



Dominant Status of Invasive-Alien Weed Species (*Parthenium hysterophorus L.*) on Earth

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Abstract:

The goal of the study was to find the important review on *Parthenium hysterophorus* with special reference on dominant status, invasiveness, harmful & beneficial aspects. *Parthenium hysterophorus* considered as a weed globally that grow out of their place, obstruct the use of natural resources, are abundant, persistent, resistant, competitive, toxic, and even poisonous in nature, and can grow in a variety of climatic conditions. An invasive- alien plant species is one that has been introduced into a new area (introduction and spread outside their natural distribution) and has a detrimental effect on the environment and diversity of the plants.

Key words: *Parthenium hysterophorus*, Alien weed species, Harmful aspects, Beneficial aspects.

Introduction:

Parthenium is considered as restricted invasive plant and recognised globally as a weed of National Significance. The Biosecurity Act of 2014 classifies that *Parthenium* as a restricted invasive plant in category 3. It can't be given away, sold, or thrown away into the world. The Act mandates that everybody take all fair and practical measures to protect the environment and biodiversity. Under their management, they can reduce the risks associated with invasive plants. This process is called General Biosecurity Obligation (The State of Queensland, Department of Agriculture and Fisheries, 2020) [81]. It is believed to have arrived in India in 1956, along with wheat sent by the US under the PL-480 scheme (public law 480 passed in 1954 to give food grain to developing countries. In India, *Parthenium* was likely introduced before 1910 via contaminated cereal grains but was not recorded until 1956 (Sohal, S.K., et.al. 2002) [32]. During its life cycle, a large single plant can produce up to 100,000 seeds. Seeds have no dormancy period and can germinate at any time if moisture is sufficient. This seed has the potential to spread and germinate over a wide area (Dutta, S., 2015). During the 1950s, it was introduced to Asia, Africa, and Oceania through cereal and grass seed shipments from the United States (Bhowmik, P.C. and Sarkar, D., 2005) [3]. The term *parthenium* comes from the Latin word *parthenice*, which means "to use medicinally" (Bailey LH.,1960) [1]. *Parthenium hysterophorus* is a flowering plant belonging to the Asteraceae family. It is native to the tropics of South America (GRIN; ARS; USDA,2010) [27]. Santa-Maria (BSBI List, 2007) [4], Santa Maria feverfew (USDA, 2016) [29], whitetop weed

(Retrieved 2010) [28] and famine weed (McConnachie AJ, Strathie LW, et al. 2011) [19] are some of the common names for this herb. It's also known as carrot grass, congress grass, or Gajar Ghas in India. In India, Australia, and parts of Africa, it is a common invasive species (Retrieved 2010; Oudhia, P. 2000) [26]. *Parthenium hysterophorus* pollen grains infest disturbed grounds, including roadsides. It infests pastures and farmland, resulting in sometimes devastating yield losses, as demonstrated by common names including famine weed. *Parthenium hysterophorus* pollen grains infest disturbed grounds, including roadsides. It infests pastures and farmland, resulting in sometimes devastating yield losses, as demonstrated by common names including famine weed (Oudhia, P. et al., 1997;1998;2000;2001) [20],[21],[22],[23],[24],[25]. It is also a common cause of pollen allergies (Kher, Prateek,2008) [14]. It's being studied for its potential to remove heavy metals and dyes from the atmosphere, regulate aquatic weeds, commercial enzyme production, as a manure additive for biogas production, as a biopesticide, and as green manure and compost (Patel, S. 2011) [30].

Habitat and Distribution of *Parthenium hysterophorus*:

Wastelands, public lawns, orchards, forestlands, flood plains, rural areas, urban areas, overgrazed pastures, industrial areas, playgrounds, roadsides, railway lines, and residential plots are all richly endowed with *Parthenium*. Drought and reduced pasture cover provide the perfect environment for the parthenium weed to thrive. While parthenium weed can grow in a variety of soil types, it thrives in alkaline clay loam soils (Berry, MI.1984) [2]. *Parthenium* can grow in a variety of soil types, but it thrives in alkaline clay loam soils. The plant is well-established in Central Queensland, with isolated infestations found west of Longreach, as well as in northern and southern Queensland. Infestations have also been discovered in northern and central New South Wales, and it can spread in most Australian states. Central America, Southern North America, the Gulf of Mexico, the West Indies, and Central South America are home to *Parthenium hysterophorus*. The weed has now spread to every continent, including the islands. It has spread at an unprecedented pace across India and other Asian countries such as China, Bangladesh, Nepal, Pakistan, and others. In some countries, such as Australia, South Africa, Ethiopia, India, and Pakistan, its spread and infestation are significant. This invasive weed is currently widespread in India (Singh et al. 2008) [31].



Figure 1: Distribution of *Parthenium hysterophorus* all over the world

Morphology of *Parthenium hysterophorus*:

Parthenium hysterophorus is a perennial herb with a deep tap root and an erect stem that becomes woody as it grows older. The plant grows several branches in its top half as it matures, and it will eventually reach a height of 2.5 metres. It has pale green leaves that are deeply lobed and coated in small soft hairs. On the tips of the various stems, small creamy white flowers appear. Every flower has four to five wedge-shaped black seeds with two thin white scales that are two millimetres long.



Figure 2: Star Shaped Flowers, Young plant & Pale green leaves, Stem, Roots

Photo: Morphology of *Parthenium hysterophorus*

Photo: Credit to Joydeep Das

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Coordinate: 22° 10' 23" N, 87° 22' 51" E

Location: Narayangarh Railway Station Area

Life Cycle of *Parthenium hysterophorus*:

Usually *Parthenium hysterophorus* germinate in the spring and early summer, grow flowers and seeds during their lives, and die in the late autumn. Parthenium species, on the other hand, can grow and produce flowers at any time of year under the right conditions (rain, available moisture, mild temperatures). Plants will flower and set seed within four weeks of germination in the summer, particularly if stressed. During its life cycle, a large single plant can produce up to 100,000 seeds. Seeds have no dormancy period and can germinate at any time if moisture is sufficient. This seed has the potential to spread and germinate over a wide area (Dutta, S., 2015) [6].

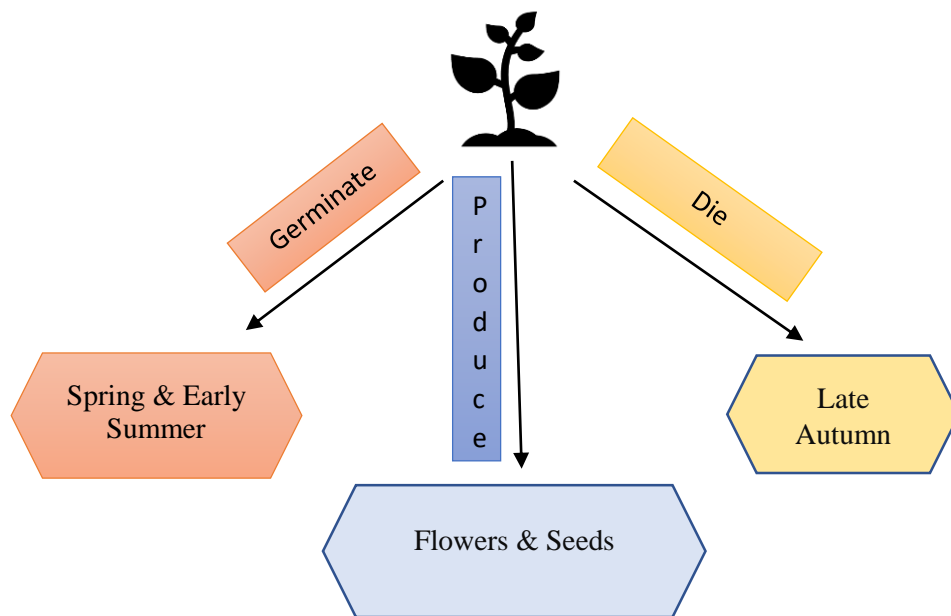


Figure 3. Life history of *Parthenium hysterophorus*

Spreading Methods of *Parthenium hysterophorus*:

Water, automobiles, equipment, stock, feral and native animals, and feed and seed can all spread parthenium seeds. Drought conditions help seed spread by increasing stock fodder and transport movements.

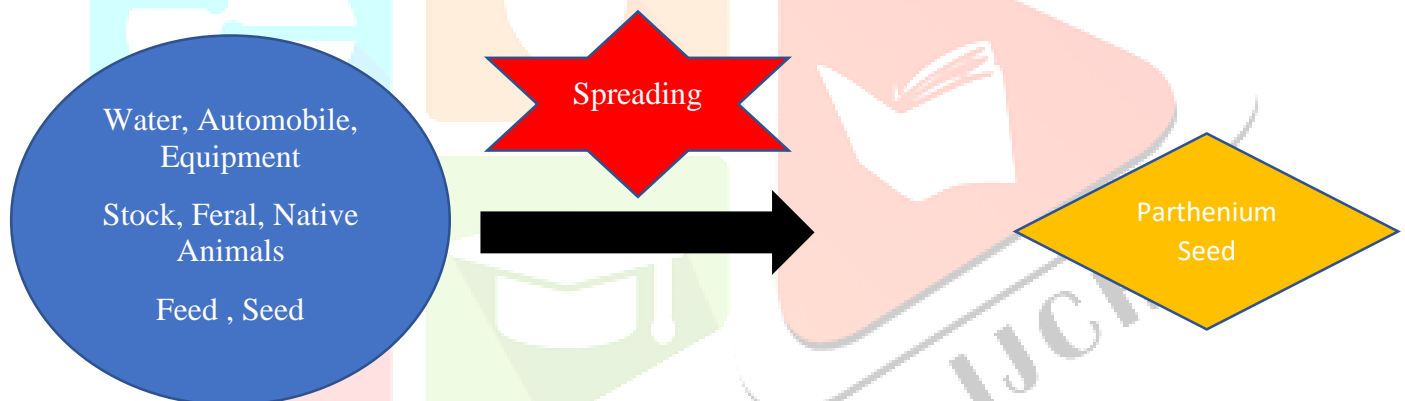


Figure 4: Diagrammatic representation of Spreading method of *Parthenium hysterophorus*

It spreads primarily by seeds. The weed can produce up to 154,000 seeds per square metre, and a single plant can produce between 15,000 and 25,000 seeds. The seeds are small and light, making them easily carried or transported by wind, water, or various human activities. *Parthenium* can regrow from broken or cut pieces. Its allelopathic effects, combined with the lack of natural enemies such as insects and diseases, have contributed to its rapid spread in India.

Harmful aspects of *Parthenium hysterophorus*:

Parthenium species is a toxic, pernicious, troublesome, allergic, and aggressive plant that poses a significant threat to humans and livestock in general. This weed is thought to be one of the most common causes of dermatitis, asthma, nasal-dermal, and naso-bronchial diseases in India and Australia. Aside from the negative consequences, it also triggers a slew of other issues, such as blocking common pathways and lowering the aesthetic value of parks, gardens, and residential communities. *Parthenium hysterophorus* pollen and dust cause allergic contact dermatitis in humans, so agriculturists are concerned about it affecting food and fodder crops (Gunaseelan 1987; Morin et al. 2009) [9],[19].

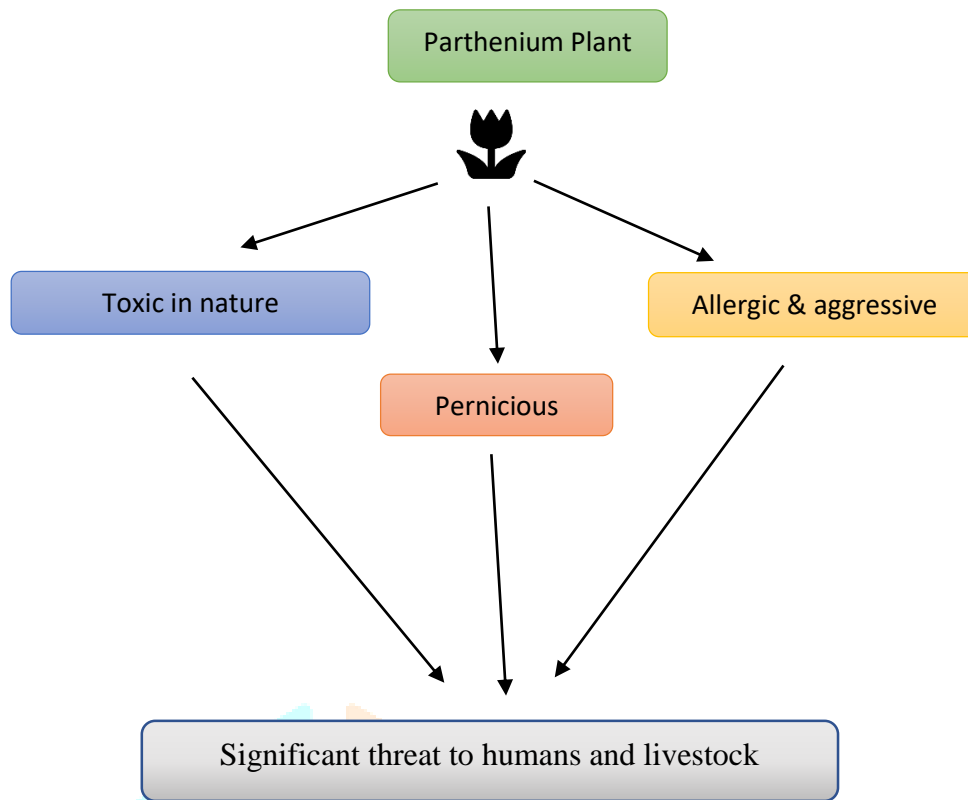


Figure 5: Diagrammatic representation of Harmful aspects of *Parthenium hysterophorus*

When cattle, buffalo, and sheep feed this weed, their milk and meat quality lose. Due to its irritating properties, parthenium can taint sheep meat and make dairy milk unpalatable (Lakshmi and Srinivas 2007) ^[15].

Beneficial aspects of *Parthenium hysterophorus*

The odour of parthenium is said to repel bees, and insects can be easily held at bay by holding a handful of the flower heads (Lindley, John. 1838) ^[17]. Parthenin, the plant's main component, has many medicinal properties, including anticancer properties (Venkataiah et al. 2003) ^[33]. Given the abundance of this weed and the large number of livestock in India, *Parthenium hysterophorus* should be seriously considered as a substrate to produce biogas through anaerobic digestion (Gunaseelan 1987). **Parthenin** has strong anticancer properties (Das et al. 2007) ^[5]. *Parthenium hysterophorus* helps to Ni (II) sequestration on activated carbon from aqueous solution (Lata et al. 2008) ^[16] This weed can be used as a low-cost xylanase processing substrate (Dwivedi et al. 2009) ^[7].

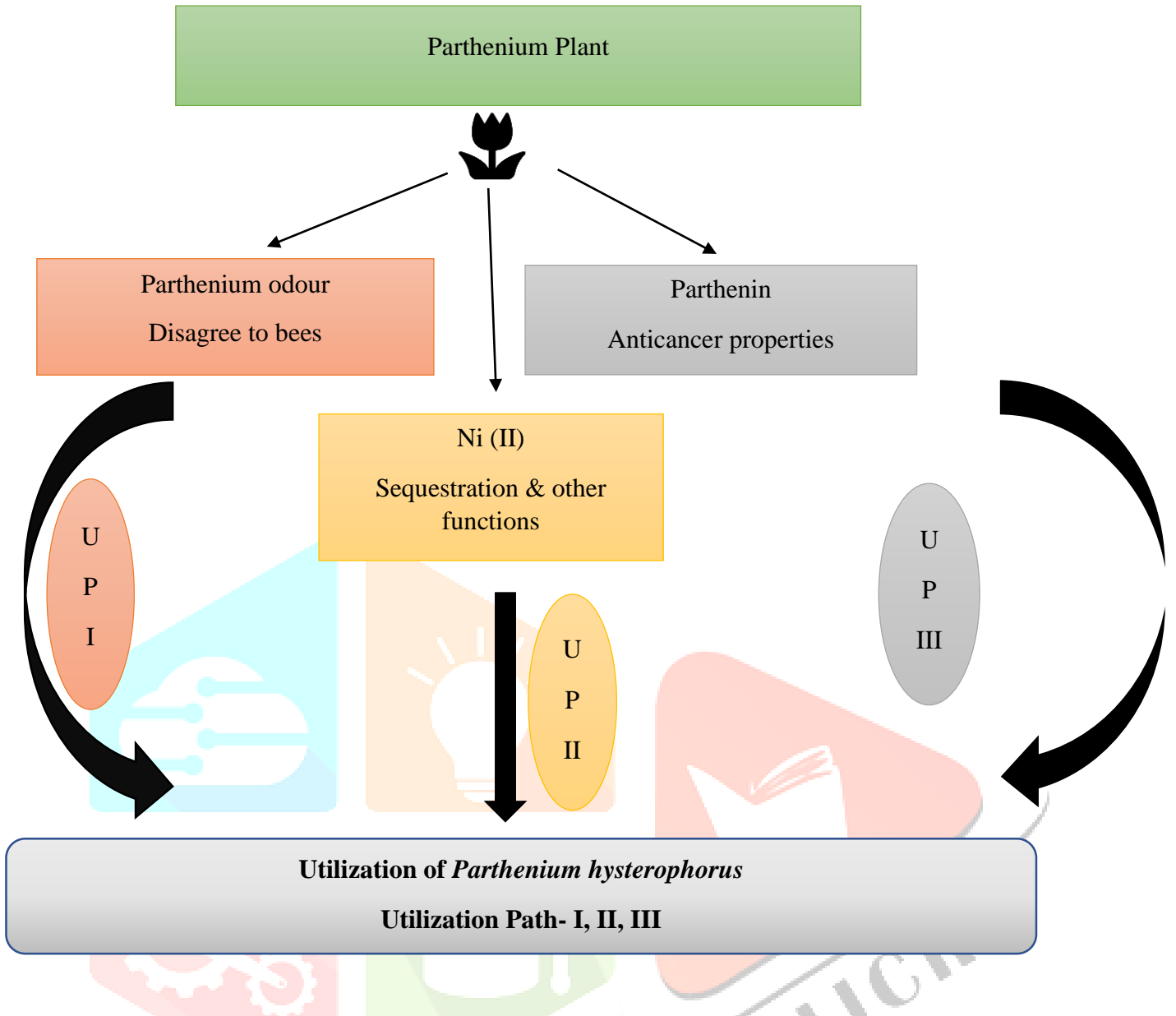
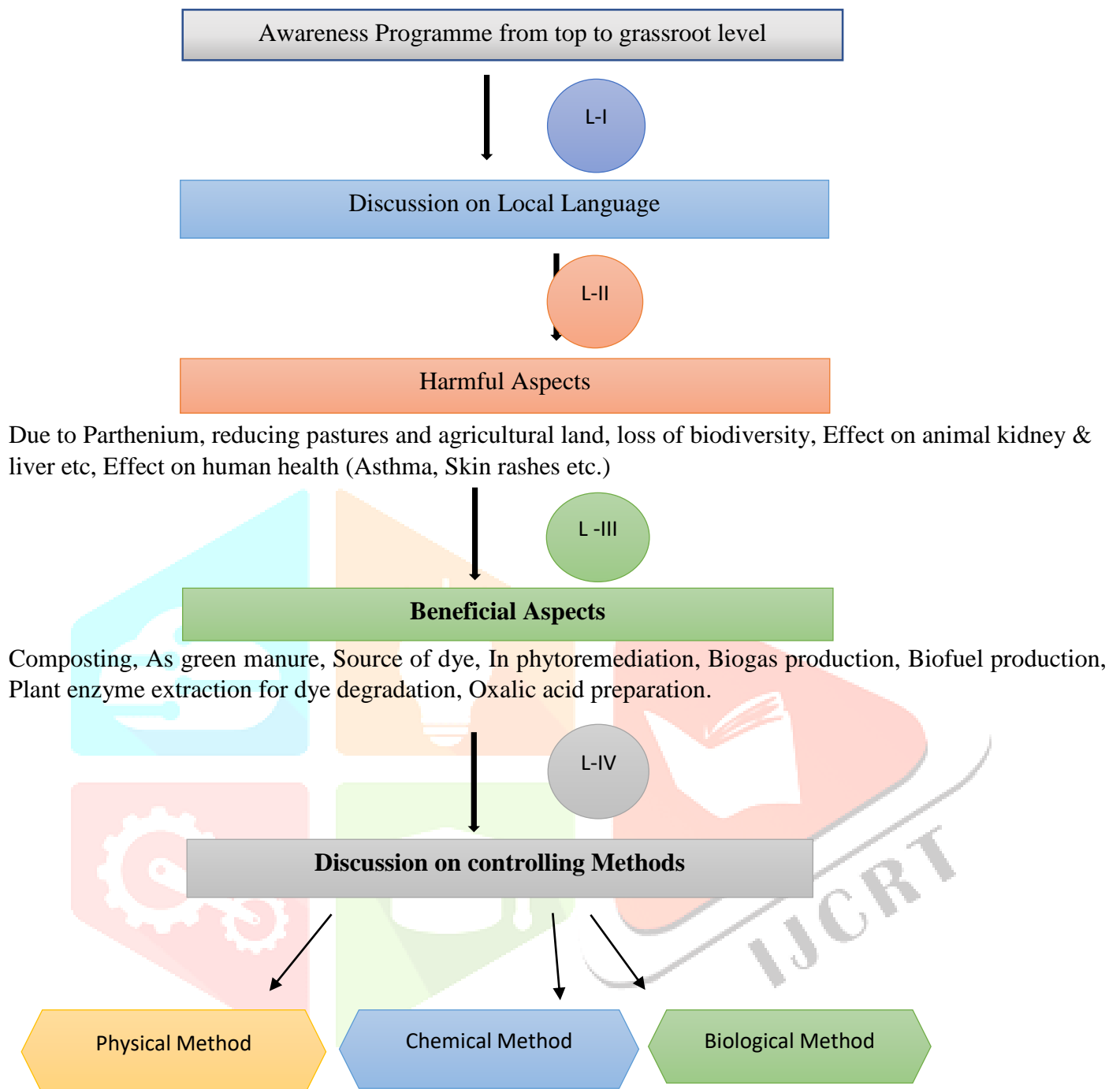


Figure 6: Diagrammatic representation of beneficial aspects of *Parthenium hysterophorus*

Model for Management of *Parthenium hysterophorus*: (Level- I, II, III, IV)**Control Methods:**

There are so many control methods like uprooting, mechanical, legal, chemical, and biological control. Here, we discussed about biological control. The deliberate exploitation of natural enemies by humans for the purpose of controlling harmful weeds is known as biological control. Biological control is low-cost and has no harmful effects for non-target species, the environment, or biodiversity. Insects, fungi, nematodes, snails, slugs, and competitive plants are all examples of biocontrol agents. Insects have gotten the most interest in *Parthenium* biological control, followed by competitive plants and pathogens. It is self-sustaining and spreads on its own, while other control measures involve inputs on a regular basis. It's easy to combine with other safety steps. Biological control with *Zygomma bicolorata* has proved to be one of the most promising

approaches so far. Host-specific bioagents from the weed's native home are introduced into other countries where the weed has spread and become invasive as part of the biological control programme.

Zygonema bicolorata is a Mexican defoliating beetle that is very successful where it is found. It appears in late spring and remains active until the fall.

Smicronyx lutulentus (Mexico) lays its eggs in flower buds, and the larvae eat the seed heads.

Epiblema strenuana is a moth that has colonised all parthenium areas since being introduced from Mexico. The larvae of the moth feed inside the stem, forming galls that stunt growth, reduce competitiveness, and reduce seed development.

Listronotus setosipennis is an Argentine stem-boring weevil that has had limited success in controlling parthenium infestations.

Conotrachelus albocinereus (Argentine stem-galling weevil) produces small galls and is still establishing itself in Queensland.

The larvae of *Bucculatrix parthenica* (a Mexican leaf mining moth) feed on plants, leaving clear windows in the leaf.

Puccinia abrupta is a Mexican winter rust that attacks and kills leaves and stems. It has spread over a large region from Clermont to the south.

Carmestia ithacae is a stem boring moth native to Mexico that is establishing itself in the northern Central Highlands.

Awareness Programme:

In recognition of the severity and nature of the threat posed by this weed, ICAR-NIBSM, Raipur is hosting a 'Parthenium Awareness Week' from August 16 to 22, 2019 to educate farmers and the general public about the dangers of Parthenium, which is responsible for causing health problems in humans and animals, as well as destroying the environment, loss of productivity, and biodiversity. Parthenium uprooting, herbicide spraying, student marches, protests, and other events were organised by ICAR-NIBSM to educate farmers and the public about the adverse effects of Parthenium and how to handle it (ICAR-NIBSM, Raipur, 2019) [13]. On this occasion, a Parthenium management programme was held for the entire week, with Parthenium uprooting and the application of the non-selective herbicide glyphosate taking place on both campuses. Throughout the year, operations related to the removal of parthenium from farms and construction sites are carried out. As a result, both farms are almost clear of Parthenium, except for a few pockets near the distant boundary sides (ICAR-IIPR, Kanpur, 2018) [11]. In May 2017 [12], CABI hosted a knowledge-sharing workshop on parthenium weed in Pakistan, which was funded by the UK Department for International Development (DFID). Various context materials were delivered by CABI's new invasive species initiative, Action on Invasive, which is committed to improving regional, national, and local integrated approaches to invasive species (CABI-UK,2017). Many African nations, from the south to the north, are infested with parthenium weed (*Parthenium hysterophorus* L.), which has serious consequences for agricultural development, biodiversity conservation, and human and animal health. As the scale and density of parthenium weed spread across the continent, there is growing concern about potential invasion risks (International collaborators meet in Ethiopia for the biological control of *Parthenium hysterophorus* in East Africa, 2016) [10].

Conclusions:

Parthenium infestation degrades the natural environment. *Parthenium hysterophorus* aggressively colonises scattered sites and engulfs the entire region, resulting in sparse to no other vegetation in the Parthenium

hysterophorus-dominated field. These weeds' rapid invasion of new environments also obliterates indigenous species, posing a significant threat to India's biodiversity.

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