HISTORY OF WEED BIOLOGICAL CONTROL IN THE PACIFIC ISLANDS

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Outline of Presentation

1. Background –
   - The region
   - Alien Weed Impacts
2. History
   - Targets, Countries and Agents
3. Information Sources
   - Literature
   - Regional meetings
1. BACKGROUND – The Region

The SPC region:
- 22 Pacific Island Countries and Territories (PICTs);
- 30 million km$^2$;
- 2% land.
- Excludes Aust., Hawaii, Norfolk Is, Easter Is, & NZ.
1. BACKGROUND: Alien Weed Introductions

• 200 years of alien plant introductions.
  – Accidental or intentionally introduced;
• Many alien plants have contributed to improving food security and survival of island communities;
• In the Pacific between 300-500 plant species could be regarded as weeds/invaders with at least 150 aggressive invaders impacting one way or the other.
Background cont’d

- Most of the important insect pests and all of the major weeds in the Pacific were introduced;
- The weedy plants tend to have serious impacts for many reasons:
  - increasing human populations causing disturbance to natural ecosystems;
  - Small islands, far from major continents, low levels of biodiversity, high levels of species endemism (as in Eastern Polynesia) and
  - weak defences or competition of native fauna and flora – more opportunities for many of alien plants to establish as weeds.
- Now increasing trade and travel pose greater biosecurity threats to the region.
2. HISTORY of Biological Control

- Globally Weed Biological Control began in the Pacific: Hawai‘i and Australia.
  - The first deliberate weed biological control work against a weed was on *Lantana camara* in 1902 in Hawai‘i;
  - The next major invasive weed problem occurred in Australia. Large areas of land were invaded by introduced cacti like prickly pears (*Opuntia* spp).
  - Biological control was decided as the solution.
- The Pacific region was the first to use biological control for weed management due to the proximity of Hawai‘i and Brisbane.
- Biological control as a pest management tool has often been restricted to a few PICTs due lack of capacity.
- Nearly all PICTs rely on the use of weed biological control agents researched elsewhere.
THE TARGETS
3. The Targets

Lantana (Lantana camara) Verbenaceae

• (since 1902) first weed in the world to be studied for biological control
• >600 Lantana varieties, >60 countries/islands affected.
• Early and ongoing research has been centred out of Hawaii and Queensland Australia.
• Worldwide >40 biological control agents (BCAs) released.
• Releases in the PICTs commenced in 1911:
  • Effective agents are Teleonemia scropulosa, Uroplata girardi, Octotoma scabripennis, Calycomyza lantanae, & Ophiomyia lantanae.
  • Others like Calycomyza lantanae, Ophiomayia lantanae, Epinota lantana, Lantanophaga pusilidactyla & Hypena laceratalis
    • released in a few PICTs but turned up in other PICTs,
Lantana camara BCA Releases in the Pacific Islands

- *Ophiomyia lantanae* were released in Fiji & New Caledonia (1911);
- *Teleonemia scrupulosa*. Fiji. 1928
- *Octotoma championi*. Fiji (1976)
- Generally good control in most islands where all/some of these agents are established and present.
Early Targets

- 12 agents collected from Mexico, USA and Argentina were released in Queensland;
- the moth *Cactoblastis cactorium* (ex. Argentina, 1925) cleared 24 million ha of prickly pear infestations by 1933.

1933. *Cactoblastis cactorium* released in New Caledonia ex. Argentina via Australia.
- Successful control of *Opuntia stricta*

Photos: Queensland Department of Lands and Natural Resources
Kusters curse (*Clidermia hirta*) Melastomataceae

- 1930. *Liothrips urichi* shipped from Trinidad were reared and released on Viti Levu & Taveuni islands in Fiji
  - good effective
- 1956. released in Oahu (Hawaii) ex. Trinidad via Fiji
Cyperus rotundus (Nutsedge)  
Cyperaceae

• *Bactra venosana* released in Fiji, 1936.  
  • Established but ineffective.
• *Athesapeuta cyperi*  
  • Not established
• Nutsedge continues to be a common problem weed for agriculture  
  • Top 10 weeds of Pacific Island agriculture
Puncture vine (*Tribulus cistoides*)  
Zygophyllaceae

- **1966.** Stem boring weevil *Microlarinus lareynii* released in PNG. Not established.
Salvinia (*Salvinia molesta*) Salviniiaceae

- The weevil *Cyrtobagous salviniae*
- Probably the best textbook example of classical weed biological control.
- 1982. Released in Sepik River, PNG.
  - >250 sq. km of salvinia mats reduced to just 2 sq.km by 1984!
- 1991. Released in Fiji (Rewa R). Effective
- Also released in Fiji, established but ineffective
  - *Paulinia acuminata* (1975)
  - *Cyrtobagous singularis* (1979)
Salvinia biocontrol in PNG

Before - 1982

After - 1984

Cyrtobagous salviniae
Photos: CSIRO

Salvinia control on a Sepik River lake system, PNG.
Photo: CSIRO
Water hyacinth (*Eichhorniae crassipes*)
Pontederiaceae

- **Neochetina eichhorniae**

- **Neochetina bruchi** - PNG (1993). Good control in combination with *N. eichhorniae*


- **Xubida infusella** – PNG (1997). Established at 1 site, impacts not significant)
**Biocontrol work (in PNG)**

- **1986-1991.** Ad-hoc releases of *N. eichhorniae*. **Limited impact**
- **1993-1998.** Intensive rearing and releases of all BCAs. **Nationwide control**

*Neochetina* spp reduced infestations from 100% in 1995 to 10% since 1998

Tambali Lagoon, Sepik River
100% to <1% infestation
Water hyacinth biocontrol in Vanuatu (2005-2008)

May 2006

Neochetina eichhorniae – rearing pool, Port Vila

May 2008
Sensitive Plant (*Mimosa diplopticha*)

- Widespread.
- *Heteropsylla spinulosa*
  - 1992. FSM.
  - 1993. PNG, Fiji
  - 1994. Cook Is, SI, Vanuatu, Niue
  - Recently detected in Palau (no record of releases)
- *Psigida walkeri* – Cook Is (not established)
- *Scamurius* sp – Samoa (Not established)

After Biocontrol
Water lettuce (*Pistia stratiotes*) Araceae

- Weevil *Neohydronomus affinis*
- PNG. 1985. Effective
- Vanuatu. 2007. ex. PNG. Effective.
Biocontrol of Water lettuce in Vanuatu

August 2005 (before)

Oct 2008 (after)
Broomweeds (*Sida* spp) (Malvaceae)

- Common weedy species in the Pacific
  - *Sida acuta* & *Sida rhombifolia*
  - Invade open areas including pastures
  - Effective control at release sites within 12 months!!
- Also released in Fiji (2002) and Vanuatu (2004)
  - Effective control
Broomweeds (*Sida* spp) Biocontrol

Before Biocontrol
3/17/2005 12:12:28 PM

2006
Chromolaena (Chromolaena odorata) Asteraceae

- **Pareuchaetes pseudoinsulata**
  - Guam 1985. Good control

- **Ceccidocharis connexa**
  - Guam & CNMI – Established. effective
  - FSM – Established.

- **Melanagromyza eupatoriiella**

- **Mescinia nr parvula** –
  - Guam. Not established.
Mile-a-minute *Mikania micrantha* Asteraceae

  - PNG and Fiji.
  - Two species of *Actinote* spp (July 2006)
  - Rust fungi (*Puccinia spegazzinii*)
    - Released & established in PNG (2009) and Fiji (2009)
3. Meetings & Trainings Held

- **Pacific Regional Meetings on biological control:**
  - **November 2009**. Auckland, New Zealand.

- **Past Trainings on Biological Control**
  - Personnel from Fiji (3), Vanuatu (1), PNG (6), Tonga (1), and Samoa (1) have received 2-week intensive training on Weed biocontrol since 1994 in Brisbane Australia.
    - 2004 was last training
  - Up to 25 agriculture extension, quarantine and environment personnel from PNG, Solomon Is and Vanuatu were trained in August 2004 on biological control methods.
Literature


Thanks