
WELCOME

COURSE SEMINAR (ENT – 699)

ON

"Integrated Management of *Parthenium hysterophorus*"

Submitted By

Ankit Upadhyay

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Submitted To

Dr. D.R. Singh

Professor & Head

Department of Entomology

Chandra Shekhar Azad University of Agriculture & Technology, Kanpur-208002(U.P.)

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INTRODUCTION

- *Parthenium hysterophorus* L., commonly known as carrot weed, white top or congress grass in India, is a herbaceous erect and annual plant belonging to the family "Asteracae" (compositae).
- This spread in geometric proportion was within a period of 20 years.
- The origin of *Parthenium* is considered to be from Mexico, America, Trinidad and Argentina.
- In the old world, the weed has been reported to occur in India, Nepal, Bangaldesh, Pakistan, Africa, China, Vietnam and Australia.
- **Evans (1987)** reported it to be an extremely important weed of South India only but it was also reported during the same time from kolkata, West Bengal (**Dhanraj and Mitra, 1976**), Aajamgarh in eastern Uttar Pradesh, Madhya Pradesh and Bihar **(Singh and Chandra, 1982).**
- **Aneja *et al*. (1991)** during extensive survey in north India recorded heavy occurrence of this weed in Jammu (J&K), Punjab, Haryana, Himachal Pradesh, Uttar Pradesh except the arid Zone of Rajasthan and Haryana

Invasion/occurrence of *Parthenium* in India

❖At present *Parthenium* has established on most of the roads and railway tracks side, vacant lands and wastelands besides invading crop, orchards and forest lands throughout India except very high elevation and coastal area

❖This is high seed production capacity, ability to germinate in varied climate, non-occurrence of seed dormancy, very tiny and light weight of seeds.

How *parthenium* spreads

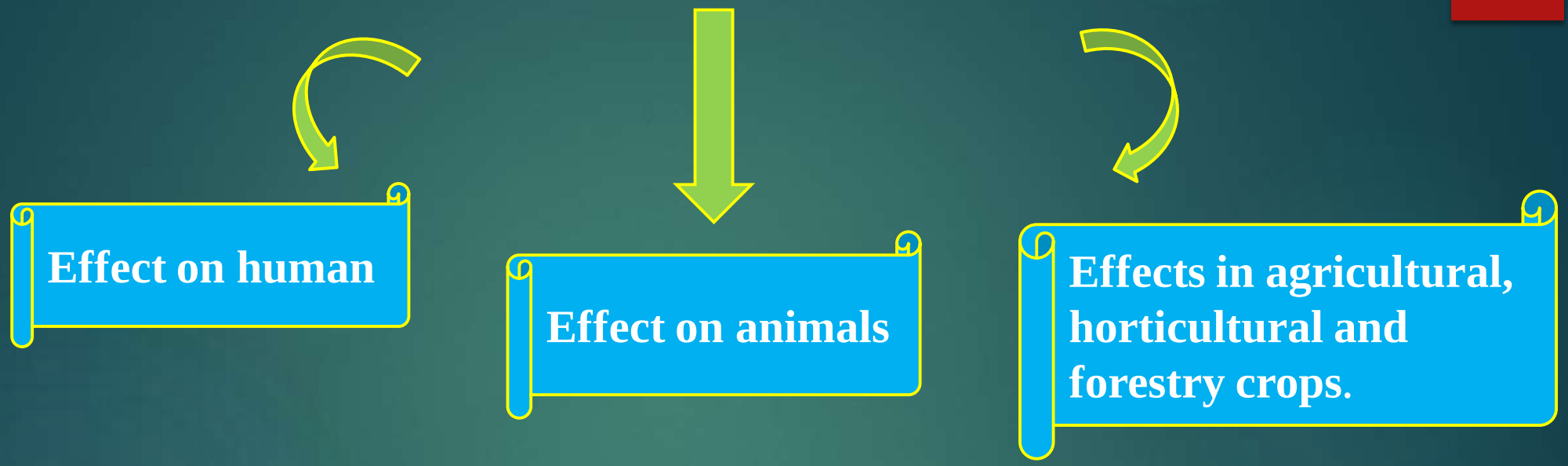
❖A single plant of *Parthenium* may produce about 300 million pollens per square meter.

❖The pollens are light in weight and are easily carried away by wind and water to a long distance.

❖ The weed has the potential of producing as high as 154,000 seeds/m2 and a single plant can produce about 15 -25,000 seeds.

❖The seeds are very light in weight and easily carried or transported by wind, water or through various human activities. A single plant of *Parthenium* may produce about 300 million pollens per square meter.

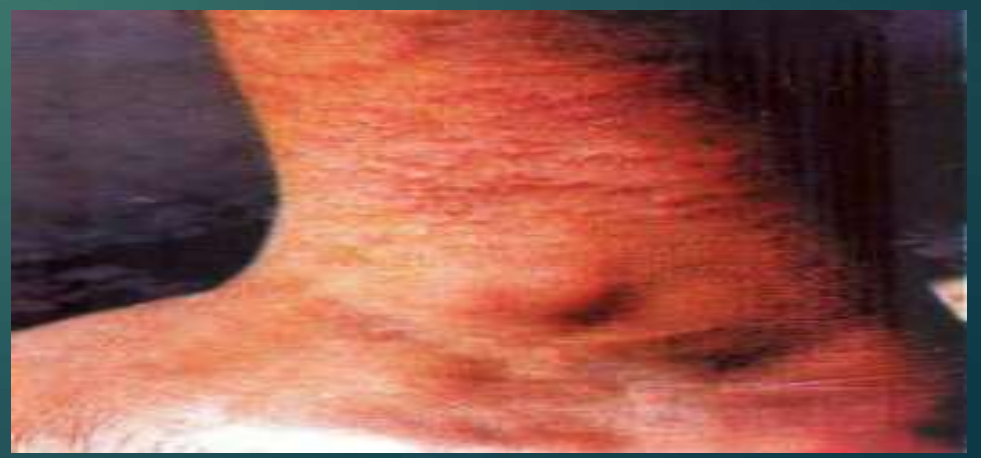
Harmful effects of *Parthenium*



❖When human beings frequently come in contact of this weed, it may cause allergy, dermatitis. eczema, black spots and blisters around eyes, burning, rings and blisters over skin, redness of skin and asthma etc.

❖ Carrot weed possesses a chemical sesquiterpene lactones (parthenin, hymenin and ambrosin) etc.

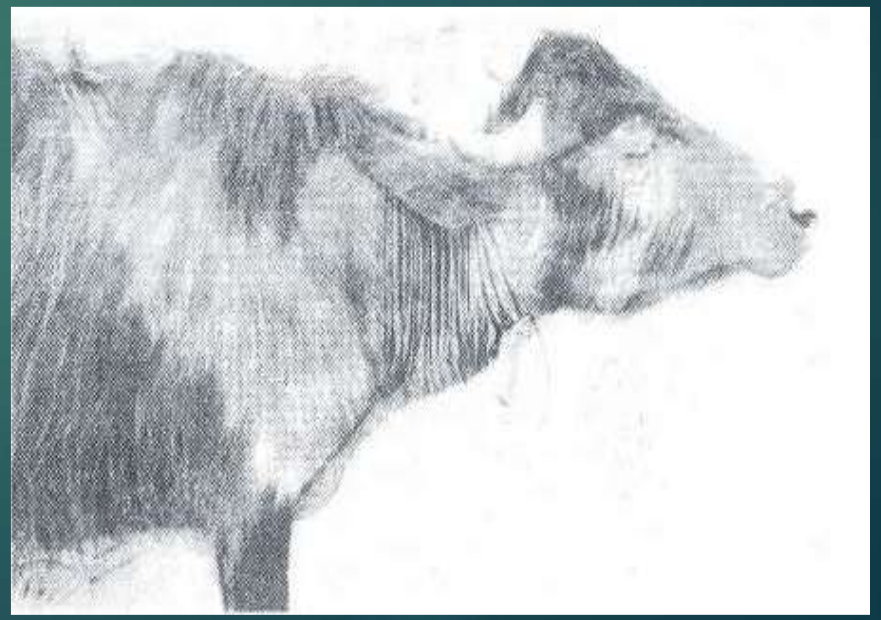
- The pollen and dust of this weed elicit allergic dermatitis in humans **(Gunaseelan, 1987; Morin *et al*., 2009).**
- **Maishi *et al*., (1998)** reported that *P. hysterophorus* contains a bitter glycoside parthenin, a major sesquiterpine lactone (SQL). Other phytotoxic compounds or allelochemicals are hysterin, ambrosin, flavonoids such as fumaric acid, p-hydroxy benzoin and vanillic acid, caffeic acid, p-courmaric acid, anisic acid, chlorogenic acid, ferulic acid, sitosterol and some unidentified alcohols



Effect on animals

❖*Parthenium* caused itching, alopecia, and dermatitis on the face, muzzle, neck, eyes, thorax, abdomen and brisket region in calves **(Fisher,1996).**

❖In cattle, due to *Parthenium* contact, there may be loss of hair. The bitter and reduced milk yields have been reported in buffaloes and goats, fed on grass mixed with *Parthenium* **(Krishnamurthy *et al*., 1977).**

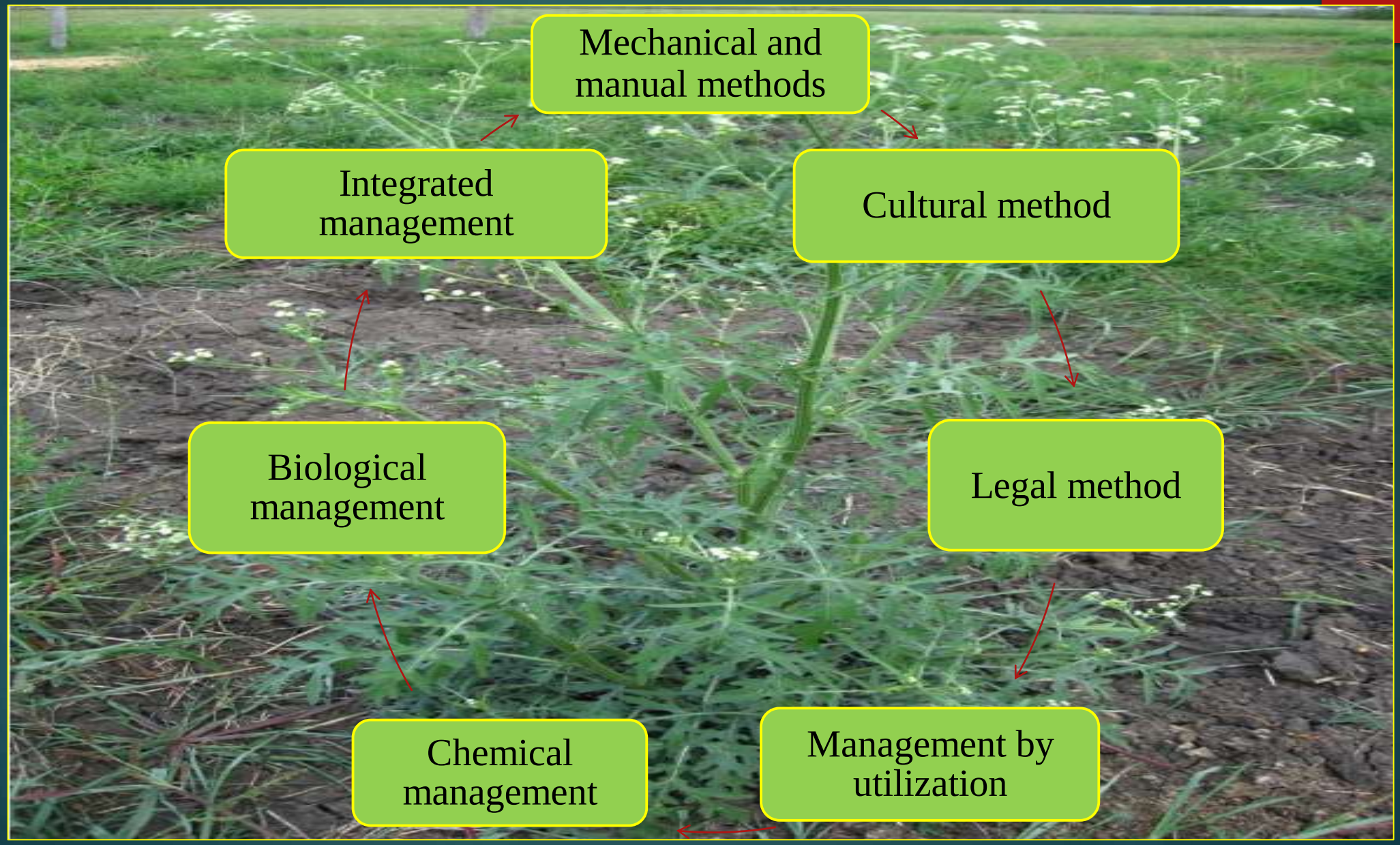


Effects in agricultural, horticultural and forestry crops.

❖It has also been reported to invade cultivated fields of most cereals, vegetables, oilseeds and plantation crops, posing a serious threat to agriculture and horticulture.

❖It is reported to cause loss to field crops like ladies finger, tomato, beans, capsicum, maize and brinjal etc.

Methods of *Parthenium* management



Manual method

- Manual uprooting of *Parthenium* before they flower is the most effective method.
- Manual uprooting of *Parthenium* is possible only in limited area such as residential colonies and agricultural fields

Cultural method

- Some researchers have advocated cultural methods by growing competitive crops to suppress *Parthenium* but as *Parthenium* is mainly a wasteland weed so the scope of this practice is limited only in specific situations such as in orchards, crop fields etc.

Legal method

- The management of *Parthenium* was also tried in India through the legal act, first in Karnataka State in 1975, declaring *parthenium* a noxious weed.

Utilization

- *Parthenium* has been well documented for its insecticidal, nematicidal and herbicidal properties, respectively **Ramaswamy, (1997**) besides oxalic acid **Mane *et al*., (1986)** and biogas production **Gunasheelan, (1987**).
- *Parthenium* can also be used to make compost and vermi-compost.
- It has been observed that if compost is prepared through NADEP method.
- The large-scale utilization of *Parthenium* may also be one of the effective

A

B

Chemical management

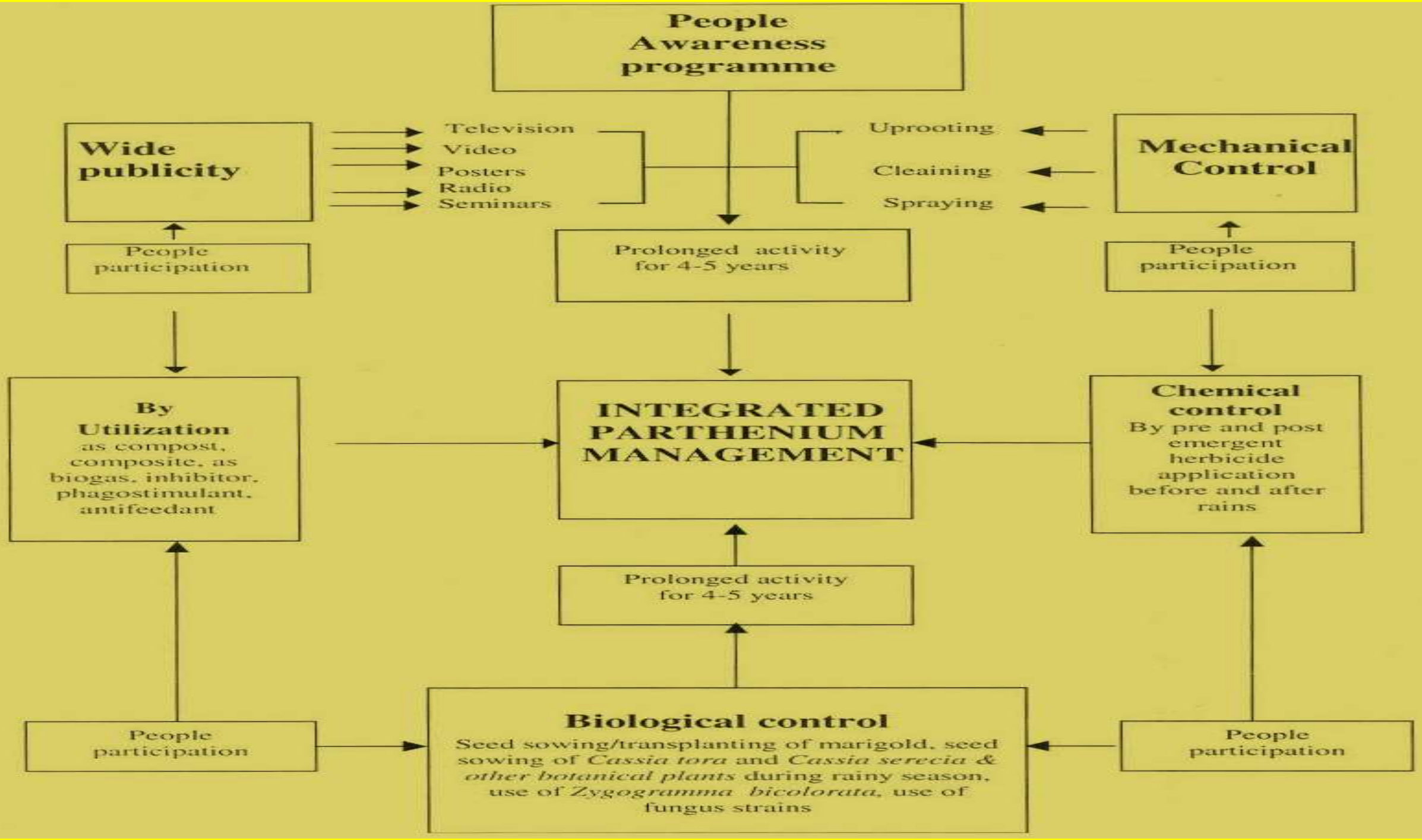
- A large number of chemicals have been recommended to control this weed **Krishnamurthy *et al*., (1977).** Herbicides such as 2,4-0, atrazine, glyphosate, metribuzin etc. have been found effective in controlling *Parthenium* **Brar and Walia, (1991)**.
- Chemical treatment can only kill existing population at the given site but can not prevent the entry of the seeds coming on the treated side from neighboring places.
- only in very limited situations, chemical use is justifiable for quick relief. Before

Integrated management

- Under this tactical umbrella all the available techniques have to be integrated as per the requirement and available resources.
- During summer and winter, it is hard to uproot the plants but *Parthenium* density remains low and in patches, therefore use of spraying of glyphosate or metribuzin will be of much use to reduce the intensity of *Parthenium* in forthcoming season.
- Before monsoon pre-emergent herbicide like atrazine, metribuzin or bromacil @ 2, 2-3 and 1.5 kg/ha can be applied on the sites already marked for dominant patches.

Conti…..

- On the onset of monsoon, spraying of glyphosate @ 1% solution or metribuzin @ 0.3% can control emerged seedlings of sufficient height, however, application should be made at any cost before flowering.
- With the onset of monsoon, marigold seeds can be sown in the vacant soils of residential colonies, farm houses, office premises and any other protected areas.
- For successful *Parthenium* management, people participation has to be invoked by the Government organizations and NGOs.


People Awareness programme
Wide publicity
Television
Video
Posters
Radio
Seminars
Uprooting
Cleaining
Spraying
Mechanical Control
People participation
Prolonged activity for 4-5 years
People participation
By Utilization as compost, composite, as biogas, inhibitor, phagostimulant, antifeedant
INTEGRATED PARTHENIUM MANAGEMENT
Chemical control By pre and post emergent herbicide application before and after rains
Prolonged activity for 4-5 years
People participation
Biological control Seed sowing/transplanting of marigold, seed sowing of Cassia tora and Cassia serecia & other botanical plants during rainy season, use of Zygogramma bicolorata, use of fungus strains
People participation

Biological control of *Parthenium* through insects

Introduction of *Zygogramma bicolorata* P. in India:

- It was first introduced to Australia from Mexico in 1980 **McFadyen and McClay, (1981**) and subsequently to India in 1983 **Jayanth, (1987**).
- Studies carried out by the Department of Land, Queensland, Australia in collaboration with the Commonwealth Institute of Biological Control (CIBC) in Mexico showed that a large number of insects feed on Parthenium **(Bennet, 1976).**
- Based on well documented success by insects from the native home of Parthenium and other countries where they were introduced, efforts were initiated in India in 1983 by Dr K.P. Jayanth at Indian Institute of Horticulutral Reseach (IIHR), Bangalore.

Conti…..

- The beetle, *Z. bicolorata*, is commonly known as the Mexican beetle, but also called as Parthenium beetle (CABI 2020b).
- Larval and adult feeding on Parthenium results inskeletonization, defoliation and reduction in flowers and seed production. Z *bicolorata* can cause 100% defoliation of Parthenium, resulting in reduced weed density, plant height, plant biomass, flower production and soil seed bank **(Dhileepan *et al*. 2000).**
- Successful mass rearing technology is needed for an effective augmentative release program of Z. *bicolorata* against Parthenium weed.

Systemic Position:

Domain: Eukaryota

Kingdom: Metazoa

Phylum: Arthropoda

Subphylum: Uniramia

Class: Insecta

Order: Coleoptera

Family: Chrysomelidae

Genus: *Zygogramma*

Species: Z. *bicolorata*

Biology of Mexican beetle, *Zygogramma bicolorata* P.

Egg:

- Eggs are generally laid on the ventral surface of both young and old leaves and generally yellowish & creamy white color egg.
- Oviposition is also observed on upper leaf surface, occasionally on the stems and even flowers under field conditions
- The eggs measured 1.21 mm long and 0.56 mm wide.
- The eggs hatched in 4-6 days.

Grub:

- The newly hatched grubs are yellowish, turning creamy white as they grow.
- The first and second instar grubs may have 1.5 and 3 mm in length.
- The third and fourth instar grubs may have body length of about 5.5 and 7 mm, respectively.
- Total larval life of 11-13 days.
- The different climatic conditions the total larval period may range from 11-20 days.

Pupa:

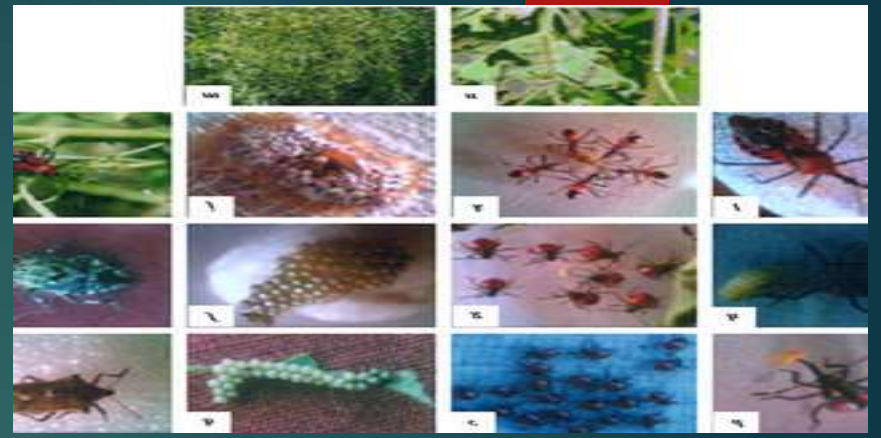
- Pupation takes place in a chamber formed by the grubs, 1-10 cm below the soil surface & creamy white as they grow Pupa and white color upper layer serfes.
- They remain as pre-pupae for about a day before entering the pupal stage.
- The insects remain within the soil for 6-12 days before emerging as fully formed adult.
- The pupa metamorphosed into adult and come out from the soil by making circular hole

Adult:

- The adults of Z. *bicolorata* P. have the brownish appearance.
- The male and female may have a mean body length and weight of 5.6 and 6.6 mm and 30 and 40 mg, respectively.
- The males of Z. *bicolorata* P. may remain alive for longer period (122-271 days) while the females up to 109-198 (mean 129-130) days.
- The females are capable to lay up to 45 eggs per day and 300 eggs per week.
- The maximum numbers of eggs are laid in 7^{th} to 15^{th} weeks, with a peak during the 9^{th} week.
- It was reported earlier that Z. *bicolorata* P. produced an average of 836 eggs per female, with a maximum of 1788 **McFadyen and McClay, (1981**).

Natural enemies of Z. *bicolorata* P.

- Some predators and parasites have been reported which may reduce the survival rate of the beetle.
- A predatory pentatomid bug identified as *Cantheoconidea furcellata* Wolf. was found to feed on grubs of the Z. *bicolorata* P. in Madhya Pradesh **Sushil kumar, (1998**).
- Both adults and grubs of *C. fercelleta* predate Z. *bicolorata* P. grubs in the field during July to October but in abundance during September.
- A single adult predator may devour 8-14 grubs in a day.
- A tachinid parasitoid *Palexorista sp*. was reported attacking 3rd- and 4th-instar grubs of *Z. bicolorata* P. from Karnataka in India **Jayanth *et al.*, (1996)**



Mass multiplication of the beetle

- Beetles are easy to multiply due to its high reproductive capacity. Z. *bicotorete* P. is capable of breeding in room temperature and relative humidity ranging from 20-30ºC and 50-70%, respectively.
- The best development of beetle was observed at 25-28°C and 70-80% relative humidity, **Patel *et al.*, (2018).**
- Beetles can be multiplied in different situations as per need.
- A single female is capable to lay 500 to 3300 eggs during its life time.
- From these eggs, 50-95% grubs hatch out of which more than 77% are capable to develop into adult. **Sushilkumar (2005).**

Multiplication in small plastic/glass containers in laboratory/house

- For rearing the beetle in laboratory or house, we can use plastic jars.
- At first, ovipositon cages has to be prepared.
- A bouquet of *Parthenium* leaves or twigs with their cut ends dipping in water collected inside a small plastic container, is placed inside each jar of about 20x16 cm.
- In such type of jars, 2-3 pairs of beetles can be released. From one such small plastic/jar, about 50-75 beetles can be obtained in a period of 30-40 days. After 6-10 days, adults will start to emerge which should be collected for field release.

Multiplication in plastic buckets and tubs out side laboratory/house:

- In this method, instead of small jars or containers, plastic buckets and tubs can be used.
- The mouth of bucket can be tied with the net cloth.
- This method requires less attention than the laboratory method except maintaining sufficient moisture.
- From each such containers 100-125 beetles can be obtained in a period of 30-40 days.

Multiplication in mosquito nets in open field:

- Good number of beetles can be reared in mosquito net method.
- In this method, standard or big size mosquito net can be used for rearing purpose.
- For outdoor multiplication, field cages can be erected over natural infestations of *Parthenium* or over areas where the weed is grown.
- Such cages are made of metal tube frames with about 2.5 m height and enclosing 8-10 sq m area.

Safe method of dispatch of Mexican beetle for sending to other places by postal/courier services:

- A great need was felt for safe packing for further distribution of Mexican beetle in different parts of the country.
- About 150 consignments of beetles were sent by NRCWS (National Research Centre for Weed Science) to various places by courier services during 2006-2008.

Conclusion:

Most of the effective agents introduced so far have established well in the field, but the impact of individual agents varies considerable. Overall, the biological control of *parthenium* in India. Appears to be partially successful, with Z. *bicolorata* P. depending on the rainfall. Our present study found that Z. *bicolorata* P. can completely defoliate the *P. hysterophorus* L. adversely affecting plant height, canopy, human health, animals health, agriculture production losses, and plant biomass. Thus, Z. *bicolorata* P. is an efficient bio-control agent of noxious weed P. *hysterophorus* L. having significant negative effect on vegetative and reproductive performance of the weed. The insect can be utilized in future management programs of *Parthenium* weed and mass production in india as efficient and self-sustainable bio-control agent.

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THANK YOU!