

Potential Agricultural Benefits of *Parthenium hysterophorus*

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Parthenium hysterophorus is a prolific and invasive weed belonging to the Asteraceae family. It is commonly known as king of weeds, carrot grass, whitetop, the scourge of India, and Congress grass. It is a native plant of Northeast Mexico, but it is extensively scattered all over the world, including Africa, Australia, the United States, India, China, and Vietnam. About 35 million hectares of land are being infested by this weed in India alone. This noxious weed is often found on wastelands, playgrounds, roadsides, railway tracks, irrigation canals, and cropped areas. This weed is notorious and causes many diseases like dermatitis, skin allergy, and hay fever in human beings and animals, besides reducing agricultural productivity and loss of biodiversity. *Parthenium hysterophorus* is now considered among the world's top seven most devastating weeds and has attained major weed status in India and Australia.

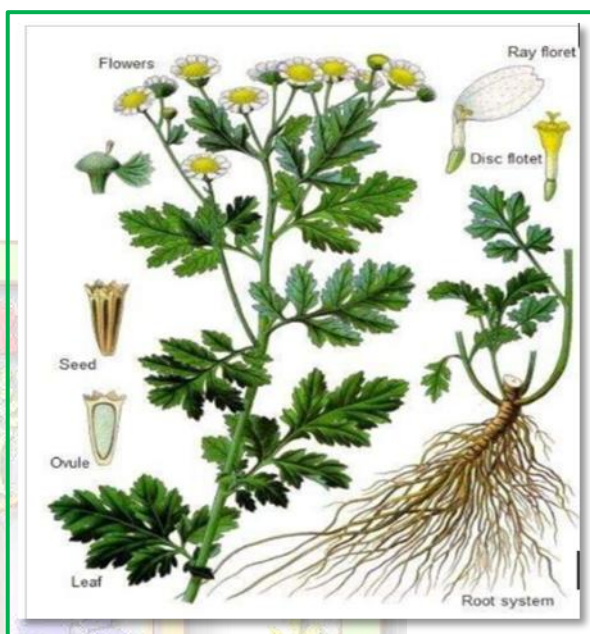


Fig1: The different plant parts of *parthenium hysterophorus*

Botanical Description

It is an annual, ephemeral herbaceous plant with a shorter life span (4 to 6 weeks), is highly branched, has profuse flowering, has high seed productivity (15,000 to 100,000 per plant), has light seed weight, and also exhibits seed dormancy in adverse environmental conditions, and it also shows regenerative capability. The flowers are white in colour, and the stems and leaves are covered with fine hairs.

Allelopathic Effect

Parthenium hysterophorus is an allelopathic plant. It produces a toxic chemical, parthenin, which is a well-known sesquiterpene lactone. There are also some other major allelochemicals, such as phenolic acids, which exist as p-coumaric acid, p-hydroxybenzoic acid, vanillic acid, caffeic acid, ferulic acid, and chlorogenic acid present in parthenium. Parthenin has been considered as a germination and radical growth inhibitor. The allelopathic potential of parthenium has a negative impact on the germination and growth of other plants such as rice, maize, black gram, and sorghum, and their yield may be decreased by 40%.

Possible Uses of *Parthenium hysterophorus*

1. Compost: The nutrient content of composted parthenium is twice as high as farmyard manure. Compost made from *Parthenium hysterophorus* is rich in micronutrients such as Fe

and Zn, along with macronutrients NPK. Compost also contains abundant enzymes, vitamins, and antibiotics. Compost has promoted growth in some of the field crops, such as sorghum, wheat, and green gram. Parthenium compost is known as milli compost because the millipedes can rapidly detoxify the chemicals and speed up the process of composting. However, the compost produced from the flowering plants is significantly less effective than that of flowerless plants. Parthenin, a poisonous chemical, degrades during the composting process.

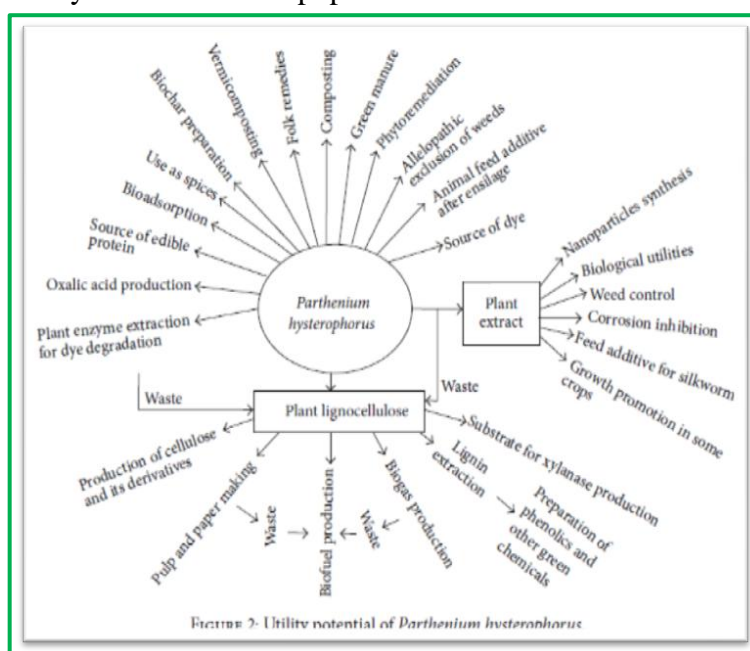
2. Bioremediation of heavy metal: Parthenium weed can absorb and accumulate heavy metals from polluted soils. It can help in eliminating the harmful materials from the contaminated or polluted soil because it functions as a hyperaccumulator. It has been known that Parthenium can absorb nickel and methylene dye from the industrial waste. Ajmal et al. (2006) studied the efficiency of dried powder of *Parthenium hysterophorus* as an adsorbent for removing cadmium from wastewater. Parthenium is an inexpensive, safe, and long-lasting absorbent of toxic and heavy metals.

3. Green manuring crop: In agriculture, parthenium is used as a green manure crop because of its high biomass production. It can act as an alternative for synthetic chemical fertilizers. The use of parthenium leaf manure for rice cultivation increases rice plant height, grain, and straw yield and eliminates the appearance of weeds. It has also shown a significant increase in the number of filled grains in the ratoon rice crop. Parthenium is now being considered as a weed-based manure.

4. As a source of biopesticide: Biopesticides are naturally occurring substances usually derived from plants, bacteria, and fungi. Parthenium has insecticide activity due to the presence of phenolic compounds such as parthenin. Additionally, it is toxic to plants and kills insects like *Spodoptera litura*, *Callosobruchus maculatus*, and *Lipaphis erysimi* and their larvae. The weed has shown larvicidal effects because of the chemical components present in root and stem extracts, which are effective against mosquito larvae, particularly *Aedes aegypti*.

5. Biochar production: Parthenium can be used as a suitable material for the biochar product because of the higher production of biomass. The substrate is heated at a very high temperature (200-300°C) under anaerobic conditions for 30-45 minutes. This biochar improved the soil quality and did not show any negative impact on soil. It can be used as a soil amendment material. During the pyrolysis process, all hazardous material, such as ambrosin, is completely degraded due to the higher temperature. Addition of biochar has shown the increased growth of Zea mays and microbial population in the soil and increased enzymatic activities such as catalase and dehydrogenase activities. The thermal conversion of Parthenium to biochar would be a sustainable weed management strategy.

6. Eradication of aquatic weeds: Aquatic weeds like water hyacinth, *Salvinia molesta*, and water lettuce greatly reduce the freshwater fish production and also harbour several vectors of human and animal diseases. The dry leaf powder of Parthenium extracts caused the leaf wilting and desiccation of these floating weeds.



Conclusion

Parthenium weed is considered an invasive and harmful weed, but it also has certain potential benefits. In the near future, parthenium weed can be utilized as the most affordable and accessible substrate for nutrient-rich compost, as a source of biopesticide, for the removal of heavy metals from soil, and as a fodder crop for livestock animals. Parthenium is an interesting weed due to having both harmful and beneficial effects in relation to crops, humans, and livestock. However, the suggested dose required for application is not scientifically determined. Parthenin and other secondary toxic metabolite content in the weed must be reduced to a larger extent. There is a lot of improvement needed in research setup regarding the effective utilization of parthenium weed and to evaluate its efficacy in field trials. But the research shows that it can be a very useful and beneficial weed when handled scientifically. Training and awareness programs would help the farmers to know about its potential benefits and the utilization of this weed in the crop field.

References

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