« Of Miconia and Men »

The story of a scientifically and socially successful biological control program in Tahiti, French Polynesia (South Pacific)

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Introduction: Biocontrol in a Socio-Economic World

➢ Negative human perceptions
- fear of introducing new alien organisms, especially predators or pathogens
  (« Phytopathophobia », Freeman & Charudattan 1985)
- suspicion/distrust of scientists (« sorcerer’s apprentices ») and governments (« conspiracy »)
- uncertainty of successful control → unpredictability of investment return (« risky business »)

➢ Conflicts of interest: threat for related species of socio-economic importance or conservation value

Gregarious larvae of *Euselasia* sp. feeding on *Miconia calvescens* leaf
http://www.botany.hawaii.edu/faculty/cw_smith/images/

« The best laid schemes of Mice and Men go often askew » (Burns 1785)
The Past Bad Reputation of Biocontrol in the Pacific Is.

- **Achatina fulica**
  - Introduction in Tahiti in 1967

- **Euglandina rosea**
  - Introduction in Tahiti in 1975

- **Extinction of 56 of the 61 endemic *Partula* tree snails in the Society Islands!**

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*La Dépêche de Tahiti (March 2000)*
The Case of *Miconia calvescens* Invasion in Tahiti

- Small tree (6-12 m tall) native to Tropical America
- Spread in native rain- and cloud forests between 0-1400 m elev.
- 8+ million seeds produced by tree/year
- Forms dense monospecific stands (light in the understorey)

> 50% of all the endemic plants in Tahiti directly threatened by *Miconia*  
(*Meyer & Florence 1996, J. of Biogeography 23*)
The Miconia Biocontrol Program: from Start to Results

- 1988 Miconia research and control program (Gvt + ORSTOM)
- 1989 First proposal to search for natural enemies (ORSTOM)
- 1993 First contact with Hawaii (UH, NPS and HDOA) ; first exploratory trips to tropical America
- 1995 First contact with IIBC (UK)
- 1997 First Miconia Conference (Tahiti) ; Signature of a cooperative agreement with HDOA
- 1999 Proposal received from CABI
- 2000 First release of a biocontrol pathogenic agent in Tahiti
- 2002 Second release in Tahiti
- 2007-on going Results presented in conferences and published in journals
The Biological Control Agent

- *Colletotrichum gloeosporioides* forma specialis *miconiae* 
  (Order Melanconiales, Class Coelomycetes, 
  Subdivision Deuteromycetinae)
- Discovered in Brazil in 1997 (R. Barreto)
- Cultivated and tested in Hawaii (E. Killgore)
- Released in Tahiti in 2000 after complementary host-specificity tests (endemic melastomes)

causes leaf anthracnose and necrosis

↓

kills Miconia seedlings
& Miconia trees partial defoliation

↓

↑ light in the forest understorey

(Killgore et al. 1999, Plant Disease 83; Meyer & Killgore 2000, Aliens 12)
Results (I)

- Impacts on *M. calvescens* seedlings:
  - 100% plant and leaf infection
  - 75% mortality (1 month old) in the lab
  - 30% mortality (< 50 cm tall) *in situ*

*Results (I)*

Results (II)

- Partial defoliation of *M. calvescens* canopy trees: between 5-35% with elevation

\[ y = 0.0352x - 8.4389 \]

\[ R^2 = 0.759^{***} \]

Results (III)

- Positive effects on the recovery of threatened endemic plants

![Ophiorrhiza subumbellata (Rubiaceae)](image1)

![Myrsine longifolia (Myrsinaceae)](image2)

![Taravao permanent plot YEAR 2000](image3)

![YEAR 2006](image4)

(Meyer, Dupouy & Taputuarai 2007, Rev. Ecol. 62)

(Meyer & Fourdrigniez 2011, Biological Conservation 144)
Results (IV)

- Increase in native plant diversity and abundance with time

NF = Native Ferns
NA = Native Angiosperms
AP = Alien plants

A « novel » plant community

(Meyer, Fourdrigniez & Taputuarai, in press, BioControl)
The Way It Was Done

- We consulted experts
  - « Always prepare for the worst! »
  - http://www.yale.edu/eeb/stearns/advice.htm

- We told the truth
  - not a « silver bullet », no eradication!
  - low success rate of biocontrol
  - relatively expensive but may be cost-effective
  - long-term program (5-10 years)

- We used simple messages and provide explanations

- We followed the rules
  - phytosanitary regulations and nature protection laws
  - advisory committees

- We informed the local authorities and the public
  - meetings with technicians and politicians
  - public conference (First Miconia Conference, Tahiti, 1997)
  - many articles in local newspapers, magazines, and talks in radios, TV
Conclusions: la recette du succès?

- Good target (no conflict of interest)
- Good scientific collaboration
- Good countries cooperation (Hawaii, Brazil, French Polynesia)
- Good financial deal (285 k vs 36 k USD)
- Good political support (despite political unstability)
- Good but short-term financial support (2000-2004)
- Good support from key stakeholders
- Good assessment with long-term monitoring (10 yrs)
- Good media coverage

« Communication is the key [...]. It is vital to have full stakeholder participation from the beginning of a project and to maintain contact and information flow throughout »
(L. Hayes, 2007)
The Current Status of Biocontrol in French Polynesia

- Accepted and recognized as an efficient and safe tool
- A « model » for other and future biocontrol programs
- but… « victime de son succès » (e.g. in organic agriculture, for Little Fire Ant control)


(Grandgirard et al. 2009, Biol. Control 48)
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