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Role of *Parthenium hysterophorus* in Human Health, Agriculture and Sustainability of Ecosystem

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ABSTRACT

Parthenium is one of the most common weeds grow throughout the world due to its remarkable adaptability to a wide range of environmental conditions and soil types. This weed plant shows both harmful and beneficial effects to agriculture, ecosystem and human health. Its uncontrolled growth not only negatively impacted on the cultivation of agricultural plants but also causes asthma, bronchitis, dermatitis and hay fever etc. to both animals and humans. It is believed that uncontrolled natural growth of Parthenium may have an overall negative impact on the ecosystem. The Parthenium compost without any of its contaminated seeds is the rich sources of agriculture plant's macro and micronutrients. Additionally various phytochemical constituents of parthenium have usefulness in agriculture as pesticides and therapeutic usefulness in the human society. The present compilation is an overview of the various aspects of parthenium growth both as natural contaminants during cultivation of agricultural plants as well as its controlled cultivation to benefit the agriculture, certain industries as well as overall human society.

KEYWORDS: *Parthenium*, *Compost, Growth, Weed, Health and Agriculture.*

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INTRODUCTION

Weeds are routinely recognized to be unwanted in a given situation and these are harmful, dangerous, or economically detrimental with significant threat to primary production and biodiversity. *Parthenium hysterophorus* L. (Asterales, Asteraceae, Linn) is an aggressive annual herbaceous weed that grows everywhere and is a member of the Asteraceae family. Common names for *P. hysterophorus* include altamisa, bitter weed, white top, and carrot grass. This plant blooms throughout the entire year (Rauf, et al., 2022). *Parthenium* is derived from the Latin parthenice suggesting medicinal uses. In Homoeopathy system, allergies caused by Parthenium can be treated by a drug prepared from *Parthenium*. In Finland

an infusion of *Parthenium* is used in for consumption (Bailey 1960). *Parthenium hysterophorus* L. Compositae (family commonly known as "Family of Sunflowers*")*, throughout the world this plant has been called in several common names that includes altamisa, carrot grass, Santa maria, bitter weed, chatakchandani, star weed, carrot weed, white top, wild feverfew, ramphool, gajarghas, the "scourge of India," and congress grass (Rao 1956). *Parthenium hysterophorus* introduced by mistake to India in 1955 using food grains imported to Pune (Dhawan and Dhawan, 1996). As a contamination to the food grain it is distributed rapidly throughout India and very easily adapted to the natural Indian climate. It has successfully conquered and naturalized several countries in the last century, including Africa, Australia, United States, Central and South America, West Indies, India, Nepal, China and Vietnam. As a result, it now infests almost every country on the planet (Aneja et al., 1991; Navie, et. al., 1996,). Its rapid and widespread is due to both human activities during globalisation and the weed plant's ability to colonise a wide variety of ecosystems and climatic conditions. *P. hysterophorus* is now considered as one of the world's top seven most dangerous weeds (Ghosh et. al., 2012) and it has been designated as a major weed in India and Australia (Evans, 1997).

Table 1: Different Indian regions' status with regard to *Parthenium hysterophorus* (Lalita, 2018)

Sr. No	Name of State	All over spreading level
1.	Andaman and Nicobar	Low
2.	Rajasthan	Medium
3.	Haryana	High
4.	Madhya Pradesh	High
5.	Mizoram	Low
6.	Uttar Pradesh	High
7.	Uttarakhand	Medium
8.	Punjab	High
9.	Gujarat	Low
10.	Assam	Medium
11.	Kerala	Low
12.	Himachal Pradesh	Medium

IMPLICATIONS ON HUMAN HEALTH

The *Parthenium* weed grows in both agricultural and natural eco-systems. The very allergic *Parthenium* weed has been linked to health problems in practically every nation where it has spread. Direct touch or indirect contacts with airborne particles are the two ways that people can be harmed. It demonstrates numerous detrimental consequences on agriculture, biodiversity, and the health of both humans and animals. Asthma, hay fever, dermatitis, bronchitis, diarrhoea, and allergies affecting the skin, eyes, nose, and mouth are some of the health issues that the *Parthenium* plant or its pollens can cause in people (Patel, 2011). If accessible, stronger steroids are frequently sedative and may increase the risk of an accident for landowners operating machinery. Some fatalities in India have reportedly been attributed to non-contact, allergic respiratory conditions in susceptible individuals. (Goldsworthy, D. (2005). *Parthenium* harmful as well as helpful according to literature survey its play a vital role cause diseases and also attention in antifungal activities against plant pathogenic and human pathogenic fungi.

Parthenium hysterophorus is used in numerous medical therapies for neuralgia, rheumatoid arthritis, diarrhea, urinary tract infections, and dysentery. *Parthenium hysterophorus* has been used in traditional medicine as an emmenagogue and a decoction to treat fever,

diarrhea, neurologic problems, urinary tract infections, dysentery, and malaria. It has been discovered that *Parthenium hysterophorus* has pharmacological activity as a vermifuge, an analgesic for neuralgia, and a treatment for muscle rheumatism. Crop output is also increased by using *Parthenium hysterophorus*. Hepatic amoebiasis has also been suggested to be treated with *Parthenium* (Sharma and Bhutani, 1988).

It is used as a folk remedy in the West Indies and Central America (Nabie et al., 1996). It is applied topically to treat skin conditions, and a herbal decoction is frequently taken orally to treat a variety of illnesses (Dominguez and Sierra 1970; Morton 1981). Root extracts can be used to cure dysentery. It is used as a folk remedy in the West Indies and Central America.

It has many negative effects on animal and human health. The *Parthenium* plant or its pollens cause asthma and hay fever, dermatitis, bronchitis, diarrhoea, and allergies on skin, eyes, nose and mouth (Figure 1).

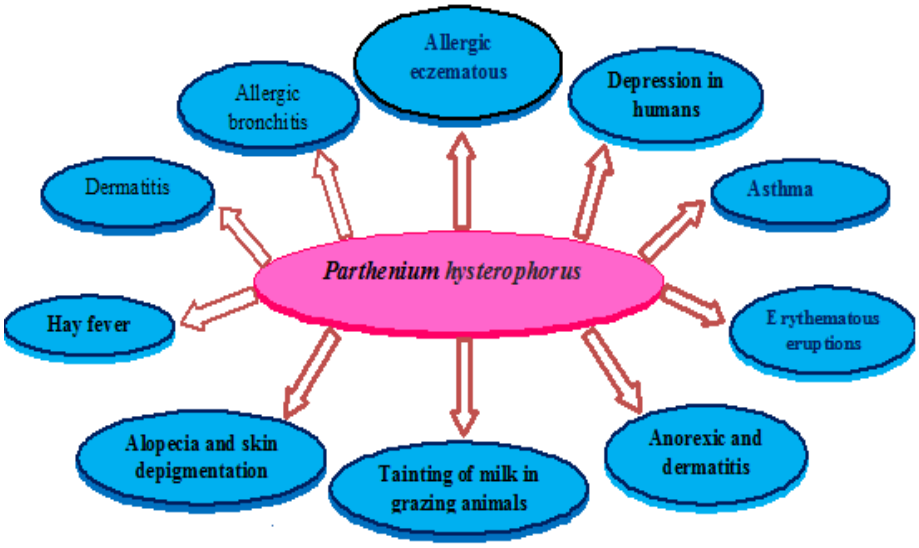

Figure 1: Harmful effects of *Parthenium hysterophorus*

Chemical constituents of *Parthenium hysterophorus* are accountable for both its beneficial and harmful effects. Alkaloids, flavonoids, pseudoguaianolides, oils, and phenolics are examples of secondary metabolites that are present in all parts of the plant, including the hair, trichomes, and pollen. These metabolites are most abundant in the leaves, which are then followed by the inflorescence, fruit, base, and stalk. In order to defend itself against herbivory, parasites, and competition from other plants, the plant creates these secondary metabolites. Because some of these molecules exhibit allelopathic signs, they are known as allelochemicals (Kumar et al., 2022). The chemical make-up of the *Parthenium* plant and the numerous processes connected to its various components are summarized in Table 2. The advantageous results show the usefulness of *Parthenium* plant.

Table 2: Phytochemical Constituents of *Parthenium hysterophorus* and their pharmacological significance

Sr. No	Chemical	Major Constitute	Plant part used	Biological Activity	References
1.	Flavonoids	Glucoside, Quercetin, Glucoside	Stems, leaves, and flowers	Anti-filmmatory, anticancer, and anti-oxident	(Roy and Shaik, 2013, & Khan and Ahmad, 2013)
2.	Phenolics acid	Ferulic acid, anicic acid and fumaric acid	Flower, stem, leaves and roots	Allelopathic, phytotoxicity useful as herbicide, growth regulation in micro and macroflora and autotoxic effect.	Pandey, 2009
3.	Sesquiterpene lactones	Coronopilin	Stem, flowers and trichomes	Antifilmmatory, anticancer	Picman and Picman, 1984
4.	Minor sesquiterpenes	Ambrosonalides, 2B-hydroxycoronopilin,1, 3- hydroyparthenin	Flower	Antifilmmator, anticancer	Sethi et al., 1987
5.	Oils	Limonene, linalool, ocimene,	Roots, leaves, flowers and stems.	Pesticidal, and insecticidal, antitussive and helmethicidal, against bacteria and fungi	(Roy and Shaik, 2013 & Pandey, 2009, & Khan and Ahmad, 2013

AGRICULTURAL APPLICATIONS

Effect on Crop Production

A sizable portion of India has been invaded by the *Parthenium hysterophorus* weed. Parthenin, hysterin, hymenin, and ambrosin are all present in this shrub. This weed has potent allelopathic effects on various products and people due to the presence of these allelochemicals (Kumar, 2009). This weed harms legumes by interfering with their symbiotic relationship with microbes that fix nitrogen, including *Rhizobium, Azotobacter*, *Azospirillum,* and *Actinomycetes* (Kumar et al., 2022). It generates a significant amount of pollen (roughly 700 million), which disperses widely from the parent plant to other crop plants and prevents the fruit from developing (Gunaseelan, 1987).

For Composting

Composting from the rich nutrient content of the *Parthenium* plant may be a useful alternative to be used as a soil conditioner since its economic use is hindered by its toxic impact. Farm Yard Manure has double the amount of nitrogen, phosphorus and potassium as *Parthenium hysterophorus* compost (Channappagoudar, 2007). Despite the availability of ample quantities of various important macro and micro plant nutrients, farmers do not compost *Parthenium*. Composting is not a new technology, but it is gaining popularity among waste management strategies as a viable alternative for manures that benefits both the economy and the environment (Kishor et al., 2010). It is a highly fecund weed due to its biological characteristics, which include a short life cycle (4-6 weeks), continuous and profuse flowering until senescence, high seed productivity (1500-10000 per plant), light seed weight, seed dormancy in adverse environmental conditions, large viable seed bank and strong regenerative capacity.

Reducing agriculture productivity

The severe invasive weed *Parthenium hysterophorus* significantly lowers pasture productivity by 90%. In central Queensland and New South Wales in Australia, it has emerged as a significant weed on grazing areas. It constricts pastures and grasslands, decreasing the quantity

of fodder. *P. hysterophorus's* decreasing impact on the grass biomass of grazing areas in Queensland, Australia, was noted by Dhileepan in 2007, (Evans,1997). Due to its remarkable adaptability to a broad range of environmental conditions and soil kinds, *Parthenium* can be found growing in a variety of environments. Although parthenium plants' germination, flowering, and seed setting are significantly impacted by periodic variations, ideal circumstances like moisture, mild soil, rain, and an ideal temperature of 12 to 270 C are typically present all year.

Use of *Parthenium* as green manure

It is always advised to gather *Parthenium* biomass prior to flowering in order to make compost using either the NADEP technique or the open pit method. Due to the non-dormancy of seeds, which can germinate on the availability of water, it is not practical to collect only flowerless plants, and all stages of parthenium are always present. As a result, farmers must uproot every stage of *Parthenium* during weeding in their fields. Composting *Partheniums* can be done by following the steps below. Create a 3x6x10 (depth, breadth, and length) pit in an area where the water doesn't pool (Lalita,, 2018). While the depth of the pit cannot be compromised, its breadth can. Cover the pit's surface and side sides with stone if you can. Arrange about 100 kg dung, 10 kg urea or rock. Collect all the *Parthenium* plants from your filled and nearby area spread about 50kg of *Pathenium* on the surface of pit. Over this sprinkle if possible add 500 gram urea or 3 kg rock. If Possible add *Trichoderma viridi*or *Trichoderma haziana* (Kind of fungi cultured Powder) in the amount of 50 gram per layer. All the above constituents will make one layer. Like First layer make several layers till the Pit is filled upto 1 fit high from the ground surface. Fill the pit in dome shape. While making layers, apply pressure by feet to make weed biomass compact (Biradar, et al., 2006). If there is no soil with parthenium roots then add 10-12 kg of loamy soil on each layer. Once the pit is filled of the aforementioned layers, a mixture of bovine dung, soil, and husk should be spread over the top. We can get well-decomposed compost after 4-5 months. 37–42 quintals of *Parthenium* material can yield 37–45% of compost.(NADEP:-

In Maharashtra, India, a farmer by the name of Narayan DeotoPandharipande (also known as "Nadepkaka") first developed this process for creating miraculous compost. The NADEP Method employs a continuously constructed tank made of bricks, cement blockades, or mud or clay. This works well in humid areas (Arshad, et al., 2009)

CONCLUSION

The common weed plant *Parthenium hysterophorus* can thrive in a wide range of environmental conditions and is found in many different nations around the globe. The current article provides an overview of several aspects of *Parthenium* growth, including its impacts on the environment, various sectors, human health, and agriculture. While this weed plant's unchecked natural growth may have detrimental effects on agriculture and human health, controlled development of this weed plant might be advantageous for the creation of green manures. This weed plants controlled and careful development may also be helpful in other facets of our lives, such as the overall ecosystem. More research in this field could therefore be beneficial for reducing its adverse effects on the ecosystem as a whole as well as for improving human society.

REFERENCES

1. Aneja, K.R., Dhawan, S.R. and Sharma, A.B. 1991. Deadly weed *Parthenium hysterophorus* L. and its distribution. *Indian Journal of Weed Science.* 23(3-4): 14-18.
2. Arshad, J., Sobiya, S., & Shazia, S. (2009). Comparison of Trifolium alexandrium L. and Parthenium hysterophorus L. green manures in rice-wheat cropping system. *Philippine Agricultural Scientist*, *92*(1), 110-115.
3. Bailey L.H. (1960). Manual of cultivated plants, Macmillan, New York.
4. Biradar, D. P., Shivakumar, K. S., Prakash, S. S., & Pujar, B. T. (2006). Bionutrient potentiality of Parthenium hysterophorus and its utility as green manure in rice ecosystem. *Karnataka Journal of Agricultural Sciences*, *19*(2), 256.

5. Channappagoudar, B. B. Biradar, N. R. Patil, J.B. and Gasimani, C.A.A. (2007) Utilization of weed biomassas an organic source in sorghum. Karnataka J. Agric. Sci. 20(2), 245-248.

6. Dhawan, S.R. and Dhawan, P. (1996) Regeneration in *Parthenium hysterophorous* L. World Weeds, 2, 244-249.

7. Dhileepan K (2007) Biological control of Parthenium (*Parthenium Hysterophorus*) in Australian rangeland translates to improved grass production. *Weed Sci,* 55, 497–501.

8. Dominguez, X.A. and A. Sierra. (1970) Isolation of a new diterpene alcohol and parthenin from *Parthenium hysterophorus. Plant Medica* 18, 275-277.

9. Evans, H.C., (1997) *Parthenium hysterophorus*: a review of its weed status and the possibilities for biological control. *Biocontrol News and Information.* 18(3), 89-98.

10. Ghosh, S., Haldar, S., Shubhaneel, N., Ganguly, A., and Chatterjee, P.K, (2012) Kinetic study of the acid hydrolysis of *Partheniumhysterophorus* L. for xylose yield in the production of lignocellulosic ethanol. *IOSR Journal of Pharmacy and Biological Sciences*. 3(3), 35-41.

11. Goldsworthy, D. (2005). *Parthenium weed and health*. Technical report, The University of Central Queensland, Rockhampton, Australia. 281, 114525.

12. Gunaseelan, V. N. (1987). Parthenium as an additive with cattle manure in biogas production. *Biological wastes*, *21*(3), 195-202.

13. Khan, M.S. and Ahmad, S. (2009) Pharmacognostical, phytochemical, biological and tissue culture studies on *Parthenium hysterophorus* Linn: a review. *Internet Journal of Alternative Medicine.* 6(2), 1-5.

14. Kishor P, Ghosh AK, Singh S, Maury BR (2010) Potential use of parthenium (*Parthenium hysterophorus* L.) in agriculture. *Asian J Agric Res,* 4, 220–225

15. Kumar, M., Kumar, R., & Singh, R. (2022). Parthenium a Noxious Weed: A Review on the Allelopathic Impact on Crop Plants and Their Management. *Bio Science Research Bulletin*, *38*(2), 106-112.

16. Kumar, S. (2009). Biological control of Parthenium in India: status and prospects. *Indian Journal of Weed Science*, *41*(1-2), 1-18.

17. Lalita, K. A. (2018). Review on a weed *Parthenium hysterophorus* (L.). *Int J Curr Res Rev*, *10*, 23.

18. Morton, J.F. (1981). The puzzling whitetop. *Parthenium hysterophorus:* Noxious weed, health hazard, folk-remedy, flea repellent. Unpublished report, Univ. of Miami, Florida.

19. Navie, S. C., McFayden, R. E., Panetta, F. D., and Adkins, S. W., (1996), "The biology of Australian weeds 27.*Parthenium hysterophorus* L, *Plant Protection Quarterly*. 11, 76–88.

20. Pandey, D.K. (2009) Allelochemicals in *Parthenium* in response to biological activity and the environment. *Indian Journal of WeedScience*, 41(3-4), 111–123.

21. Patel, S. (2011). Harmful and beneficial aspects of Parthenium hysterophorus: an update. *3 Biotech*, *1*(1), 1-9.

22. Picman, J., & Picman, A. K. (1984). Autotoxicity in Parthenium hysterophorus and its possible role in control of germination. *Biochemical Systematics and Ecology*, *12*(3), 287-292.

23. Rauf, A., Khan, I. A., Alnasser, S. M., Shah, S. U. A., & Rahman, M. (2022). Phytochemical analysis and in vitro and in vivo pharmacological evaluation of parthenium hysterophorus linn. *Evidence-Based Complementary and Alternative Medicine*, *2022*.

24. Roy D.P. and Shaik, M.M. (2013) Toxicology, phytochemistry, bioactive compounds and pharmacology of *Parthenium hysterophorus*," *Journal of Medicinal Plants Studies*. 1(3): 126–141.

25. Rao, R.S. (1956). Parthenium: A new record for India. *J. Bombay Nat. Hist.* Soc. 54, 218-220.

26. Sethi, V. K., Koul, S. K., Taneja, S. C., & Dhar, K. L. (1987). Minor sesquiterpenes of flowers of *Parthenium hysterophorus*. *Phytochemistry*, *26*(12), 3359-3361.

27. Sharma, G.L. and Bhutani. K.K. (1988). Plant Based Antiamoebic Drugs; Part II. Amoebicidal Activity of Parthenin Isolated from *Parthenium hysterophorus.* Planta Med 54(2).