

## Observation of Ecology, Biology, Effect and Management of Parthenium Weed at Panchayats of Vellore by Rural Agriculture Work Experience (RAWE) Students

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The B.Sc (Hons) Agriculture students Aravind. S, Dhanush. B, Jaysurya .V, Nithishkumar. M, Sriram. R and Tamilvendan. S studying in Adhiparasakthi agricultural college, Kalavai, Ranipet district going through RAWE programme 2022 at Vellore block under the guidance of , RAWE Vellore block facilitator, Assistant professor, Dr. Paranthaman. M (Dept of Plant Breeding and genetics), Principal Dr. Thanunathan. K and Assistant professors Dr. Indhumathi. K and Dr. Vasantha priya. S ( Dept of Agri Extension) . In this programme students undergo experiential learning by visiting farmers and diffusion of new technologies about agricultural field demonstrations conducted farmers. In this article we Biology, Effect and *Parthenium* analyzed and Rural Agricultural Work Programme at Panchayats



Fig 1

practices by the students to discussed about Ecology, management of studied by Students for Experience (RAWE) of Vellore.

### Introduction:

*Parthenium* weed, *hysterophorus L.* is an perennial herbaceous. Its

*Parthenium* annual or short-lived belongs to the

family Asteraceae and subfamily Asteroideae. Members of the genus are commonly known as feverfew. Common names include Santa-Maria, Santa Maria feverfew, whitetop weed, and famine weed. In India, it is locally known as carrot grass, congress grass or Gajar Ghas In Tamil Nadu, it is known by the name Mookuthi Poondu and Visha Poondu. It is a common invasive species in India, Australia, and parts of Africa. It is a major invasive weed in many parts of the world and is regarded as one of the worst weeds because of its invasiveness, potential for spread, impact upon human health and economic and environmental impacts. It can cause dermatitis, asthma and hay fever. *Parthenium* weed is toxic to cattle if consumed in large amounts, and tainted beef or poor milk quality from livestock that has eaten the weed has been reported. It also threatens the biodiversity of native grasslands in India, Australia and part of Africa.



## Classification

Kingdom	:	Plantae
Clade	:	Tracheophytes
Clade	:	Angiosperms
Clade	:	Eudicots
Clade	:	Asterids
Order	:	Asterales
Family	:	Asteraceae
Subfamily	:	Asteroideae
Tribe	:	Heliantheae
Subtribe	:	Ambrosiinae
Genus	:	Parthenium

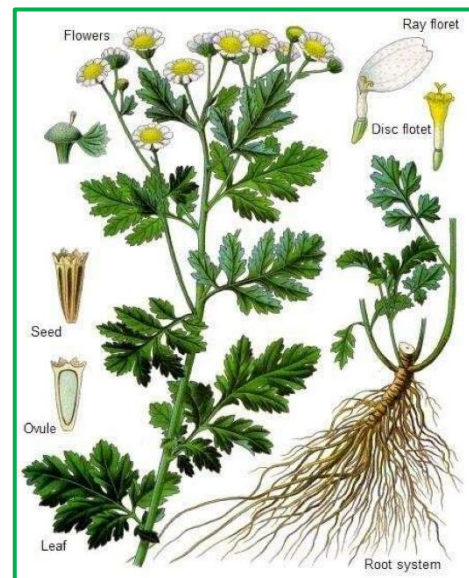
## Origins

The plant Parthenium weed is native to the region around the Gulf of Mexico, including the southern United States of America, and is possibly native to northern Argentina, southern Bolivia and south-west Brazil.

## Morphology

Parthenium weed is an annual (or, under certain conditions, a short-lived) perennial with an erect and much-branched growth habit. Fully grown plants can reach a height of 2.5 m, although most individuals do not exceed 1.5 m. The leaves are pubescent and strongly dissected into narrow lobes. The small white flowers (4 mm across) have five (rarely six, seven or eight) distinct ray florets and grow on the stem tips.

A typical flower produces four or five blackish achenes (2 mm) enclosed in a straw-coloured fruit layer with two lateral attached sterile florets. The rapid germination and fast growth rate and the allelopathic nature of the plant help it to suppress neighbouring vegetation and allow it to grow vigorously and as a result produce a large number of seeds which continuously increase the size of its soil seed bank.



## Spread

The weed can produce large quantities of viable seed: up to 20 000 seeds per plant and more than 340 million seeds per ha can be present in the soil as a seed bank. The seed is easily spread by vehicles, farm machinery and animals (domestic and wild), can contaminate pasture seed lots and stock feed and can be carried in river or flood water. International spread between countries occurs mainly by the movement of contaminated produce (grain for human or cattle feed). It is suspected that this spread has been by vehicles or as a contaminant of seed lots to Nepal, Bhutan, Bangladesh and Pakistan. (Fig 2)

**Sri lanka:** During Civil war, To satisfy food shortage goat send to accompany Indian Military mission. Parthenium seed was said to stick to the fur of goat or they stored in their guts and contaminated the Sri lankan soil. It was accused that this weed is deliberately send to Sri Lanka to cause harm to people and livestock by India.

**Ethiopia:** In Ethiopia, Parthenium weed has become a serious problem in grazing and cropping lands and is thought to have arrived into the country as a food grain contaminant in a USAID programme in about 1980.

**Australia:** Parthenium weed was first reported in Australia in 1950 (herbarium record) and was thought to have been introduced into a rural location just north of Brisbane, Queensland. The weed arrived as a contaminant of a pasture grass seed lot imported from Texas (USA), By 1994 it had invaded about 17 million ha of prime grazing pastures in central Queensland. The area affected has now extended to 60 million ha.

**India:** During the 1950s after independence, India was facing a food shortage. To mitigate this crisis, the Congress government at the centre at that time decided to import wheat from the USA. The food-grain was obtained under the PL 480 (food for peace) programme of the USA. But the wheat that was shipped to India was of inferior quality, and it was mixed with seeds of the parthenium weed. Thus from this shipment from the USA, the dangerous weed spread in India.

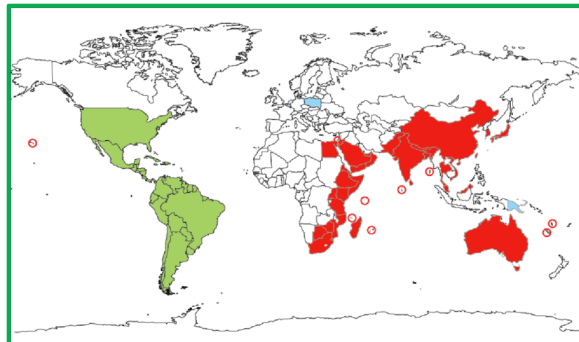


Fig 2

Spotted first in Pune, five decades down the line, it can now still be found in Andaman-Nicobar islands. It is alleged that when the weed was first spotted, the government didn't take any step to stop its spread. For this reason, people named the weed as 'Congress grass', considering it as a gift of the Congress government to the nation.

### Observation and Analysis by Vellore RAWE Students

Rural Agriculture Work Experience was offered to Bachelor of Science (Hons) Agriculture Students during first Semester of final Year (Fourth year). On that, Student of the prestigious Aadhiparasakthi Agriculture College, Kalavai, under the guidance of Principal Dr. K. Thanunathan, Assistant professors Dr. K. Indhumathi and Dr. S. Vasantha priya ( Dept of Agri Extension), RAWE Vellore block facilitator Assistant professor Dr. M. Paranthaman (Dept of Breeding and genetics) examined incidence, effect and spread of Parthenium weed.

We, Students Aravind. S, Dhanush. B, Jaysurya .V, Nithishkumar. M, Sriram. R and Tamilvendan. S were individually allocated respective Panchayat namely Sathiyamangalam, Virinjipuram, Ellavambadi, Poigai, Eraivankadu and Vallandupuram. For the period of 45 days we collected information on Parthenium created awareness through Rally to the people of panchayat. (Fig 1)

The noxious weed is completely spread on the barren (uncultivated) land appeared like a crop under grown and erected along the border and inside of cultivating field. The people of panchayat completely depend on the barren grassland and road side grasses for grazing their cattle. According to local Veterinary Hospital located at Poigai, many livestock especially cow are affected by accidentally eating this weed and reported Bitter milk problem because their fodder is polluted with *Parthenium* leaves. This affect famers economically whose income is completely depended on Cattle rearing. Parthenin a major toxic chemicals in Parthenium.

When farmers try to plug out the weed without any precaution (Like gloves and mask) were observed severe skin irritation and blisters (dermatitis). We also found people burning the weed in masses which would have caused breathing malfunction and asthma. This weed also capable of causing allergies through pollen. Among other allelopathic effects of the species, the presence of *Parthenium* pollen grains inhibits fruit set in tomato, brinjal, beans, and a number of other crop plants were observed. This uncontrollable weed were found atleast 6 feet tall indicating lack of awareness for need of eradication.



### Conducting Rally on *Parthenium*

On observing such drastic and dire effects of this congress weed and lack of awareness to the people of above said Panchayat, we conducted rally on “The evil effect of *Parthenium* to People, Livestock and environment and need for its eradication.”

We gathered about 200 students from Government Boys Higher Secondary School, Poigai. Following strict Covid-19 protocol we successfully conducted the rally. We displayed Board saying slogans about the weed eradication and chart explaining their effects. We also distributed pamphlets to the people regarding *Parthenium* weed control. (Fig3)



Fig - 3

### Demonstration

We selected a piece of severely *Parthenium* affected land and demonstrated safety-removal of the weed. We also recommended chemical and Biological control for this weed.

### Press Release

Our Activity were found by the prominent Newspaper “The Hindu” and they released a column of news explaining our project on 28 Jan 2023 (Fig 4)

### Chemical Analysis and Toxicity of *P. Hysterophorus*:

Parthenin is a major toxic chemical in *Parthenium hysterophorus*. Parthenin is a chemical compound classified as a sesquiterpene lactone. It has been isolated from *Parthenium hysterophorus*. It is genotoxic, allergenic, and an irritant. Parthenin is believed to be responsible for the dermatitis caused by *Parthenium hysterophorus*.



Fig - 4

Isolation and structural elucidation of the active principles of *P. hysterophorus* is required to determine their chemical properties. Chemical analysis of *P. hysterophorus* has indicated that all its parts including trichomes and pollen contain toxins called sesquiterpene lactones (SQL). It is reported that *P. hysterophorus* contains a bitter glycoside parthenin, a major sesquiterpene lactone. Other phytotoxic compounds or allelochemicals are hysterin, ambrosin, flavonoids such as quercelagetin 3,7-dimethylether, 6-hydroxyl kaempferol 3-0 arabinoglucoside, fumaric acid. P-hydroxy benzoin and vanillic acid, caffeic acid, p coumaric, anisic acid, p-anisic acid, chlorogenic acid, ferulic acid, sitosterol and some unidentified alcohols . (Fig 5)

Parthenin, hymenin and ambrosin are found to be the culprits behind the menacing role of this weed in provoking health hazards. *Parthenium hysterophorus* from different geographical regions exhibited parthenin, hymenin, coronopilin, dihydroisoparthenin, hysterin, hysterothrin and tetraeurin A as the

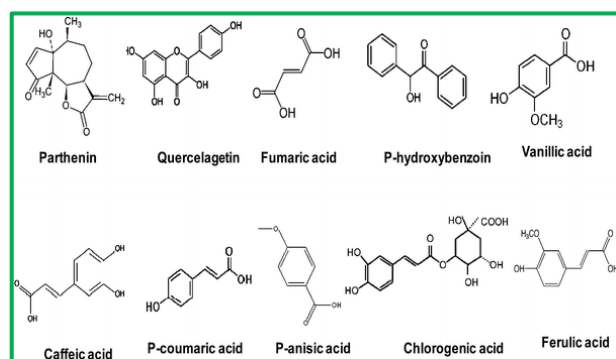


Fig - 5

principal constituents of their sesquiterpene lactones and it identified a novel hydroxyproline-rich glycoprotein as the major allergen in *P. hysterophorus* pollen.

The flowers of *P. hysterophorus* and isolated four acetylated pseudoguaianolides along with several known constituents. A novel sesquiterpenoid, charminarone, the first seco-pseudoguaianolide, has been isolated along with several known compounds from the whole plant by Venkataiah et al. (2003). Chhabra et al. (1999) discovered three ambrosanolides from the chloroform extract of this weed.

### Control and Management

**Mechanical Control:** Light infestations of *Parthenium hysterophorus* in cultivated fields may be hoed or weeded by hand if labour is available at acceptable cost. Burning the weed using flame thrower is practicing in Australia

**Chemical Control:** Generally the application of herbicides is expensive and often harmful; Paraquat sprays may be applied while the weeds are young. Glyphosate 1-1.5 ml per liter may be effective against this species.

**Biological Control:** The most satisfactory and promising means of practical long-term control are biological. The best-established control organism so far is a beetle native to Mexico, *Zygogramma bicolorata* (Mexican Beetle), which was first introduced to India in 1984. It since has become widespread and well-established on the subcontinent. It defoliates and often kills the weed, and its damage to the young flowering tops reduces seed production. In various countries, such as Australia and South Africa, several other biocontrol agents have been released or are under evaluation. These include at least two more species of beetles that have been released in South Africa, a stem boring weevil *Listronotus setosipennis*, and a seed weevil *Smicronyx lutulentus*.

Also in South Africa, rust fungi have been of some use: the winter rust *Puccinia abrupta* var. *partheniicola* plus the summer rust *Puccinia xanthii*.

In Australia, apart from the foregoing, yet other biocontrol agents have been employed or evaluated on *Parthenium hysterophorus*, to a total of 11 species since 1980. Of those eleven, nine appear to have established in various regions. The two with the greatest effect seem to be the Parthenium beetle *Zygogramma bicolorata* and a stem-galling moth *Epiblema strenuana*. However, other species that appear to have established usefully include a leaf-mining moth, *Bucculatrix parthenica*; a stem-galling weevil, *Conotrachelus albocinereus*; and a root-boring moth *Carmenta ithacae*.

### Health Hazards to Humans and Livestock by *Parthenium*

This weed is known to cause many health hazards which have now reached epidemic proportions. Agriculturists are concerned about *P. hysterophorus* affecting food and fodder crops, since the pollen and dust of this weed elicit allergic contact dermatitis in humans. Persons exposed to this plant for prolonged period manifest the symptoms of skin inflammation, eczema, asthma, allergic rhinitis, hay fever, black spots, burning and blisters around eyes. *Parthenium hysterophorus* also causes diarrhoea, severe papular erythematous eruptions, breathlessness and choking. Exposure to *P. hysterophorus* pollens causes allergic bronchitis

Exposure to *P. hysterophorus* also causes systemic toxicity in livestock. Alopecia, loss of skin pigmentation, dermatitis and diarrhoea has been reported in animals feeding on *P. hysterophorus*. Degenerative changes in both the liver and kidneys and inhibition of liver dehydrogenases have been reported in buffalo and sheep. The milk and meat quality of cattle, buffalo and sheep deteriorate on consumption of this weed. Significant reduction in rat WBC count after oral treatment of Parthenium extract signifies its immune system weakening ability.

A study published in 2021 further showed that the plant could promote malaria by supplying much appreciated food and shelter to mosquitoes in Eastern Africa.

### Reducing Agricultural and Pasture Productivity

The allelopathic properties of unburnt and burnt residues of *P. hysterophorus* on the growth of winter crops, radish and chickpeas. The extract prepared from both unburnt and burnt was toxic to the seedling length and dry weight of the test crops. Burnt extract was more toxic due to its highly alkaline nature.

Parthenin has also been reported as a germination and radicle growth inhibitor in a variety of dicot and monocot plants and it enters the soil through the decomposing leaf litter.

Burning of *P. hysterophorus* in fields reduced germination, biomass growth, plumule and radicle length of *Phaseolus mungo*. Poor fruiting of leguminous crops and reduction in chlorophyll content of crop plants were observed in *P. hysterophorus*-infested.

*Parthenium hysterophorus* played role as alternate host for crop pests functioning as an inoculum source. This weed has been reported to serve as a reservoir plant of scarab beetle, a pest of sunflower. *Parthenium hysterophorus* invasion causes changes in above-ground vegetation and below-ground soil nutrient contents, disturbing the entire grassland ecosystem in Nepal.

*Parthenium hysterophorus* is a serious invasive weed of pasture systems, reducing pasture productivity 90%. It has become a major weed of grazing lands in central Queensland and New South Wales in Australia. It squeezes grasslands and pastures, reducing the fodder supply.

### Conclusion

The information presented in this paper demonstrates that parthenium weed is an extremely aggressive and prolific invasive weed of growing global significance. Several aspects of its reproductive biology and ecology contribute towards its invasiveness, and reports of the weed's invasion into new localities are commonplace. In India, the lack of people coordination slowdown the motive of complete eradication of the weed. Poor Legislative control and Extension department degrades the possibility of Parthenium free environment in our society. Moreover, recent studies have concluded that parthenium weed can be effectively managed by complementing existing biological control strategies with suppressive plants, and this approach is likely to work into the future in a changing climate, and in other locations around the globe where parthenium weed is becoming a problem.

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