

## Prospects of Biological Weed Management in Organic Farming

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### What is Biological?

Living organisms viz., insects, disease organisms, herbivorous fish, snails or even competitive plants for the management of weeds are called biological methods. Not possible to eradicate weeds -weed population can be reduced. Not useful to control all types of weeds. Introduced weeds are best targets.

### History of Biological Control

- Biological control of weeds - Mid 1800s
- Over 125 species of weeds (Julien, 1992)

*Opuntia vulgaris* in central and northern India by *Dactylopius ceylonicus* introduced from Brazil and subsequently during 1836-1838 into southern India. First project from Australia, - Argentinean moth *Cactoblastis cactorum* released in 1925, brought about virtual complete control of *O. inermis* and *O. stricta* from 24 million hectares of infested land and restoring the same to agricultural use. From late 1950's projects were initiated on aquatic and semi-aquatic weeds, annuals and biennials, crop land and rangeland weeds in Australia, Canada and the USA.

### Guidelines on biological control of weeds

Information on the weed, its taxonomy, close relatives, natural enemies and native range. Preliminary exploration to find the native range and select the site for an exploration laboratory. Setting up of an exploration laboratory. Searching for the natural enemies, identification and conducting preliminary host range studies. Detailed host specificity studies, importation and quarantine after confirmation of the first factor. Conducting host range studies in introduced land. Release and monitoring on long term basis to confirm establishment, control and spread.

### Techniques of Biological Control of Weeds

Classical biological control method is practiced when an invasive species has established outside its native range. Second approach is of augmentation when the existing natural enemies are not providing effective control.

### Biocontrol Agents

- Use of Pathogens
- Use of Aquatic Mammals & Rodents
- Use of Fish
- Use of Snails
- Use of Insects
- Use of Birds & Animals
- Allelopathic Plants

### Biological Weed Control by Insects

1. *Lantana camara* a prickly shrub is controlled effectively by
  - (a) Larvae of *Crociosema lantana*, the tortricid moth,
  - (b) Larvae of *Agromyza lantanae*,
  - (c) Larvae of *Thecla echion* and *T. bazochi*, the Iycaenid butter flies
2. Prickly pear, *Opuntia* spp. is controlled by the larvae of *Cactoblastis cactorum*, a moth borer and *Dactylopius opuntiae*, the cochinal insect.
3. India, the infestation of *Opuntia* was controlled by cochinal insects *Dactylopius indicus* and *D. tomentosus*.
4. *Cuscuta* spp. dodder, a parasitic weed occurring on a variety of plants - by *Melanagromyza cuscutae*, *Smicronyx cuscutae*.
5. *Eupatorium odenophorum* in Hawaii and Australia - a gallfly *Procecidochaes utilis*.
6. *Leptospermum scoparium*- mealybug *Eriococcus orariensis*.
7. *Imperata cylindrica*- *Orseoliella javanica*
8. *Cyperus rotundus*- *Bactra vermosana*

### *Parthenium hysterophorus*

- Field releases of *Z. bicolorata* were initiated in 1984 which established readily under field conditions in Bangalore in 1984.



**Before beetle release**



**Beetle eggs on**



**Beetle Nymph feeds on**



**Beetle feeds on**



**Beetle congregation**



**Two weeks after beetle release**

### Biological control of aquatic weeds

Herbivorous fish Tilapia spp. algae (Chara and Nitella) and saw weeds (Najas) in Africa. White amur (Ctenopharyngodon idella Val.) has a voracious appetite for many aquatic plants. Common carp (Cyprinus carpio) a non-herbivorous fish, certain aquatic weeds. Carps are used in Hungary for weed control in rice fields, and they show promise for controlling weeds in large drainage ditches in the United States. Manatees or sea-cows (Trichechus manatuo L) are aquatic animals - water hyacinth, and on accessible plants at the water's edge. Large tropical fresh water snail Marisa cornuarietis L. submersed weeds, common coontail (Ceratophyllum demersum L.), Illinois pond weed (Potamogeton illinoensis) and southern naiad (Najas guadalupensis). Snail prefers submersed weeds as food plants to floating or emersed weeds. However, it does feed on Salvinia (Salvinia rottendifolia) a floating weed. A flea beetle (Agasiches connexa) - aligator weed (Alternanthera philoxeroides), a free-floating aquatic weed.

### Biotic Agents: Plant Pathogens

Two Approaches:

- Classic-Initial inoculation of the weed with a self-sustaining fungus
- Annual application of endemic or foreign fungi, “mycoherbicide” approach Eg.
- Classic: Skeleton weed control in Australia with the fungal rust, *Puccinia chondrilina*
- Mycoherbicide: Northern joint vetch suppression in rice a *Colletotrichin sp.* 90-95%
- *Spurred anoda* and *Velvetleaf suppression* with *Alternaria macrospora*
- Fungi *Alternaria macrospora* and *Puccinia heterospora* affect spurred anoda (*Anoda cristata*)
- Water hyacinth (*Eichhornia crassipes*) - *Cercospora rodmanii*. Conway et al. (1978) observed that this pathogen is pathogenic only to water hyacinth
- *Fusarium roseum* 'culmorum' is pathogenic to *Hydrilla verticillata*.

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