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Review

Parthenium Grass: Is it curse to the society?

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Vast and easy acclimatization is the most favorable aspect of weed for their havoc in agriculture land. Either hazardous or non-hazardous, weed hinders the quality of crop plants. *Parthenium* hysterophorus is one of the hazardous weed which not only possess crop damaging capability but also a cause of serious human`s and cattle`s diseases. Several strategies had been implemented to manage the menace caused by this weed. An effected integrated approach can be a future solution for eradication of *parthenium*. The present review focuses on the distribution pattern, harmful effects and solution for obliteration of *parthenium.*

Keywords: Gajar ghas, Integrated Weed Management, Agroecosytem.

INTRODUCTION

Gajar ghas globally known as “Congress Grass” and scientifically as *Parthenium* hysterophorus is the most upcoming deadly problem for north India. This weed is a native of Mexico and South America but found to be widespread throughout India and many other countries (Satsangi et al., 2002). *Parthenium* is also popular with other names such as carrot weed, chatak chandini, asadi, gajari, phandriphuli, nakshatra gida, vayyari bharna and safed topi. *Parthenium* is considered as one of the worst weeds because of its invasiveness, potential for spread, economic and environmental impacts and also classified among the seven most dangerous weed of the world (Singh et al., 2003). It was reported that *Parthenium* releases phenolic compounds which affect growth and nitrogen fixing potentiality of many crop plants (Mall and Dagar, 1979). Not only this weed shows resource portioning with other crops but also a cause of annoyance and health hazard to mankind and animals as well as threat to biodiversity and danger to environment (Knox et al., 2011; Sharma et al., 2005, Worku 2010). Dermatitis, fever and asthma to homosapians are also among the major consequences of this weed.

SEED DISPERSAL

Dispersal of this weed is very rapid; each plant produces around 5000 to 25000 seeds. For every 120,000 native grasses, around 340 million *Parthenium hysterophorus* seeds per hectare can be present in the surface of the soil (CRC Weed Management Guide 2003). This weed is easily distributed by the movement of vehicles, machinery, livestock, grain and other produce. Optimum

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temperature for growth of *Parthenium hysterophorus* is between 22°C to 25°C but seeds can grow between 8°C to 30°C. (APFISN Fact Sheet). A persistence test for the seeds demonstrates that seeds buried at 5 cm below the soil surface can survive for at least 2 years, whereas seeds on the soil surface do not survive for more than 6 months (Monaco 2001).

HABITAT

Vacant lands, orchards, forestland, flood plains, agricultural areas, wastelands shrub lands, urban areas, over grazed pastures railway tracks and roadside are luxurious places for the growth of *Parthenium hysterophorus*. Drought, and subsequent reduced pasture cover, creates the ideal situation for this weed to establish. This weed can tolerate a wide variety of soil type but prefer to grow in alkaline, loamy and heavy-black clay soil. The weed grows well in areas where the annual rainfall is greater than 500 mm and falls dominantly in summer. It can grow up to an elevation of 2200 m above sea level. *Parthenium* is an exotic weed having deep penetrating roots and erect shoot of 1.5 to 2 m having hairy leaves and possess the capability of establish in the alien environment whereas suppressing the growth of other native species , this is the potential reason for dominance of *Parthenium* throughout the year (APFISN Fact Sheet).

DETRIMENTAL EFFECT

Countries having tropical climate such has America, Australia and India had already declared *Parthenium*as a noxious weed. According to scientists this weed is described as a "poisonous, allergic and aggressive", thus posing a serious threat to human beings and livestock (Kumari 2014; Evans 1997).

EFFECTS ON HUMANS

This weed causes many health hazards one of them is contact dermatitis. It is a kind of T cell- mediated disease whose symptoms are itchy erythematous papules and papulovesicular lesions on skin (Akhtar et al., 2010). Diarrhea, severe popular erythematous eruption, breathlessness, chocking (Maishi et al., 1998), allergic bronchitis, hay fever, alopecia, loss of skin pigmentation, dermatitis and diarrhea are among serious problem occurs due to this weed. Persons exposed to this plant for sustained period manifest the above mentioned symptoms which are found to be related with cytotoxicity of the sesquiterpene lactone parthenin (Narasimban et al., 1984).

EFFECTS ON BIODIVERSITY

This weed aggressively colonizes and disturbs the natural flora of that area. Due to its vigorous mode of reproduction and array of secondary metabolites gives this weed the status of invasive alien species (Kapoor 2012). It was observed that in *Parthenium* dominating area, very sparse and sometime no other crops developed (Devi et al., 2014). According to an study leaf extract of this weed had reduces the germination of *Cajanus cajan* up to 60% and total inhibition of germination was observed in *Sorghum vulgare* seed on applying root extract of *Parthenium* (Satsangi et al., 2002). This species easily adapts to the new place often replaces the indigenous species, thus affecting the biodiversity of India.

EFFECTS ON ECONOMY

This weed is poisonous to mammals; hence consumption of these weeds by livestock (sheep) can taint meat. (Tudor et al., 1982). An earlier assessment suggests that an inverse relation exists between *Parthenium* and pasture grass population and growth and germination of legumes are more affected than the growth of cereals, oats and rice, barley (Muniyappa and Krishnamurthy, 1980). According to study done by the scientists this weed has some chemicals, like parthenin, hysterin, hymenin, and ambrosin, due to the presence of these chemicals, the weed exerts strong allelopathic effects on different crops, and also both fully and partially burnt residue are toxic for the growth of winter crop such as radish and chickpea (Singh et al., 2003). It was also reported that leaching of *Parthenium* as root exudate plays a crucial role in allelopathic interference with surrounding plants (Belz et al., 2007). It is also found to be a reservoir plant of scarab beetle which is a pest of sunflower. Invasion of this weed not only changes the above-

ground vegetation but also affects below ground soil nutrient content (Timsina et al., 2011).

CONTROL

Many efforts have been taken to control this weed which includes conventional, chemical, bioremediation and biological methods and also by doing certain combination and permutation with these methods seems to be a promising solution for effective management of this troublesome weed (Robert, 2011; Saini et al., 2014). But due to its high proliferation rate and ecological adaptability, this weed is managed only below the threshold level and is still threatening biodiversity and causing health problems to both human and animals (Kaur et al., 2014).

Conventional methods

Physical control

Uprooting of *Parthenium* weeds before flowering and seed setting is an effective method, it is easy to uproot this weed during the rainy season when soil remain wet. Although labor intensive, hand weeding and hoeing can be beneficial, especially if done before the weeds produce seed (Tadesse et al., 2010; Tamado et al., 2004). Cutting and slashing of weed enhances its regeneration capacity hence uprooting is the finest option. Manual removal is not very cost effective (Mahadevappa, 1997) as it can be implemented only in limited situation and if it became necessary to hire labour then they should be equipped with protective measures ascertaining their sensitivity towards *Parthenium.* As manual uprooting increases the incidences of contact dermatitis and other allergic reactions among workers and this method is also highly uneconomical as it is feasible only in agroecosytem with sparse weed cover. Burning is another strategy which can also be employed to manage this weed, however it is not recommended as it distorted the quality of soil. Though, previous research proposes that burning for other purposes such as woody weed control will reduce the infestation of *Parthenium* as long as the pasture is allowed to recover before stock is introduced. But this method is also inadequate as it requires large quantity of fuel which is again cost effective and also it destroys other economic plants growing in nearby vicinity (Dogra et al., 2012; Kumar et al., 2010).

Mulching

While cultivation of rose mulching with rice straw is an effective method for controlling an array of weeds which include *Parthenium.* This gives us an idea that mulching in common land may help us controlling this weed.

Chemical

Controlling weed by using herbicides is more feasible and economical as compare to physical control method (Muniyappa and Krishnamurthy 1980). Various herbicides are easily available in market (Table1) which can be used as it is or in several combinations. Research done by scientists reports that by applying 2,4-DEE(0.2%) and metribuzin(0.25and 0.50%) were found to be more effective for controlling *Parthenium* weed just after 15 days of spraying (Khan et al., 2012). Downside of using herbicides is that it should be applied repeatedly especially in area of *Parthenium* seeds bank since they remain viable for 2 to 3 years (Tamado et al., 2002). Many of above listed herbicides are not selected because of their hazards to other crops.

Biological Method

Using other species such as insects, fungi and various useful plants for suppressing the growth of *Parthenium* is also a promising approach for its control (Shabbir et al., 2010).

Control with help of insects

Epiblemastrenuana (stem-galling moth) Listronotussetosipennis (stem-boring weevil), Bucculatrixparthenica (leaf-mining moth), Smicronyxlutulentus (seed-feeding weevil), Zyogramma bicolorata (leaf-feeding beetle) (Dhileepan 2001) Conotrachelusalbocinereus (stem galling moth); Carmentaithacae (stem boring moth); and Platophalonidiamystica (stem boring moth) are the insects reported for bio controlling of *Parthenium*. Different parts of weeds are attacked by these insects and damage caused by them varies with the stage of their life cycle, larval or

Table 1. List of Herbicides.

S/N	Herbicide	Mode of Action	Reference
1	Alachlor	Inhibit Synthesis of Fatty acid	University of Wisconsin-Extension
2	Atrazine	Photosystem II Inhibitor	University of Wisconsin-Extension
3	Bromoxynil	Inhibit Photosystem II	University of Wisconsin-Extension
4	Chlorimuron;	Inhibits synthesis of acetolactate synthase	University of Wisconsin-Extension
5	2,4-D	Specific site Unknown	University of Wisconsin-Extension
6	Dicamba	Specific site Unknown	University of Wisconsin-Extension
8	Flumioxazin	Inhibit synthesis of PPO	University of Wisconsin-Extension
9	Glufosinate ammonium	Inhibition synthesis of glutamine	Martin 2000
10	Glyphosate	Inhibit synthesis of EPSP Synthase	University of Wisconsin-Extension
11	Halosulfuron	Inhibit acetolactate synthase synthesis	University of Wisconsin-Extension
12	Hexazinone	Inhibit acetolactate synthase synthesis	University of Wisconsin-Extension
13	Indaziflam	Inhibit acetolactate synthase synthesis	Oklahoma Cooperative Extension Fact Sheets
14	Imazaquin	Inhibit acetolactate synthase synthesis	Oklahoma Cooperative Extension Fact Sheets
15	Metribuzin;	Inhibition of photosynthesis at photosystem II	Ross et al., (1996)
16	MSMA	Destruct cell membrane	Baumann et al., (1999)
17	Oxyfluorfen	Cell Membrane Destroyers	Ross et al., (1996)
18	Oryzalin	Inhibit plant cell division	Ross et al., (1996)
19	Pendimethalin	Inhibits chromosome separation and cell wall formation	Ross et al., (1996)
20	Picloram	Inhibits action of auxin	EPA (1995)
21	Prodiamine	Inhibit chromosome separation and cell wall formation	Ross et al., (1996)
22	Simazine	Photosystem II inhibitor	Ross et al., (1996)
23	S-metolachlor	Inhibits synthesis of Long-chain Fatty Acid	University of Wisconsin-Extension

adult (Pandey 1994).

Control with the help of fungal species

Pucciniaabrupta var., Pucciniaxanthii var. partheniihysterophorae (previously known as P. melampodii Diet. and Holw.) Partheniicola (Jackson) Parmelee, (Uredinales), Entylomacompositarum, Plasmoparahalstedii (Farlow) Berl. and Alternaria alternata, A. dianthi, A. macrospora, Fusariumoxysporum (Pandey et al., 1992), F. moniliforme, Rhizoctoniasolani, Colletotrichumcapsici, C. gloeosporioides; and Oidiumpartheni; species of Cladosporiumoxysporum

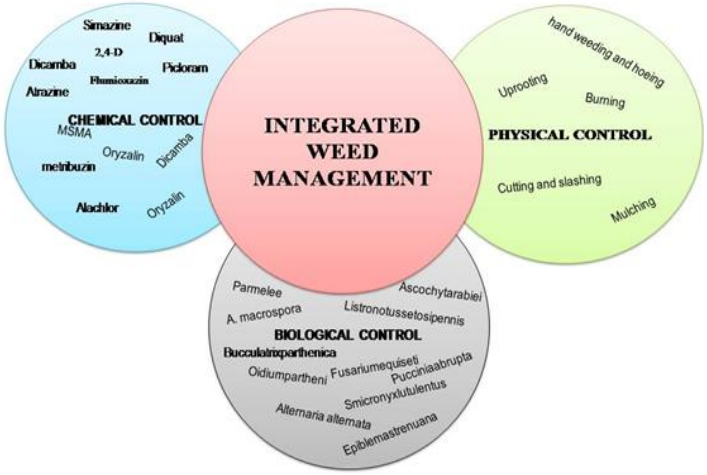

Figure 2. Venn diagram representing Integrated weed Management.

Ascochytarabiei, Fusariumequiseti, Phomaglomerata, Cochliobolushawaiiensis, Pucciniaabrupta var. partheniicola (Fauzi et al., 1997) Pucciniamelampodii, Macrophominaphaseolina and D. Tetramera (Parmelee, 1967) are the reported species which affect the *Parthenium* plant of all ages (Purahong and Hyde, 2010).

Legal

In Karnataka state of India a legal act was passed on 23 October 1975 in section 3, read with sub section (7) of section 21 of Karnataka Agriculture Pest and Disease Act 1968 for management of weed which includes *Parthenium hysterophous*. This act had not proved to be much success due to lack of proper follow up action by administration (Bhan et al., 1997).

Others

Several useful Plants had shown the allelopathic response on this weed which comprises of *Marigold, Abutilon indicum, Tefrosia purpurea, Cassia sericea* along with *Stylosathes Shymals* had shown to drastically reduce the spread of this weed (Satsangi et al., 2012). According to a study competitive pasture plants along with biological control agent had shown up to 86% decrease in *parthenium*. Strategies recommended for management of *Parthenium* weed are effective but has certain limitation (Adkins et al., 1997). Thereby, Integrated Weed Management is seems to be an effective method for producing promising results (Figure 2).

UTILITIES OF *PARTHENIUM*

As every coin has its two sides, *Parthenium* also have certain reported utilities, however they are of less worth as compared to its detrimental effects. Utilization of *Parthenium* is also one of the best remedy for the eradication. By doing pyrolysis of this weed to sequester carbon result in a formulation of Biochar which has been proved to improve the soil quality as it increases basal respiration and microbial biomass increased catalase and dehydrogenase activities which ultimately results in decreased soil stress and hydrolytic enzymes activities. *Parthenium* weed has also been reported for degradation of textiles dyes as this weed has great invasive property and adaptability for extreme condition hence researchers used this weed for extracting plant phenol oxidase enzyme as it have an ability to degrade various aromatic rings in dye (Kelaniyangoda and Ekanayake 2008). This weed can also be used for the production of Biogas (Seier et al., 1997). This weed is also richest source of green manure as it has plenty of micronutrients such as Fe, Zn, Mn, and Cu and macronutrients including NPK which makes it two times richer than farmyard manure (Dhawan and Dhawan, 1995).

According to one of the research study composting this weed with *Eudrilu seugeniae* supports the growth of the worm which explore its possibility of a good substrate for vermincomposting having the richest source of lignocellulosic biomass this weed is of great economic importance in paper and pulp industry. Another recent research going on with this weed is the formation of silver nanoparticle and Zinc oxide nanoparticle and these nanoparticles are proposed to have a high potentiality for use against the growth of microbes such as (Parashar et al., 2009; Kumar 2012; Rajiv et al., 2013). *Escherichia* coli, *Pseudomonasputida, Pseudomonas aeruginosa*, *Klebsiellapneumoniae, Staphylococcus aureus, Salmonella typhi*. Apart from economic point of view, this weed has a great importance as it has been used as a traditional medicine to treat fever, urinary tract infections, dysentery, and malaria. It has been found to be pharmacologically active as analgesic in muscular rheumatism, therapeutic for neuralgia and as

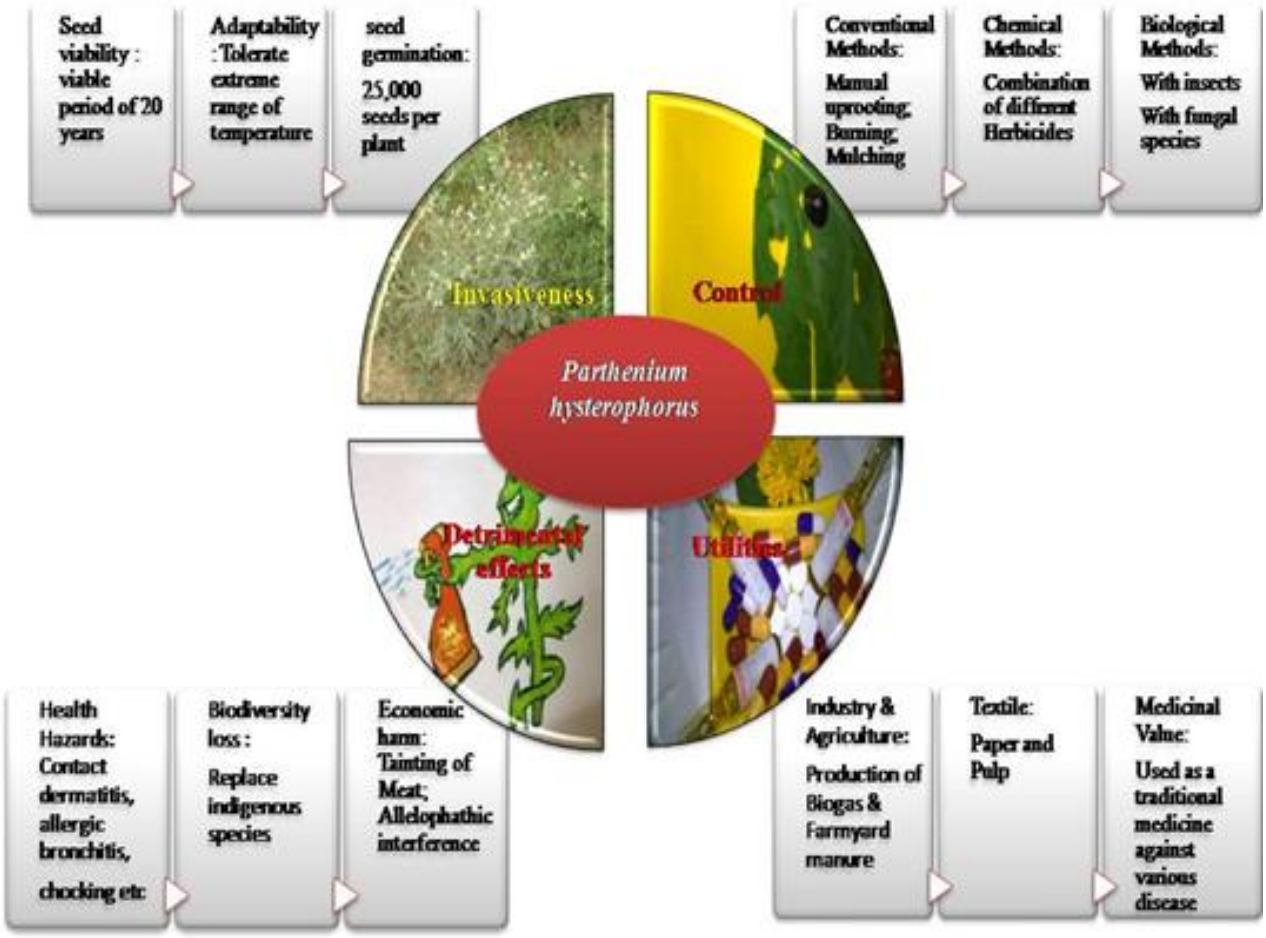

Figure 1. A General Overview on Parthenium.

vermifuge (Maishi et al., 1998). Methanol extract of the flowers of this weed has shown the potential to be used as an anti-carcinogenic agent. So, flower extract of this weed can be used for developing drug for diabetes mellitus. This is an Era of oil crisis; production of oil from this weed always seeks great attention.

CONCLUSION

It was reported that this weed was accidentally introduced into India in 1956 and since that time it was spreading over the country (Chandras and Vartak, 1970). This weed is responsible for decreasing the yield up to 40% in several crops and 90% decrease in forage production, (Khosla and Sobti, 1979; Nath, 1981). This weed has cause great harm to economy as well as health hazards in India. Several Control and preventions varying from conventional to modern methodology had been employed for the eradication of this weed. Integrated weed management and increasing interspecific competition by spraying the seeds of a competitive plant species like *Tagetus erecta, Tephrosia purpurea, Cassia sericea, Cassia tora* etc are the upcoming stratergies for management of *Parthenium*. Due to high invasive rate of *Parthenium* and destruction cause by this weed, it is very much essential to eradicate this weed as early as possible. Apart from extermination one more method of the effective management is the utilization. Several uses of this weed had been reported which comprises of paper production, fuel production and many more. A general overview for parthenium is depicted in Figure 1.

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