

Parthenium: An Unwanted Guest with Potential Benefits

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Introduction

Parthenium hysterophorus, a flowering plant species from the family Asteraceae, is native to the Central and South America. It has become an invasive species in India, Australia, and Africa. In India it is commonly called as carrot grass or congress grass. The plant was considered as one of the most problematic weeds in agriculture which plays a major role in loss of crop yield. It invaded all the areas of cropped and non-cropped area due to its shorter duration (90-120 days), rapid growth, adaptable to adverse climatic condition with lack of natural enemies. The plants are considered as poisonous, pernicious, problematic and aggressive which poses serious threat to biodiversity, human and livestock. The plants will produce an allelochemical called Parthenin, hysterin, hymenin, and ambrosin, which suppresses the growth of crops in the surrounding area. Parthenin can lead to conditions such as dermatitis and respiratory problems in humans and livestock. If livestock consume plants containing parthenin, their milk may become contaminated with its toxic substance, resulting in a bitter taste of milk and meat with potential health risks. Though having a disadvantage some pros such that it will remove the heavy metals from the environment, can be used as biopesticide, green manure, compost, enzyme production for commercial use and control of aquatic weeds with its allelochemical. It has antitumor, anticancer, and antioxidant properties, and its extracts are frequently employed as disease-controlling insecticides.

Plant Biology and distribution:

An annual herbaceous plant that primarily reproduces by producing seeds that are around 2 mm in size of small white capitula composing of five seeds on reaching maturity. The single plant can produce about 5,000-25,000 seeds. Now it has been spread over 46 countries and region. It is believed that this alien plant was brought to India in the 1950's as contaminants in PL 480 wheat, which was imported from the USA. Public Law 480 was issued in 1954 to provide food grains to developing nations in an effort to end famine and malnutrition. In India,

this invasive weed is currently very common. This herbaceous threat has invaded almost two million hectares of land in India.



Fig 1: Vegetative and flowering stages of *Parthenium hysterophorus*

Chemical composition present in *Parthenium hysterophorus*

The pollens and trichomes of parthenium contain sesquiterpene lactones (SQL). The major SQL is glycoside parthenin and other allelochemicals such that hysterin, ambrosin, and flavonoids which are responsible for the harmful effects of such weed.

Harmful effect of Parthenium:

On human health and livestock

Parthenium hysterophorus an extremely invasive weed that is detrimental to both people and animals. Chlorogenic acid, anisic acid, p-anisic acid, caffeic acid, and benzoic acids are among the harmful substances found in its roots and other plant parts that cause a number of health problems. Human exposure to parthenium can result in allergic reactions such as hay fever, asthma, photodermatitis, skin rashes, excessive water loss, skin peeling, and mouth and nose swelling or itching. Repeated contact exacerbates poisoning symptoms such diarrhea, erythematous rashes and shortness of breath which pose serious health hazards to communities in impacted areas.

Additionally harmful to cattle, parthenium affects animal health, production and behaviour while decreasing the amount of feed available in grasslands. Anorexia, dermatitis, alopecia, anemia and skin depigmentation are the problems among livestock that feed or graze parthenium. Further it will decrease the milk output and low-quality meat in grazing animals.

On crops and soil

The allelochemical which present in the plant cause the serious deterioration to the growth of crop plants. The parthenium leaves containing chemicals especially p-coumaric acid and caffeic acid they will affect the germination, growth and yield of crop. It acts as growth inhibitor for some crops like rice, wheat, maize, red gram, sorghum and black gram. There is the strong relationship between the soil micro-organism and crop development. The plants have an ability to uptake nutrients from the depleted soil hence it accumulates more nutrient in its leaves (Nitrogen-3%, phosphorus-2%, potassium-4%). Once the plant gets destroyed and undergoes decomposition the it acts as good manure for the soil.

Beneficial effects

Many studies have recorded it has antidiabetic, antioxidant, antitumor, antimicrobial activity. Apart from this, the leaves contain more of N, P, K, Ca, Mg and chlorophyll which will be more suitable to make the compost out of it. *Parthenium hysterophorus*, with its high phenolic content, poses challenges to plant growth and development by hindering early growth stages and reducing dry matter output. However, this phenolic concentration, along with the organic carbon content and C/N and C/P ratios, can be significantly lowered through composting. When Parthenium is composted with *Eichhornia crassipes* (water hyacinth), a water weed rich in polyphenol oxidases, these inhibitory effects are mitigated, transforming the toxic plant materials into nutrient-rich organic compost.

Researchers are currently focusing on Parthenium's plant-derived herbicidal properties as an additional beneficial feature. The dry weight and weed density of weed species such as *Cynodon dactylon*, *Cyperus rotundus*, *Digitaria sanguinalis*, *Portulaca oleracea*, *Echinochloa crus-galli*, *Euphorbia prostrata*, and *Xanthium strumarium* are decreased by parthenium plant extracts. The sesquiterpene lactone is thought to have an allelopathic effect on nearby plants by inhibiting cell division that is mediated by gibberellin and indole acetic acid.

It has been demonstrated that parthenium can absorb methylene blue dye and nickel from industrial waste and wastewater which lead to bone deformities, high blood pressure,

kidney illness and the death of red blood cells (RBCs). Parthenium is an inexpensive, safe, and sustainable absorbent for this kind of industrial waste.

Integrated management of parthenium

Mechanical and manual method: Removal before flowering or at the time of flowering to avoid seed shedding in the soil.

Cultural method: To suppress the growth of parthenium fast growing crops like Dhaincha/ Sesbania, berseem/Lucerne, marigold, *Cassia sericea*, *Tephrosia purpurea*, *Achryanthes aspera* can be grown as competitive plants. Among these *Cassia sericea* and *Cassia tora*, because of the allelopathic effect on parthenium eliminate the emergence of parthenium from the soil.

Chemical method:

	Crops	Herbicide and dose	Time of application
1.	Non cropped area	Glyphosate 1-1.5 %	Post emergence
2.	Sugarcane, sorghum, Maize, pearl millet	2,4-D 0.5 kg/ha	Post emergence
3.	Soyabean/Rajma/ Tomato	Alachlor 2 kg/ha	Pre – emergence
4.	Potato	Metribuzin 0.5 -0.75 kg/ha	Pre – emergence

Biological method:

The most important method while considering as integrated weed management of parthenium because of cost-effectiveness, environmental safety and sustainability. The parthenium can be controlled using the biological elements such that Mexican beetle (*Zygogramma bicolorata*). This beetle has been introduced from Mexico during 1982 after the host specificity test on cultivated crops in India. The beetle is about 6 mm in length with white or light reddish appearance and dark brown longitudinal markings on the elytra. Light yellow colour eggs will be laid on the lateral sides of leaves which will be hatched between 4-6 days. The life cycle of the beetle will be completed within 22-32 days. Both grub and adult are capable of feeding the plant parts completely which leads to the death of plants. The most active period for the beetle to feed the plant was during June to October. The time after rainy seasons the weeds starts to emerge and the plants will be in the succulent condition which will be most

ideal for the beetle to feed on plants. The time period between November to May will not be the breeding period for beetles.

Method of release:

The beetles can be scattered on the infested area of parthenium directly from the multiplication cages or the established sites. Also releasing fully grown grubs will be excellent. They can be prevented from migrating away since they enter the soil immediately. Adults will eat and oviposit in the same location after emerging. Different life stages of Mexican beetle *Zygogramma bicolorata* are given below (Fig 2) (Image source- Report submitted by Rina Saha, 2017).



Fig 2: Different life stages of Mexican beetle *Zygogramma bicolorata*

A) Adult male and female, B) Eggs and C) I Instar larvae D) II Instar larvae, E) III Instar larvae and F) IV Instar larvae G) Fully grown adult ready to pupation and H) Pupa



Fig 3: *Zygogramma bicolorata* feeding on parthenium plant

The other biological ways to control parthenium viz., Stem-galling moth *Epiblema strenuana*, Stem-boring weevil *Listronotus setosipennis*, Moth *Carmenta ithacae*, Leaf-rust

Puccinia melampodi, Fungus *Puccinia abrupta* var. *parthenicola* urediniospores, Fungus *Alternaria* spp., *Fusarium* spp., *Rhizoctonia solani*, *Colletotrichum capsici*, etc.,

Effective utilization of parthenium:

It can be used to make compost, vermicompost and manure preparation as it will act as good source of nutrient for crops because the plant parts of parthenium will accumulate the large of nutrient from the soil. The uprooted parthenium plants before flowering stage can be used for preparing compost with 5 kg dung slurry and 500 g urea in layers in the pit and covered with soil.

Parthenium awareness week

“Parthenium awareness week” is being conducted in the month of August 16-22 every year to motivate the public for the eradication and management of obnoxious weed parthenium. As major activity under “Swachh Bharat Abhiyan” it has becoming more important by clearing parthenium weeds in the institutes, universities and KVKs to be as “Parthenium free campus”.

Way forward:

Parthenium hysterophorus, while notorious as a harmful invasive weed, also possesses untapped potential for various beneficial uses. From its ability to control aquatic weeds and act as a source of green manure to its promising applications in composting, biopesticides, and industrial waste management, this "unwanted guest" offers an opportunity for sustainable utilization. By combining cultural, mechanical, and biological control measures, we can effectively manage its spread while exploring its potential benefits. Let us all work together to raise awareness, innovate solutions, and transform this problematic weed into a resource for environmental and agricultural sustainability.