effects (Das *et al.*, 2007). Due to the high levels of Nitrogen, potassium, phosphorus, calcium, Mg, and chlorophyll, *Parthenium hysterophorus* is perfect for green manuring (Apurva *et al.*, 2010). *P.* hysterophorus is also used to keep fleas away from dogs (Sushilkumar, 2014). It is also an important source of potash, oxalic acids, and high-quality protein, all of which may be utilized in animal feed (Mane *et al.*, 1986). Besides the helpful facts, it has many harmful effects on humans, animals and agriculture. According to Maishi *et al.* (1998), *P. hysterophorus* contains parthenin, a significant sesquiterpene lactone with a bitter glycoside. It is discovered that parthenin, hymenin, and ambrosin are to blame for this weed's dangerous function in posing health risks (Lata *et al.*, 2008). A key factor in the plants nearby being affected by allelopathic interference is parthenin leaking as root exudate (Belz *et al.*, 2007). *P. hysterophorus* can colonize and adapt to new environments, which decreases the diversity of native species. (Akter & Zuberi, 2009).

The plant *Parthenium hysterophorus* served as a plant reservoir for insect pests. Moreover, it supports the crop

pests for survival under unfavorable conditions (Kumar *et al.*, 2021). The present study has been taken up to document the diversity of insect pests and their natural enemies in *P. hysterophorus*.

MATERIALS AND METHODS

The random field survey was conducted at the experimental farm of the College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, between the gap of two seasons *Kharif* and *Rabi* during 2021-22 and 2022-23.

Method of observation

Insect pests occurring on *Parthenium* weed were observed at weekly intervals from randomly selected plants from the seedling stage to maturity. All the insect pests like sucking and defoliators were recorded on a whole plant basis. Natural enemies are also recorded on a whole plant basis. Observations were recorded between 7 a.m. to 10 a.m. and again in the afternoon from 5 p.m. to 7 p.m.

Grouping of insect pests

Recorded insect species were categorised as insect pests and natural enemies of pests based on their incidence pattern.

Relative abundance

The relative abundance (p_i) is the proportional representation of a species in a community or sample of a community. The relative abundance (p_i) of each species is expressed as

$$P_i = \frac{n_i}{N} \times 100$$

where, n_i is the number of individuals of the same species and N is the total number of individuals for all species (Achacoso *et al.*, 2016).

RESULTS AND DISCUSSION

Diversity and abundance of insect pests on *Parthenium hysterophorus*

Parthenium hysterophorus weed attracted a wide variety of insect species belonging to 5 orders, 14 families, 17 genera and 17 species (Table 1; Figure 1). Among them, five species belong to order Lepidoptera, eight to Hemiptera, two to Diptera and one to Orthoptera and Coleoptera, respectively. The highest relative abundance of insect order was Hemiptera (47.05 %) followed by Lepidoptera (29.41 %), Diptera (11.76 %), Orthoptera and Coleoptera (5.88 %). The results of this study were consistent with those of Sushilkumar (2009), who reported carrot weed or congress grass (*P. hysterophorus*) as a host of *virgata* in the Punjab and Haryana and the cerembycid borer at Jabalpur and Vindhyanagar in Madhya Pradesh. He also reported that many other insects like aphids, cotton bollworm, bagworm, hairy caterpillar, mealybugs and grasshoppers have also been feeding on *P. hysterophorus.*

Diversity and abundance of natural enemies on *Parthenium hysterophorus*

A range of natural enemies of various agriculturally important insect species belonging to 5 orders, 7 families, 11 genera and 11 species were recorded on *P. hysterophorus* (Table 2; Figure 2). Among them, one insect species belongs to the order Hemiptera, four to Coleoptera, one to Mantodea, two to Hymenoptera, and three belongs to the non-insect order Araneae. The highest relative abundance of natural enemies of insect order was Coleoptera (36.36 %) followed by non-insect order Araneae (27.27 %), Hymenoptera (18.18 %), Hemiptera (9.09 %) and Mantodea (9.09 %). The results of this study were consistent with those of Sushilkumar and Bhan (1998), who reported that the most favoured host for the adults and grubs of the host-specific leaf-feeding Mexican beetle, *Z. bicolorata*, was *P. hysterophorus*.

CONCLUSION

The presence of *Parthenium hysterophorus* between cropping seasons provides a continuous habitat for insect pests, allowing them to survive and migrate to the next crop season, leading to early infestations and increased pest pressure on cultivated crops. This study emphasizes the importance of timely weed management, particularly the uprooting and destruction of *Parthenium hysterophorus* between cropping seasons, to break the lifecycle of pests and reduce their carryover population. By eliminating this reservoir host, farmers can effectively mitigate early-season pest outbreaks and improve pest management strategies. Further studies are required to explore the potential of utilizing natural enemies in biological control programs.

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Helicoverpa armigera



Condica capensis



Blastobasis sp



Spodoptera litura



Anavitrinella pampinaria



Philaenus spumarius



Cofana spectra



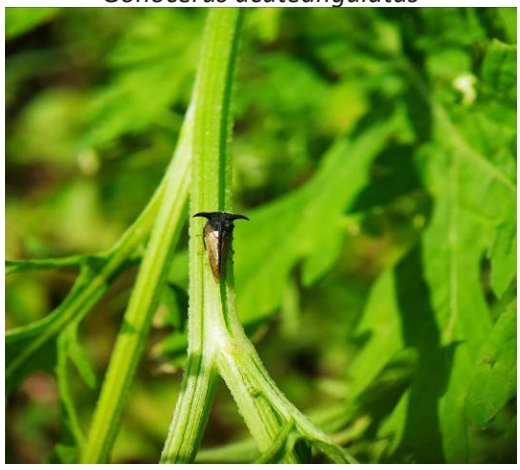
Empoasca vitis



Gonocerus acuteangulatus



Anavitrinella pampinaria



Oxyrachis tarandus



Two tailed planthopper



Ferrisia virgata



Rhagoletis completa



Lucilia sericata



Pyrgomorphy conica



Weevil

Figure 1. Diversity of insect pests on *Parthenium hysterophorus.*

Table 1. Pooled diversity and abundance of insect pests on *Parthenium hysterophorus* during 2021-22 and 2022-23

Order	Family	Common name	Scientific Name	Relative abundance (per cent)
Lepidoptera	Noctuidae	American boll-worm	*Helicoverpa armigera*	29.41
		Tobacco cutworm	*Spodoptera litura*	
		Condica	*Condica capensis*	
	Geometridae	Common gray moth	*Anavitrinella pampinaria*	
	Blastobasidae	Furness down	*Blastobasis spp*	
Hemiptera	Aphrophoridae	Spittlebugs	*Philaenus spumarius*	47.05
	Cicadellidae	White leafhopper	*Cofana spectra*	
		Green leafhopper	*Empoasca vitis*	
	Coreidae	Squash bug	*Gonocerus acuteangulatus*	
	Miridae	Mirid bug	*Apolygus lucorum*	
	Membracidae	Treehopper	*Oxyrachis tarandus*	
	Delphacidae	Two tailed plan-thopper	-	
	Pseudococcidae	Striped mealybug	*Ferrisia virgata*	
Diptera	Tephritidae	Fruit fly	*Rhagoletis completa*	11.76
	Calliphoridae	Common green bottle fly	*Lucilia sericata*	
Orthoptera	Pyrgomorphidae	Grasshopper	*Pyrgomorphy conica*	5.88
Coleoptera	Curculionoidea	Weevil	-	5.88

Table 2. Pooled diversity of natural enemies of insect pests on *Parthenium hysterophorus* during 2021-22 and 2022-23

Order	Family	Common name	Scientific Name	Relative abundance (per cent)
Hemiptera	Pentatomidae	Predatory stink bug	*Alcaeorrhynchus grandis*	9.09
Coleoptera	Coccinellidae	Ladybird beetle	*Cheilomenes sexmaculata*	36.36
		Ladybird beetle	*Coccinella transversalis*	
		Glacial Ladybird beetle	*Hippodamia glacialis*	
	Chrysomelidae	Parthenium beetle	*Zygogramma bicolorata*	
Mantodea	Hymenopodidae	Asian ant mantis	*Odontomantis planiceps*	9.09
Hymenoptera	Braconidae	Parasitoid wasp	*Cotesia congregata*	18.18
		Parasitoid wasp	*Aleiodes sp*	
Araneae	Oxyopidae	Striped lynx spider	*Oxyopes salticus*	27.27
		Green lynx spider	*Peucetia viridans*	
	Salticidae	jumping spider	*Portia spp*	



Alcaeorrhynchus grandis



Alcaeorrhynchus grandis



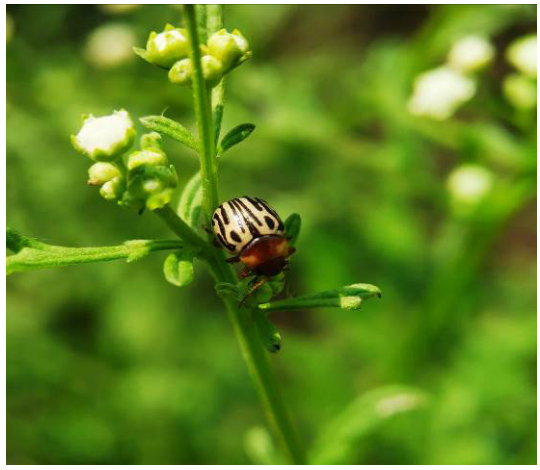
Cheilomenes sexmaculata



Coccinella transversalis



Hippodamia glacialis



Zygogramma bicolorata



Odontomantis planiceps



Cotesia congregata



Aleiodes sp



Portia sp



Oxyopes salticus



Peucetia viridans

Figure 2. Diversity of natural enemies on *Parthenium hysterophorus*.

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