



IMPACT AND MANAGEMENT OF PARTHENIUM HYSTEROPHORUS

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ABSTRACT

Parthenium hysterophorus L. commonly called as congress grass is noxious weed among the top ten worst weeds of the world. Its high reproduction potential, fast growth rate, allelopathic potential, and unpalatable to animals make it capable of rapid spread vigorously. It affects human health causes skin diseases and allergic reactions, also affect livestock and reduces yield of agricultural crops in the affected field. The aim of this review is to provide general information about the weed, distribution, ill effects, and management of parthenium. There are many ways, physical, chemical, and biological to control it but it cannot be controlled by using a single approach. Integrated approach should be the better way to manage this noxious weed.

KEY WORD: Weeds, Congress Grass, Allelopathic, Glyphosate.

INTRODUCTION

Parthenium hysterophorus L. (Asteraceae), a noxious weed, inhabits many parts of the world, in addition to its native range in North and South America and the West Indies (Picman and Picman, 1984). *Parthenium hysterophorus* is found in Australia, Bangladesh, Ethiopia, India, Sri Lanka, Kenya, Madagascar, Nepal, Pakistan, Papua New Guinea, Puerto Rico, South Africa, Swaziland, Taiwan, Vietnam and the United States. In India, it is locally known as 'Gajarghas'. *Parthenium* was introduced to India in seed form as a contaminant of food grains imported from Mexico. It is regarded as one of the worst weeds because of its invasiveness, potential for spread, and economic and environmental impacts, and it is noxious because it is highly adaptable to almost all type of environmental conditions, can invade all types of land, also causes high losses in the yield of field crops and direct contact with plant (Aneja *et al.*, 1991) and (Auld *et al.*, 1983). In India it has invaded almost all the states with a high level of spreading in Haryana, Punjab and U.P. It was first reported in India in 1880, but recognized as a threat in 1950s. It was first time reported from India in 1956, growing as stray plants at waste places in Pune (Maharashtra). It is a tall growing, deep rooted, much-branched dicotyledonous weed species attaining a meter height at fully flowered stage. The weed bears numerous small white flowers aggregated together to form the Capitulum inflorescence. At maturity Capitulum is transformed into Cypsela type fruit which bears numerous seeds. It is mainly propagated through seeds. Within a decade it had spread so vigorously in the Plains of India that it became a problematic weed posing problem of its extermination. Now it has achieved the status of the

countries "worst weed" owing to its allelopathic effects on crop production and harmful effects on people and animals.

CURRENT SPREAD OF PARTHENIUM WEED

It is widely found in almost all the parts of world such as in Asia (Bangladesh, India, Israel, Pakistan, Nepal, southern China, Sri Lanka, Taiwan and Vietnam), Africa (Ethiopia, Kenya, Madagascar, Mozambique, South Africa, Somalia, Swaziland and Zimbabwe), Australia and the Pacific (New Caledonia, Papua New Guinea, Seychelles and Vanuatu (Dhillepan and Senaratne, 2006). In India, it is locally known as "Congress Grass or Gajar Ghans". It was first introduced due to contaminated PL-480 wheat imported from the United States of America in 1950s, and is also called as 'Congress Grass'. India has become one of the most Parthenium affected countries in the world as this weed is occurring in all of her states and presenting a major problem in many those states that have large areas of non-cropped and pastures rain-fed land (Sushilkumar and Varsheny, 2010), (Sushilkumar, 2012). The spread of Parthenium has been reported from all states of India in varying intensity. In general, overall spread in terms of density and infestation level was highest in Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Haryana, Karnataka, Maharashtra, Madhya Pradesh, Punjab, Tamil Nadu and Uttar Pradesh; medium in Assam, Gujrat, Himachal Pradesh, Jharkhand, Jammu & Kashmir, Uttarakhand, Odisha, West Bengal and Rajasthan; low in Andaman & Nicobar, Arunachal Pradesh, Goa Kerala, Lakshadweep, Manipur, Mizoram, Meghalaya, Nagaland, Pondicherry and Sikkim. The overall average infestation of *Parthenium* varied in different states of India (Table 1).

HOW IT IS SPREADS

Parthenium possesses an enormous ability to grow and establish fast (Monika, 2014). *Parthenium* completes our life cycle within 3 - 4 months and it shows three to four generations in a year which helps in quick spreading and generation of adverse impacts on the surrounding vegetation (Kohli *et al.*, 2006). *Parthenium* seeds are mainly dispersed through water currents, animals and the movement of vehicles, machinery, livestock, grain. *Parthenium* weed has a short life cycle, grow very quickly and survive or grow under different habitats. Most of the long distance spread is through vehicles, farm machinery and flooding. The weed produce enormous number of seeds which are very small in size and also light in weight and can survive as seed bank in soil for years (Dogra *et al.*, 2011). These some characteristics help to *parthenium* weed dispersal up-to long distances and result in their rapid spread in the invaded areas.

Causes of rapid spread

- High reproductive potential
- Fast growth rate
- Allelopathic potential
- Unpalatable to animals

IMPACTS OF PARTHENIUM

Impact on crop production

Due to the invasive capacity and inhibitory role of allelochemicals, phenolics and sesquiterpene lactones, mainly parthenin, it inhibits the germination and growth of plants including pasture grasses, cereals, vegetables and other plant species (Veena *et al.*, 2012). In India *Parthenium hysterophorus* causes a yield decline of up to 40% in agricultural crops (Khosla and Sobti, 1981). (Maharjan *et al.*, 2007) showed that increase in concentration of extract was invariably associated with decrease in germination and seedling characteristics of the crops. The germination and growth of agricultural crops, like rice, wheat, maize, pigeonpea, blackgram, sorghum etc. are inhibited by its allelopathic effect. The weed affects nodulation in legumes due to inhibition of activity of nitrogen fixing and nitrifying bacteria, namely, *Rhizobium*, *Actinomycetes*, *Azotobacter*, and *Azospirillum*.

Impact on human and animal health

In India, this weed has been considered as one of the greatest source of dermatitis, asthma, eye irritation, and sinusitis (hay fever) types of diseases (Table 2). Pollens in contact with body causes swelling and itching of mouth & nose. Consumption of weed roots causes excessive water loss from the body due to contact of *Parthenium hysterophorus* causes (Oudhia and Tripathy, 1998) acute toxicity in cattle and milk becomes bitter tasting due to the presence of parthenin compound, which is also hepatotoxic in nature. Due to Contact of this weed causes inflamed udder, fever and rushes in cows, allergic inflammation in the mouth of cattle's. If it is present in animal diet then causes dermatitis with pronounced skin lesions and a significant amount (10–50%) of *Parthenium hysterophorus* in the diet can kill cattle and buffalo (Veena *et al.*, 2012) (Ahmed *et al.*, 1988).

MANAGEMENT AND CONTROL

Physical

It is most cost effective method for control. It includes several cultural practices such as preventing introduction of *Parthenium* seeds by keeping clean the equipments, livestock, animal feed, people, and vehicles, preventing physical spread of the seeds by cultivators, shoes, tires, machinery (Robert, 2011). According to Connachie *et al.* (2010), Asteraceae (2004), Tamado, and Milberg. (2000), observed that in certain area of india, crop rotation using marigold (*Tagetes* spp.) during kharif, instead of the usual crop, is found effective in reducing *parthenium* infestation in production areas and burning also can kill *parthenium* weed above ground plant parts and seed near the soil surface, but buried seeds may survive, (Stamp's. 2011).

Chemical Control

A large number of chemicals have been tried for control (Sushilkumar, 2005, Sushilkumar, 2012) observed that the chemical treatment can only kill existing population at the given sites but cannot prevent the entry of the seeds coming on treated side from neighboring places. There are many herbicides have been tested against *Parthenium* in cropped and non-cropped condition (Mishra and Bhan, 1996, Brar and Walia, 1991, Sushilkumar 2012). For complete vegetation management including *Parthenium*, glyphosate (1 to 1.5 kg/ha) is recommended. Diquat 0.5 kg/ha in 500 litre spray effectively controlled *Parthenium* at all growth stages (Dhanraj and Mitra 1976).

Biological Control

Classical Biological Control

Biological control is an eco-friendly and effective means of control or mitigating pests and pest effects through the use of natural agents. In the last three to four decades, a great deal of emphasis has been given to control *parthenium* through various biocontrol agents like microbial pathogens, insects, and botanicals, (Ray and Gour., 2012), Watson and Wymore., 1990).

Insects as Classical Biocontrol Agents

Several insects have been tried to control *parthenium* weed in the different countries (Table 2). (Dhileepan 2003a, b) study on the effectiveness of leaf feeding beetle *Zygogramma bicolorata*. The leaf-feeding beetle *Zygogramma bicolorata* and the stem-galling moth *Epiblema strenuana* are widely used in many countries to manage and control the *Parthenium*. *Z. bicolorata* is also used in our country to control *Parthenium* *Zygogramma bicolorata* (leaf-feeding beetle). (Stamp's, 2011, Dhileepan, 2001), and the stem galling moth significantly reduces flower and seed production of the weed, especially at a young age. Some other insects are *Bucculatrix parthenica* (leaf-mining moth), *Smicronyx lutulentus* (seed-feeding weevil), *Listronotus setosipennis* (stem-boring weevil), (Stamp's, 2011, Dhileepan, 2003).

Classical Control by Fungal Plant Pathogens

In classical control methods, obligate parasites, especially rust fungi, are the first choice because they exhibit narrow host ranges, high reproductive capacities, and efficient aerial dispersal 46. Pathogens like *Fusarium pallidoroseum*, *Puccinia melampodii* and *Oidium parthenii* also show good potential as bio control agents. (Dhileepan and Senaratne, 2006, 16, Stamp's, 2011, Dhileepan, 2001, Dhileepan, 2003).

TABLE 1. Spread and infestation level of *Parthenium*

Name of state	Over all spread and infestation level of <i>Parthenium</i>	Name of state	Over all spread and infestation level of <i>Parthenium</i>
Andaman & Nicobar islands	Low	Kerala	Low
Andhra Pradesh	High	Madhya Pradesh	High
Arunachal Pradesh	Low	Maharashtra	High
Assam	Medium	Manipur	Low
Bihar	High	Meghalaya	Low
Chattishgarh	Medium	Mizoram	Low
Chandigarh	Medium	Nagaland	Low
Delhi	High	Orissa	Medium
Goa	Low	Pondicherry	Medium
Gujarat	Low	Punjab	High
Haryana	High	Rajasthan	Medium
Himachal Pradesh	Medium	Sikkim	Low
Jammu & Kashmir	Medium	Tamil Nadu	High
Jharkhand	Medium	Uttar Pradesh	High
Karnataka	High	Uttarakhand	Medium

Source: Sushil kumar (2012)

TABLE 2: Effect of *Parthenium* on human health and livestock Source: Gnanavel (2013)

Contact dermatitis	Seasonal eruption of the exposed skin surface
Eczema	Chronic lichensified eczema of the exposed skin surface
Eczematoid dermatitis	Skin eruption and itching
Dermatitis	Skin eruptions and itching
Allergic reaction	Cracks all over the sole
Allergic papules	Sore throat, bubbles in the mouth
Fatigue	General weakness, skin eruptions
Severe dermatitis	Loss of scalp, body hair, ridging on nails
Fever in cows	Inflamed Fever in cows udder and rashes
Ulcerations in buffaloes, horses donkeys, sheeps and goats kidney and liver	Acute and chronic toxicity, ulcers both in the mouth and digestive tract, oesophagus

CONCLUSION

The noxious *P. hysterophorus* grows in a wide variety of habitats and causes changes in above ground vegetation as well as in below ground soil nutrients. Awareness must be created among the inhabitants of the countries about the impacts of *Parthenium*. How this weeds look like, how the seeds are spread from one place to another and the possible methods of control should be taught to all of the peoples so that all the members of the community can be involved in combating the weed. In case of *Parthenium*, which has infested large areas of India, an integrated approach using cultural, physical, chemical, and biological techniques coupled with community participation has been quite successful.

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