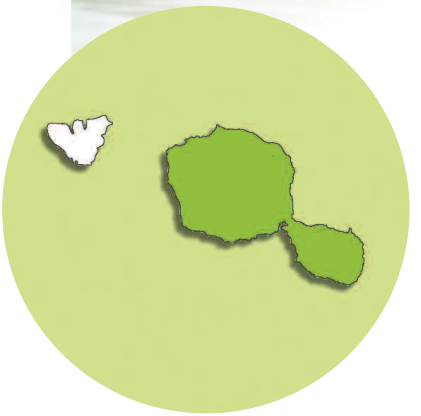


Miconia trees

(Miconia calvescens)

Introduction of a pathogenic fungus to check the growth of Miconia trees and restore the wet forests of Tahiti (French Polynesia)

Research Agency for French Polynesia and the Louis-Malardé Institute

- The primary task of the Research Agency is to prepare, coordinate, stimulate and monitor the implementation of research policy in French Polynesia.
- The Louis-Malardé Institute, a publicly funded institute in French Polynesia, contributes through its work to preserving health, public sanitation and the natural environment of French Polynesia.
- Contact: Jean-Yves Meyer - jean-yves.meyer@recherche.gov.pf

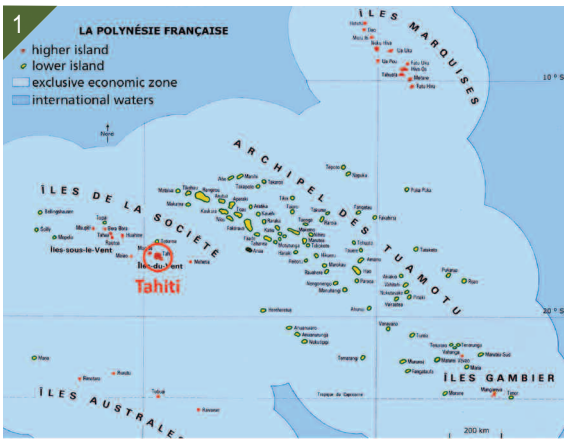
Intervention site

- The tropical forests of the Pacific islands, including those of French Polynesia, are hotspots of biodiversity, particularly in terms of the endemic plants. However, numerous invasive alien species threaten that biodiversity.
- Miconia trees were introduced to Tahiti for the first time in 1937 as an ornamental plant in a private botanic garden and subsequently dispersed to several islands in the Society and Marquesas groups. They have since become a major priority in efforts to preserve the wet forests of the islands. Over the past 50 years, the species has spread to over 70% of Tahiti and may now be found up to altitudes of 1 400 metres in the “cloud forests”.
- A number of techniques are used to combat the species, depending on the point in the invasion process and the development of the plants, and on the available means (uprooting, manual or chainsaw cutting, use of herbicides on stumps).
- Due to the limited effectiveness of those methods and the extent of the colonisation, work was put into finding a biological means to manage the plants.

Disturbances and issues involved

- Miconia trees develop into dense, virtually single-species stands and thus severely reduce the light for native plants in the understories, particularly herbaceous plants, shrubs and young trees. They directly threaten approximately one hundred species endemic to Tahiti.
- Their presence is also thought to lead to erosion on steep slopes.

1



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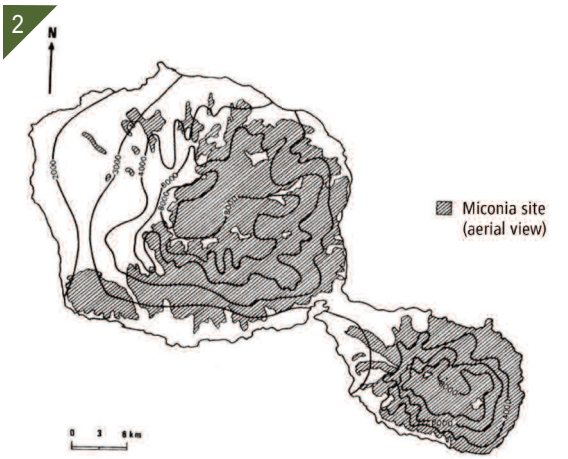

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1. Position of Tahiti and the archipelagos of French Polynesia.
2. Colonisation by Miconia trees in Tahiti..

Interventions

Search for a biological-control agent

- In 1997, a pathogenic fungus, *Colletotrichum gloeosporioides forma specialis miconiae* (CGM), was discovered in Brazil by the phytopathologist Robert Barreto. The fungus causes anthracnose disease (drying) in the leaves and necrosis of the plant as a whole.
- According to laboratory tests run in Hawaii, CGM is highly specific to Miconia and does not attack native and endemic plants (Killgore *et al.*, 1997).

A test in Tahiti

In 2000, with the approval of the Polynesian government, the pathogenic agent was released on two invaded sites located at an altitude of approximately 600 metres in the wet forest (precipitation > 3 000 mm per year). The development of almost 100 Miconias at various growth stages, ranging from seedlings to adult trees, was monitored for six years.

For the test, the fungus spores, grown in a lab at the Louis-Malardé Institute, were placed in a solution and sprayed on the targeted trees.

Thirty days after spraying, spots were observed on leaves and after three months, 100% of the trees on the test sites were infected, with damage on 90 to 99% of leaves. The observed mortality rate was 15% for the species as a whole and reached 30% for plants less than 50 cm in height.

Monitoring changes in Miconia populations

Over a period of three years, the fungus spread to the entire island of Tahiti and infected virtually all Miconias. It was also observed on Moorea, an island located 20 kilometres to the north-west of Tahiti, though the fungus had not been intentionally released there.

No infection of any non-targeted plants was observed at any time.

The degree of observed defoliation increased with the altitude, from 5 to 45% between 600 and 1 000 metres, suggesting the influence of temperature and humidity rates on the development of the infection and on the reproduction and dissemination of the pathogen.

Monitoring over five years (2005-2010), on eleven test sites representing 100 square metres each, positioned along an altitude gradient, revealed a return of native plants, particularly pioneer species requiring larger amounts of light. Recolonisation by other invasive plants remained limited at the lower altitudes. Rare endemic plants, such as *Pittosporum taitense* trees or the *Liparis clypeolum* orchid, were observed on one site at an altitude of 600 metres, whereas they had not been seen in that area for twenty years.

Results and costs

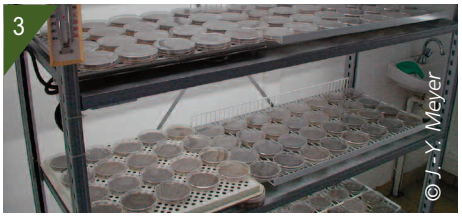
Results

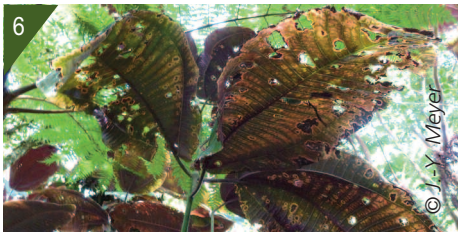
Even though CGM did not totally eliminate Miconia from Tahiti, even 16 years after its introduction and in particular in the lower altitudes where the higher temperatures would seem to limit its activity, the monitoring nonetheless confirmed its relative effectiveness in restoring mid-altitude wet forests.

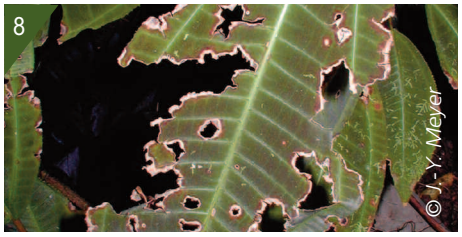
The partial defoliation of the Miconia trees benefited native plants, including threatened endemic species on the French IUCN red list, such as *Myrsine longifolia* (EN), *Psychotria speciosa* (EN) et *Ophiorrhiza subumbellata* (VU).

Costs

The overall programme for research and interventions against Miconia in French Polynesia, funded by the Polynesian government, was estimated to represent 71 million CFP francs, i.e. approximately 595 000 euros, for the period 1988 to 2008. The cost for the work since 2008 was not available.







3. CGM grown in Petri dishes in the lab.
4, 5. Applying CGM to Miconia trees.
6, 7, 8, 9. Damage to leaves caused by the fungus.

Information on the project

- A chapter in the book titled *Suppressing over-abundant invasive plants and insects in natural areas by use of their specialized natural enemies*, (Van Driesche & Reardon, 2017) was devoted to the Miconia programme (Meyer, 2017).
- The interventions were the topic of numerous articles in the local press and on various internet sites, as well as of television and radio programmes (Polynésie Première, La Dépêche de Tahiti, etc.).
- The research on Miconia in French Polynesia has been the topic of numerous scientific articles and conferences.

Outlook

- Use of the biological control agent slows the colonisation of Miconia and enabled the partial restoration of the wet forest in Tahiti, particularly at higher altitudes.
- The agent could not, on its own, eradicate Miconia from the island, but it represents a tool in conjunction with other techniques used to manage the species.
- Another biological agent, *Coccodiella miconiae*, is currently being tested in Brazil. It would seem to attack Miconia leaves at an earlier growth stage than CGM and could be used as a second, complementary technique.

Authors: Doriane Blottière, IUCN French committee, and Jean-Yves Meyer, Research Agency for French Polynesia, for the Resource Centre on invasive alien species in conjunction with the overseas IAS initiative.
July 2018. Published by the French Biodiversity Agency.

10. Regrowth of endemic species following defoliation of Miconia trees.

For more information...

- Meyer J.-Y. 2017. Chapter 9. Partial restoration of native rainforest in the island of Tahiti (French Polynesia) after introduction of a fungal pathogen to control the invasive tree *Miconia calvescens* in Suppressing over-abundant invasive plants and insects in natural areas by use of their specialized natural enemies (Van Driesche, R.G. & Reardon, R.) p. 59-63.
- Meyer J.-Y. 2013. Le Miconia, "cancer vert" des forêts tropicales du Pacifique. 50 ans de recherche en Polynésie, IRD Editions, p. 59-66.
- Foudrigniez M., Taputuarai R., Meyer J.-Y. 2008. Étude de l'évolution de la composition de la végétation et de la régénération des plantes en sous-bois de forêts envahies par le Miconia et attaquées par le champignon pathogène C.g.m (2005-2007). Rapport technique, programme de lutte biologique contre le Miconia. 35 pp.
- Killgore E.M., Sugiyama L.S., Barreto R. 1997. Prospective biological control of *Miconia calvescens* in Hawai'I with nonindigenous fungus *Colletotrichum gloeosporiodes (Penz.) sacc.f. sp. Miconiae*. Proceedings for the first Regional Conference on Miconia control, 65- 71.
- Meyer J.-Y. 2009. The Miconia Saga: 20 years of study and control in French Polynesia (1988-2008). International Miconia Conference. 19 pp.

This management report fills out the collection already published in the second and third volumes of the book titled "Invasive alien species in aquatic environments, Practical knowledge and management insights", in the Knowledge for action *series published by the French Biodiversity Agency.*
(https://professionnels.ofb.fr/index.php/en/node/416)

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