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HEALTH HAZARDS OF *PARTHENIUM HYSTEROPHORUS* L. AND ITS MANAGEMENTS

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ABSTRACT:

Parthenium hysterophorous L. is one of the most aggressive invasive weeds. Threatening natural ecosystems and agroecosystems in the world. *Parthenium* weed causes losses of crops and pastures, degrading the biodiversity of natural plant communities, causing human and animal health hazards and resulting in serious economic losses to people and their interests in many countries around the globe. Several of its biological and ecological attributes contribute towards its invasiveness. *Parthenium* is one of the worst weeds for agriculture. The environment and human health are almost throughout the country. *Parthenium* is extremely prolific and causes several economic losses, health problems and habitat destruction. This weed is considered to be a cause of allergic, respiratory problems, contact dermatitis and mutagenicity in humans and livestock. The plant causes acute allergic eczematous dermatitis in humans which under continued exposure becomes chronic. The skin of the neck, face and arms become hard like the skin of a crocodile from dermatitis passing over the populations of this herb. Some person is allergic to its pollens resulting in fever and asthma.

KEYWORDS: *Parthenium hysterophorus L., Impact on Biodiversity, Antioxidant, Antifungal.*

INTRODUCTION:

History and Distribution of *Parthenium hysterophorus* L.:-

Parthenium hysterophorus L. is one of the worst weed for agriculture,

the environment and human health. *Parthenium* is also known as 'Congress grass' and 'Gajar ghas' in India. It is a herbaceous, erect and annual plant belonging to the family Asteraceae (Compositae). *Parthenium* was accidentally introduced in India through imported food grains in the mid-1950s (Dhawan and Dhawan, 1996). After the noticeable occurrence of *Parthenium* in Pune (Maharashtra) it spread like 'wildfire' throughout India. Many methods ranging from manual uprooting and chemical herbicides to biological control agents have been proposed to limit the spread of this uncontrollable weed. Parthenium hysterophorus L. contain toxins from the chemical group of sesquiterpene lactone (C15 group) (Oudhia and Tripathi, 1998).

Parthenium hysterophorus L. is an invasive weed, that threatens natural ecosystems and agroecosystems in over 30 countries worldwide (Steve Adkins 2014). *Parthenium hysterophorus* L. enlisted in Global Invasive species. It is a highly prolific and pernicious weed (K.R Aneja et.al 1991).

In Australia, *Parthenium hysterophorus* L. occurs in Queensland, New South Wales and the Northern Territory. In Queensland, an area of about 1,70,000 sq.km between Injure and Greenvale, receiving between 500 and 1000mm rain annually. In New South Wales, roadside infestations are constantly occurring along the roads leading out of Queensland, as far south as Narrandera on the Newell Highway. In the Northern Territory, *Parthenium* weed occurs along a stretch of the Roper River. In Australia, *Parthenium hysterophorus* L. occurs in Queensland, New South Wales and the Northern Territory. In Queensland, an area of about 1,70,000 sq. km between Injure and Greenvale, receives between 500 and 1000mm of rain annually. In New South Wales, roadside infestations are constantly occurring along the roads leading out of Queensland, as far south as Narrandera on the Newell Highway. In the Northern Territory, *Parthenium* weed occurs along a stretch of the Roper River.

Parthenium hysterophorus L. an American weed has spread to many parts of India covering approximately five million hectares Naturalized in wastelands and open forests in Bhilwara, Chittorgarh, Jhunjhunu, Pali and Jaipur districts in Rajasthan. *Parthenium* is one of the worst weeds for agriculture, the environment and human health almost throughout the country, infesting more than 5 million hectare area.

Introduction of *Parthenium hysterophorus* L. in India:-

Parthenium hysterophorus L. commonly known as congress or carrot grass in native of Central and South America and West Indies.

Parthenium hysterophorus L. is supposed to have entered in India in the early 1950s along with imported food grains. (Wheat, under agreement PL 480). It was observed in Poona, In India in 1955

since then it has spread to several parts of India in alarming proportions like Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Delhi and Rajasthan is moving fast and far in the plains and hills through vehicular traffic, wind water and urban waste. *Partheuium* is found more polluted in wastelands, rocks crevices, along irrigation canals, roadsides, railway tracks, and developing residential colonies around the towns (K.R.Aneja *et al.*,1991 and S. Patel, 2011).

Parthenium hysterophorus L. weed is found in both natural and agroecosystems. It shows many adverse effects on agriculture, biodiversity, and the health of animals and human beings. In man, the *Parthenium hysterophorus* L. plant or its pollens cause health problems of asthma, hay fever, dramatic, diarrhoea and allergic to skin, eyes, nose and mouth (S. Patel, 2011). The weed is allergic and unpalatable to grazers but it consumed by cattle results in losses due to serious concerns of health hazards and tainting of milk and meat (G.D.Tudor *et al.*, 1982).

Biology of *Parthenium hysterophorus* L.:-

Parthenium hysterophorus L. is highly branched, short lived (annual), upright (erect) herbaceous plant that forms a rosette habitat during the early stage of life. At maturity, but occasionally can reach up to 2m or even more in height profusely branched, usually 50 to 150 cm. high, leaves pinnetely or bipinnetely lobed. Stem is cylindrical, solid, more or less fluted with longitudinal lines corresponding to the extension of the midrib of the leaves. Mature stems are greenish and covered with small soft hairs which are known as hirsute, stems become much harder as reach to maturity. Numerous small flower- heads generally known as capitulum are organized in clusters at the top of the branches (in terminal panicles). Each flower-head (capitulum) is borne on a stalk (pedicel). Capitulum (3-5 mm across) is off-white or white in color containing ray florets (0.3-1 mm long). They also have various (15-60) small flowers (tubular florets) in the centre surrounded by two rows of small green bracts (involucres). It can flowered at any time of the year, but commonly occur during raining season Heads white in corymbs cymes, germinating after rain at any season, flowering in 6 to 8 weeks, and sensing with drought or frost. The best alternating temperature regime for its weed seed germination is 21/16 ◦C (day/night). Further its seeds can live for between 4-6 years in the soil as seed bank. Studies have also shown their buried seeds to live much longer than seeds on the soil surface reproduce by small seeds lasting up to 20 years in soil, induced dormancy on burial.

Parthenium hysterophorus L. is an allotetraploid or an allotetraploid with diploid-like chromosome behaviour.

Biochemistry of *Parthenium hysterophorus* L.:-

The beneficial and harmful effects shown by *Parthenium hysterophorus* L. are due to its chemical constituents. All parts of its plant including hairs, trichomes, and pollens contain several secondary metabolites such as alkaloids, flavenoids, oils and phenolics (A. Javid and S. Shafique 2010).

The chemical analysis of *Parthenium* reveals that its leaves and flowers contain:

(i) Parthenin

(ii) Chloronolipin

These allergy-causing micromolecules are known as allergens. The allergens are water soluble so they enter into the cells through small pores of the skin and in the cell they form bonds with protein and vitamin molecules. Generally, allergens are electrophilic in nature and therefore they react with nucleophilic amino or thiol groups of the protein. This reaction sensitizes the skin cells and causes itching and burning sensations.

Health Hazards in Humans & Animals:-

Parthenium hysterophorus L. is extremely prolific and causes severe economic loss, health problems and habitat destruction. This weed is considered to be a cause of allergic respiratory problems, contact dermatitis and mutagen city in humans and livestock (S. Petal, 2011, Lata and Ashok Kumar, 2018).

Parthenium weed has many ill effects, on human beings and other plant parts, in all stages of its life cycle, causing dermatitis in man. Pollens cause airborne contact dermatitis and when inhaled cause allergic rhinitis (Sriramaro *et al.*,1991). The harmful effects are induced by secondary metabolites, particularly parthenin toxin, present in different parts of the plant (G.H.N.Towers 1981).

The plant causes acute allergic eczematous dermatitis in humans, which under continued exposure becomes chronic. Highly sensitized individuals are forced to avoid contact with the plant entirely. Up to 10% of people living in *Parthenium* weed areas in India suffer from allergic rhinitis and sinusitis (hay fever).

The skin of the neck, face and arms become hard like the skin of a crocodile from dermatitis passing over the populations of this herb. Some people are allergic to its pollens resulting in fever and asthma.

Effect on the Growth of Plants:-

In agriculture ecosystems:- *Parthenium hysterophorus* L. weed competes directly with crop plants for space, nutrients, water and sunlight. One of its prominent indirect effects is exhibited through

allelochemicals, phenolics and sesquiterpene, and lactones (mainly parthenin.These chemicals are present in the roots, stems, leaves, fruits, and pollens of *Parthenium* weeds (Roy and Shaik 2013).

Ground studded with fruits, receptacle and leaves of *Parthenium hysterophorus* L. supports no undergrowth. Aqueous leachate of the cypsela inhibits the growth of wheat seedlings. All parts of *Parthenium hysterophorus* L. weed including the trachomas and pollen contain growth inhibitors. These are released to the substratum via root exudation, volatilization or rain wash from serial parts and via leaching or decomposition of dry parts in soil. These toxins inhibit growth in an indigo era, bean cowpea, tomato, ragi and wheat.

Parthenium hysterophorus L. Pollen inhibits pollen germination and fruit-set in *Crotalaris perllida*, *Desmodium heterocorpon*. Brinjal, chillies and tomato reduce leaf chlorophyll content in beans. Mixing *Parthenium* leaf material into soil reduce emergence and plant dry weight in bean and cowpea, tillering in ragi, branching in tomato and yield in all these test species.

Parthenium hysterophorus L. a sesquiterpene lactone and several phenolicscaffeic acids, vanillic acid, ferulic acid, chlorogenic acid, phydroxybenzoic acid, ferulic acid, anisic acid are among the inhibitors identified. The inhibitors also cause a reduction in nucleic acids, proteins, reducing sugars, total and nitrate nitrogen and phosphates.

The inhibitors also affect adversely the activity of free-living and symbiotic nitrogen fixes and nitrify in the soil as borne out by culture studies and soil analyses.

Impact Of *Parthenium hysterophorus* L.:-

(1) Impact on Biodiversity:- This weed has the potential to disturb the natural ecosystem, as it can grow throughout the year in almost all drastic conditions suppressing native vegetation. Owing to the absence of effective natural enemies, its allelopathic effect as well as photo insensitivity and thermo insensitivity, it is a threat to natural diversity. The rapid spread of *Parthenium* can disturb the natural ecosystem because it has a very fast infestation capacity and allelopathic potential which can disrupt any type of natural ecosystem. Species richness, evenness and local biodiversity gradually decrease where this plant is present, this situation indicates the native biodiversity loss of weeds and other crop plants due to *Parthenium* infestation.

(2) Impact on Crop production:- *Parthenium hysterophorus* weed has been invested in a large area of India (Kumar, S 2009). This plant contains parthenin, hysterin, hymenin, and ambrosin. Due to the presence of these allelochemicals, this weed has strong allelopathic impacts on different crops and human beings also (Gunaseelan, V N.1987). This weed has adverse impacts on legumes by

disturbing their symbiosis with Nitrogen fixing bacteria such as Rhizobium, Azotobacter, Azospirillum and Actinomycetes.

Control of the Weed:

The control of *Parthenium hysterophorus* L.weed is a serious challenge due to its vigorously spreading nature. Immediate actions are quite necessary to eradicate the plant since it has a more hazardous impact on the environment as well as on public health. India has a great risk of rapid invasion of the weed in agricultural lands, for which it might give proper attention towards the remedy to control *Parthenium hysterophorus* L. Many types of research are going on for finding the cheap and best way for its control. Some of the control measures that can be undertaken in India are as follow:-

(A) Grassland Management:- Grazing management is the most useful method for the control and managing the *Parthenium hysterophorus* L. spread on a large scale. However, this practice has not been implemented effectively in India. Meadowlands can be sustained by growing grasses and herbs in them. This may, however requires rehabilitation of poor meadow followed by sound grazing maintenance programs. Such a practice, however, has a lot of challenges in our country due to socioeconomic and cultural factors.

(B) Burning:- Another commonly practised way of controlling *Parthenium hysterophorus* L.weed is burning. Mass vegetation of the weed can be destroyed by this practice. But it cannot be considered a safe control strategy for the weed since there is a great risk to soil, air and existing plant and animal diversity. *Parthenium hysterophorus* L. ash also has an allelopathic effect on crop yield but yield loss is low in comparison to the leachate and dry mass of this weed (Kumar, S. 2014).

(C) Herbicide Control/Chemical Management:- Chemical management or herbicidal control is the most widely used to control the growth of *Parthenium hysterophorus* L. However, now we focus on bioherbicides but it is not effective as chemical herbicides till now. Chemical herbicides which are commonly used are glyphosate @ 2.5 kg / ha-1, atrazine @ 2.6 kg/ ha-1, bromoxynil @ 0.56 kg/ ha-1, common salt @ 20%, 2,4-D amine @ 3 l/ ha-1, 2,4-D ester @ 4 l/ ha-1, Floumeturon @ 2.24 kg/ ha-1, Hexazinone @ 3.5 kg/ ha-1, Metribuzin @ 0.7 kg/ha-1, Norflurazon @ 2.24 kg /ha-1 and Paraquat 0.5 l/ ha-1. These herbicides are well known for their ability to control this weed. (Khaket et .al., 2015, Reddy, K. N and Bryson, C.T., 2005, Mishra, J.S. and Bhan, V.M., 1994. Mishra, J.S and Bhan, V.M., 1994,Bajwa Ali Ahsan *et al.*,2019, Pazhanisamy,S.2021). The stage and time of the rosette stage is the right time to apply post-emergent herbicides in the wasteland, non-cropped areas, along railway tracks, water canals and roadsides (Khan *et al.*, 2012). Very effective treatments for P.

hysterophorus L control were noticed glyphosate and metribuzin, having a higher effect (Mukherjee, B and Chatterjee, M., 19932, Belgeri. Amalia *et al.*, 20220) after the herbicide application.

(D) Biological Control:- Biological control might be one of the best methods for controlling the Parthenium hysterophorus L. weed dispersal. It can be done by the use of insects that can feed on Parthenium hysterophorusL. and we can also use fungi, bacteria and plants which have adverse effects on Parthenium. The moth Epiblema strenuana (introduced from Mexico) has been established in all Parthenium hysterophorus L. dominated areas. The moth's larvae feed on the stem of the weed and forms ball which inhibit plant growth. Some other released insects which are found to be beneficial.

Utilization of *Parthenium hysterophorus* L.:

(1) Use as a Traditional Medicinal plant:- *Parthenium hysterophorus* L. accidentally entered India in 1910 with the germplasm of cereal grains and is now considered an obnoxious weed in our country (Rai et al.,2003). The noxious impacts of *Parthenium hysterophorus* L. have been well documented not for human health but also for livestock and native plant species. It causes serious effects like asthma, bronchitis, dermatitis (allergic reaction), and hay fever in human beings. Despite this problem, it has also been used in industry for its noxious, insecticidal, nematicidal and herbicidal properties as well as for composting. The bisque root is used as a remedy for amoebic dysentery. The sub-lethal doses of parthenin extract help in reducing cancerous activity in the cells of mice. Investigations also revealed that *Parthenium* can be used to cure hepatic amoebiasis, neuralgia and certain types of rheumatism (Sharma, G.L. and Bhutani, K.K., 1988.). In America, it is applied externally on the skin as a remedy for a wide variety of diseases. In Jamaica, the elixation is used to kill the flea in animals (Dominguez, X.A. and Sierra, A., 1970).

(2) Antifungal:- As mentioned earlier *Parthenium hysterophorus* L. have antifungal effects on different fungal species. This quality of *Parthenium* can be used to cure human and animal fungal diseases. The antifungal potential of different extracts of *Parthenium hysterophorus* L. against human pathogenic fungi was investigated by (Rai MK and Upadhyay SK., 1990) and (Rai MK., 1995.). Fungi related to dermatitis were found sensitive to sequestoterpene lactone found in *Parthenium hysterophorus* L. and it can be used for the remedy of skin diseases (Rai et al., 2003).

(3) Antioxidant:- *Parthenium hysterophorus* L. methanolic extracts showed a high antioxidant effect. Therefore, it can be utilized as a natural antioxidant. It is a naturally available antioxidant; if it will be commercially available it can replace synthetic antioxidants which have harmful impacts on human health. It is more valuable to produce antioxidants naturally after the research that synthetic antioxidants have high carcinogenicity in comparison to naturally produced antioxidants.

(4) Antitumor:- *Parthenium hysterophorus* L. methanolic extract obtained from flowers revealed antitumor activity in mice having transplantable lymphocytic leukaemia. Level of neoplastic markers like glutathione, cytochrome P-450, glutathione transferase and UDP-glucuronyl transferase adjusted significantly consequently backing off the advancement of tumours and expanded survival of animals (Mukherjee, B and Chatterjee, M., 1993).

(5) Antimicrobial: *Parthenium hysterophorus* L. exhibits strong antimicrobial and antifungal activity. It inhibits the growth of rhizosphere flora such as Rhizobium, acetobacter and Rhizospirrilum as well as can inhibit bacterial and fungal growth such as those of A. niger, F. oxysporum, C. albicans S. aureus, and E. coli etc.

CONCLUSION:

This Parthenium *hysterophorus* L.weed spread more rapidly in comparison to other weeds. It covers many areas of agricultural land as well as bare lands. With the present population explosion in India, it is necessary to use lands properly for agriculture as well as forestry. It is necessary that we can use every resource of nature for improvement. We can control this weed through its management and it would happen when we have the proper knowledge about the beneficial and harmful effects of *Parthenium*. When we have proper knowledge we can use it from a different perspective which we have discussed above. This is not about the *Parthenium hysterophorus* L. although it should be applied for other weeds also

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A. Mature plant with Flowering stage.

B. Adult Plant under growing stage.

C. 3 Week Plant Growing Stage.