# Conserving and valorizing biodiversity: the medicinal flora of Madagascar

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ACADÉMIE DE RECHERCHE ET D'ENSEIGNEMENT SUPÉRIEUR

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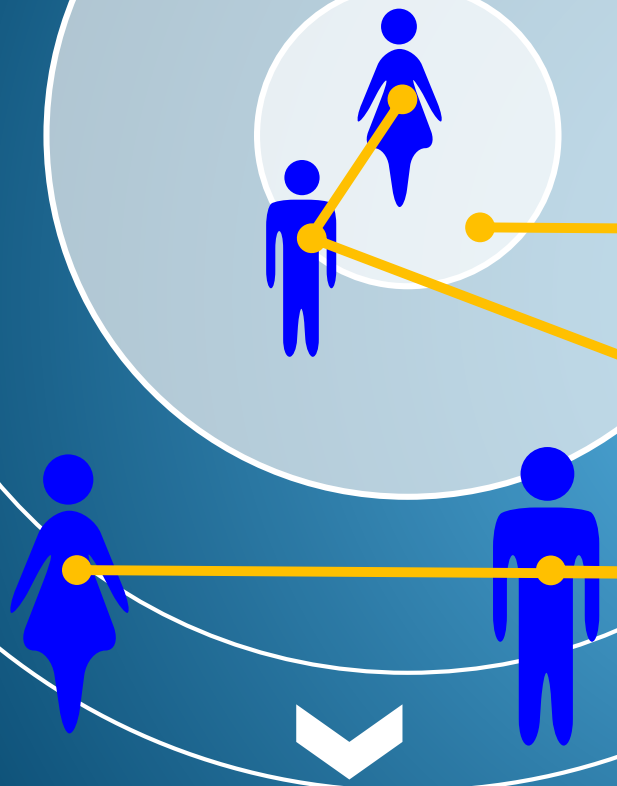
# A major player of indirect cooperation

- The Academy of Research and Higher Education (ARES) is a public interest organization representing the higher education of the Federation Wallonia-Brussels *(Universities - Colleges - Arts Colleges*)

- The Development Cooperation Commission (CCC) is a standing committee of the Academy of Research and Higher Education

- ✓ Definition of a common development cooperation policy for universities, colleges and arts Colleges
- ✓ Coordination and management of educational and research projects
- ✓ Financed by the Directorate General for Development Cooperation and Humanitarian Aid (Belgian State)

# ARES-CCD COOPERATION POLICY



**Structural capacities**
→ performance of partner institutions

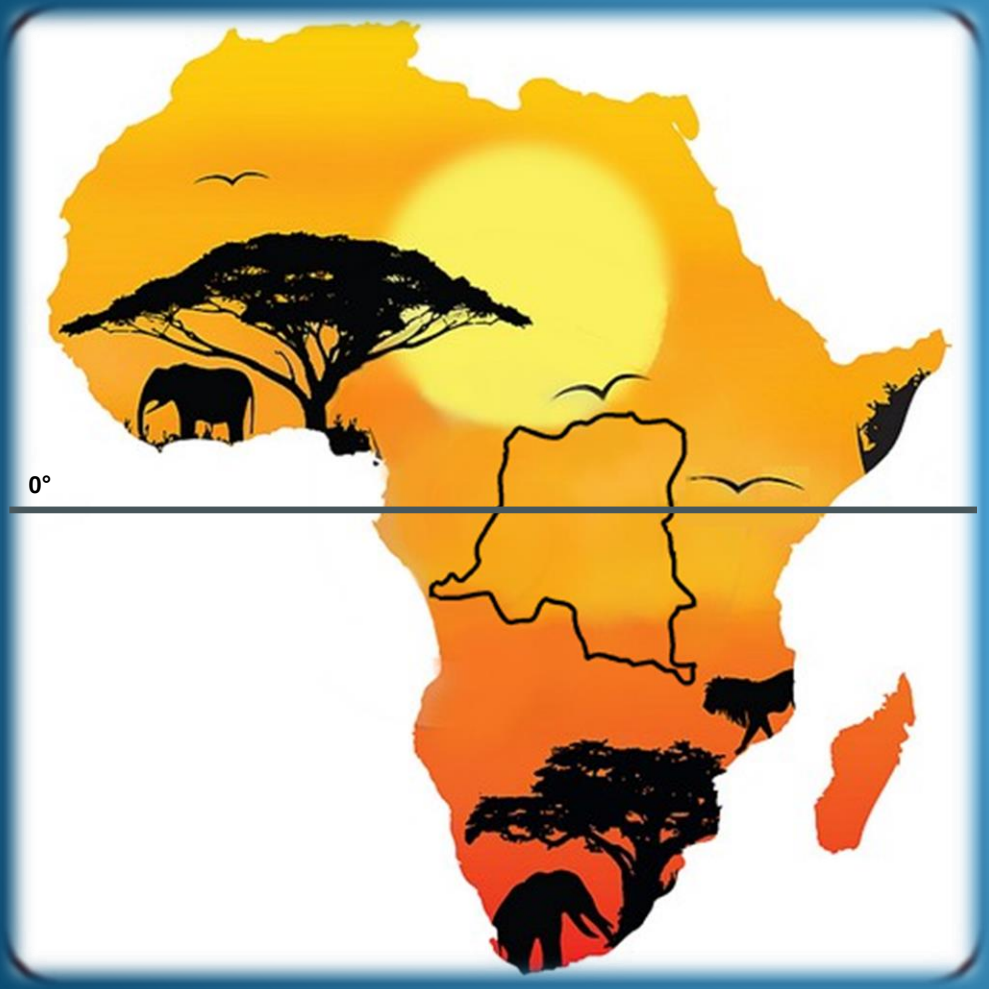
**Research and Formation capacities**
→ development-oriented

**Individual capacities**
→ expertise for development

**Strengthen and enhance, through partnerships, the contribution of higher education to development**

**SUSTAINABLE HUMAN DEVELOPMENT OF THE SOUTH**

# Context of Madagascar




- Madagascar broke away from Africa more than 150 million years.
- This island is home to 12,000 species of plants (of which 70-80 % are endemic ), making it one of the regions with the most diverse and original flora in the world.
- Biodiversity hotspots: only 1.4 % of earth surface but concern 60 % of animal and vegetal species
- The environment is fragile and threatened:
  - ✓ Demographic pressure
  - ✓ Deforestation
  - ✓ Erosion,…
- Madagascar retains only 9 % of its original hotspot surface

# IMRA: partner in Madagascar

*(since 1998)*


**Institut Malgache de Recherches Appliquée**

- ✓ **Scientific research and training of researchers**
- ✓ **Promotion and education of the rural world**
- ✓ **Improvement of health status**

*Harvest, drying, sorting, packaging*

*Storing of medicinal herbs*

*Production of herbal extracts*

## The IMRA is a specialist in medicinal plants

- ✓ The plants used in traditional medicine are investigated and valued
- ✓ Extracts are produced for the Madagascar community to be sold at subsidized prices.

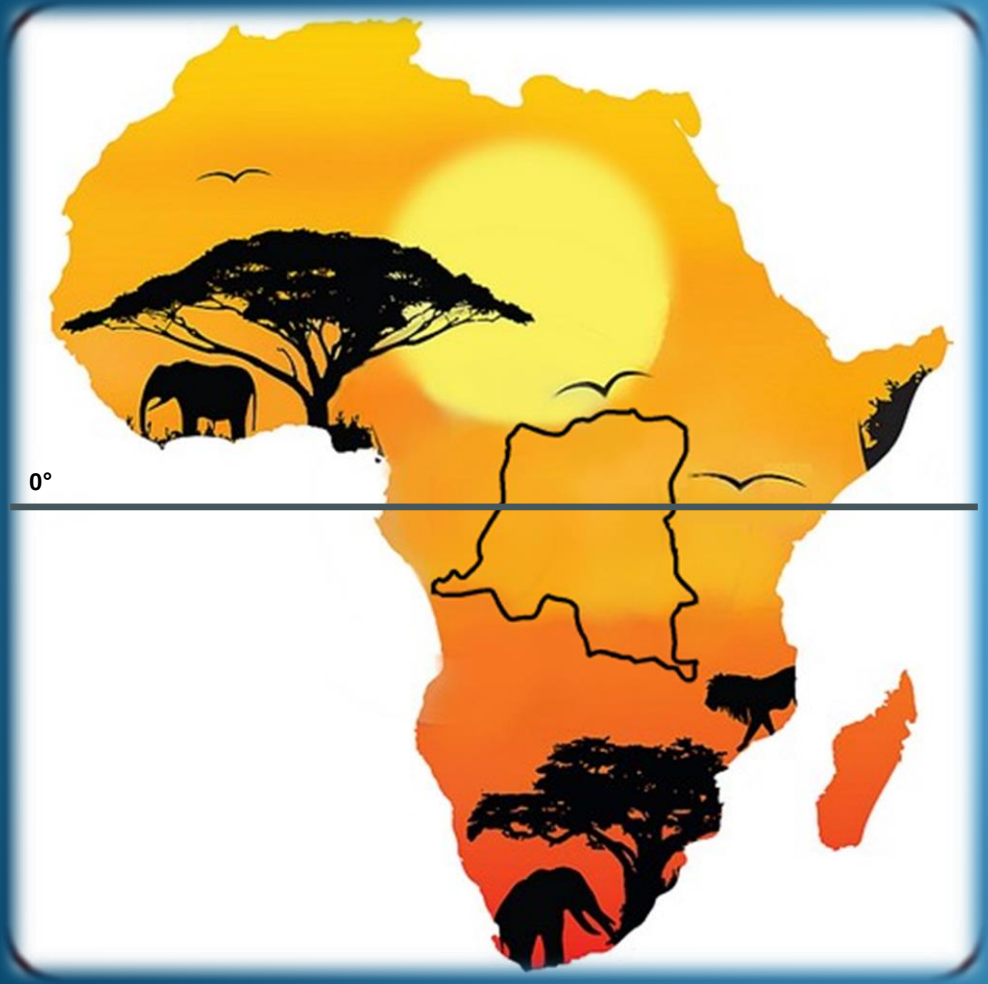
## The IMRA collects an average of 200 plants / year

- ✓ In primary forest and other habitats of the island.
- ✓ Species identified as interesting are no longer found in their natural sites.

## The IMRA faces two major problems

- ✓ The time needed for the study of plants
- ✓ The disappearance of many species

# Objectives of bioconservation projects




1. **Contribute to the conservation and sustainable management of plants (medicinal plants in particular)**

2. **Contribute to the study and promotion of most important genetic resources (development of innovative approaches in therapy)**

# 1. Develop a strategy for the conservation and sustainable management of medicinal plants

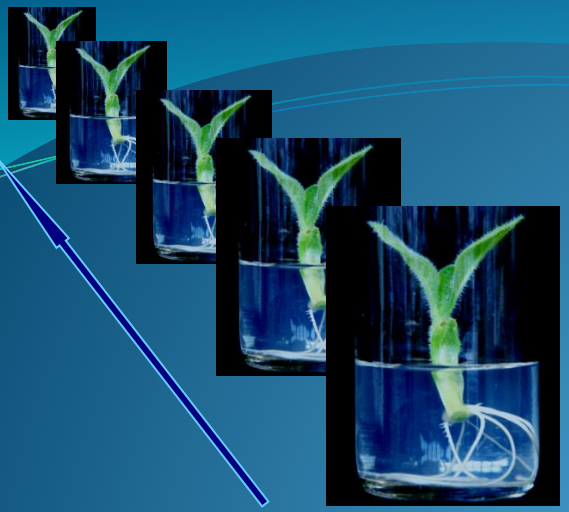
a) **Establish a basic infrastructure**
   ➔ **development of a collection of medicinal plants**

b) **Develop a pilot *ex situ* conservation for a limited number of plants following:**
   - ✓ **A technical limitation criterion**
     The aptitude to vegetative propagation
   - ✓ **An emergency criterion**
     The level of disappearance of the plant
   - ✓ **A social criterion:**
     The importance of the plant in traditional medicine

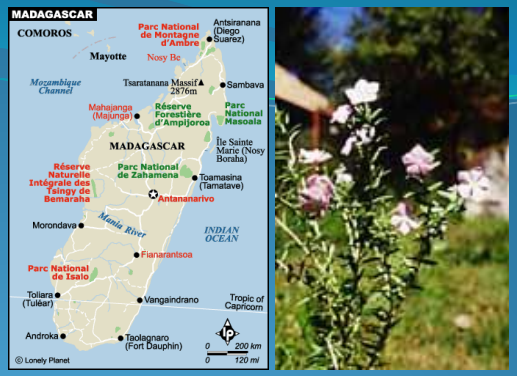
c) **Disseminate the knowledge for the subsequent exploitation of selected genetic resources**

*Syzygium cuminii* (L.) Skeels (Myrtaceae)
➔ MADEGLUCYL®

PRODUITS MASY



Distribution and utilization





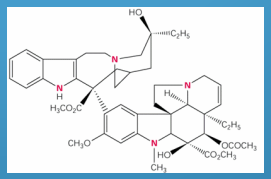

Harvesting


Propagation and conservation

Le cycle de conservation et d' utilisation des ressources génétiques végétales

-196° C

Cryoconservation

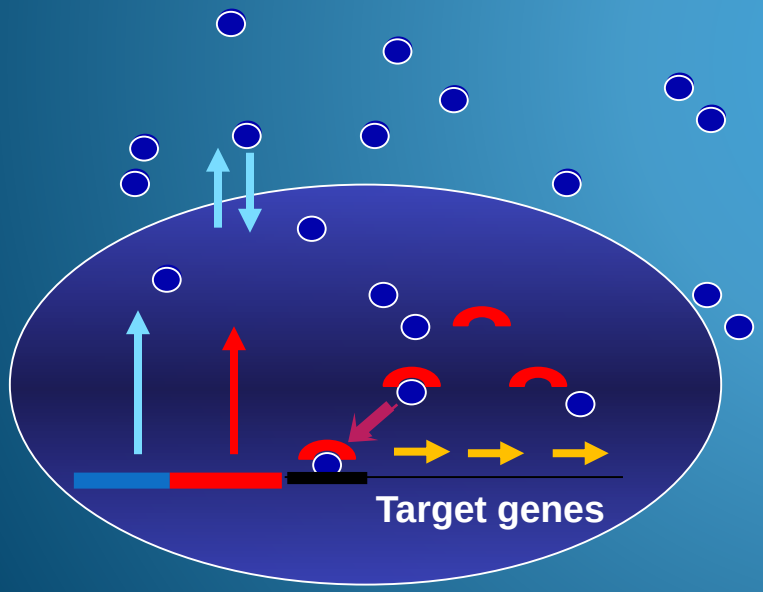


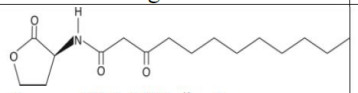
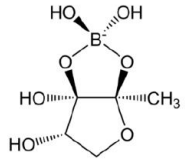
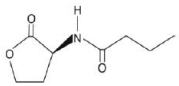
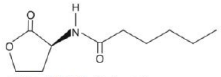
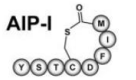
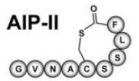
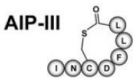
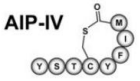
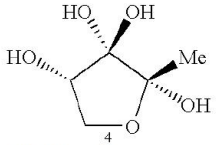
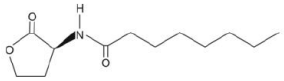
Characterisation

The culture room, October 2002

# 2. Study and promotion of important genetic resources ➔ innovative therapeutic approaches

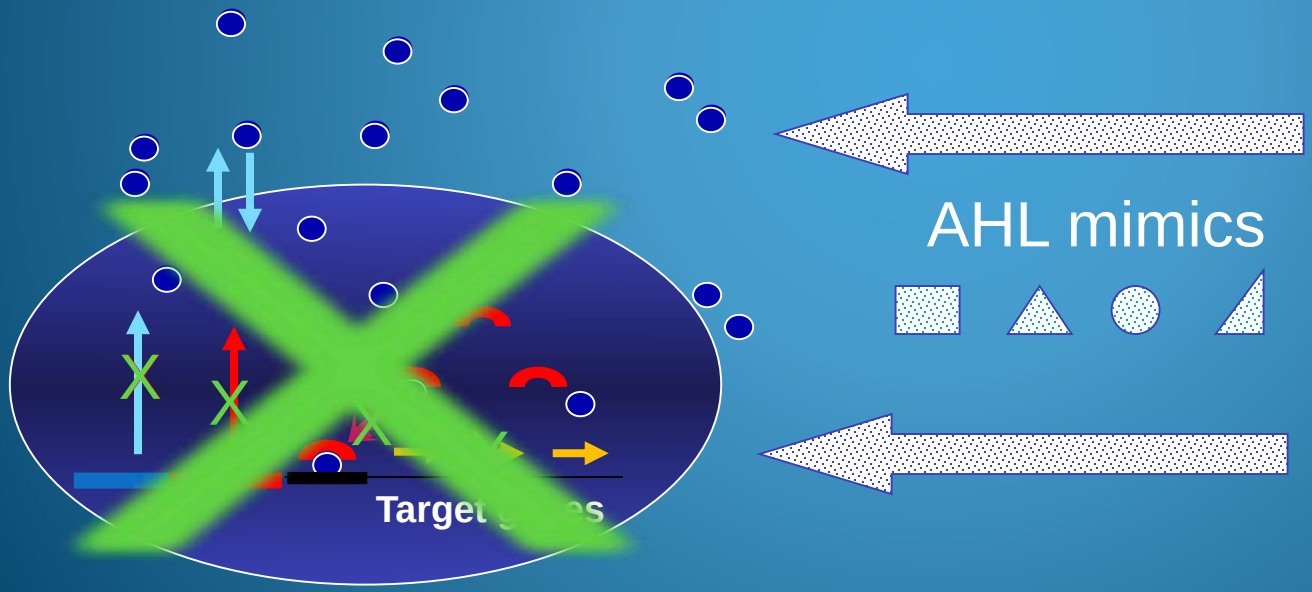
Modulation of **Quorum Sensing**: a new approach to fight bacteria



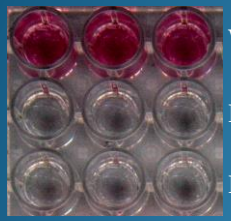

| Gram négatif : LuxI/R | Gram positif : Oligopeptides | Hybride |
|---|---|---|
|  3-oxo-C12-HSL/lasI *P. aeruginosa* | ERGMT<br>CSF/*phrC*<br>*B. subtilis* |  AI-2/LuxS *V. harveyi* |
|  C4-HSL/RhlI *P. aeruginosa* | | |
|  C8-HSL/TraI *A. tumifasciens* |  AIP-I  AIP-II  AIP-III  AIP-IV |  AI-2/LuxS *S. typhimirium* |
|  C6-HSL/LuxI *V. fischeri* | AIP I-IV *S. aureus* | |

# 2. Study and promotion of important genetic resources ➔ innovative therapeutic approaches

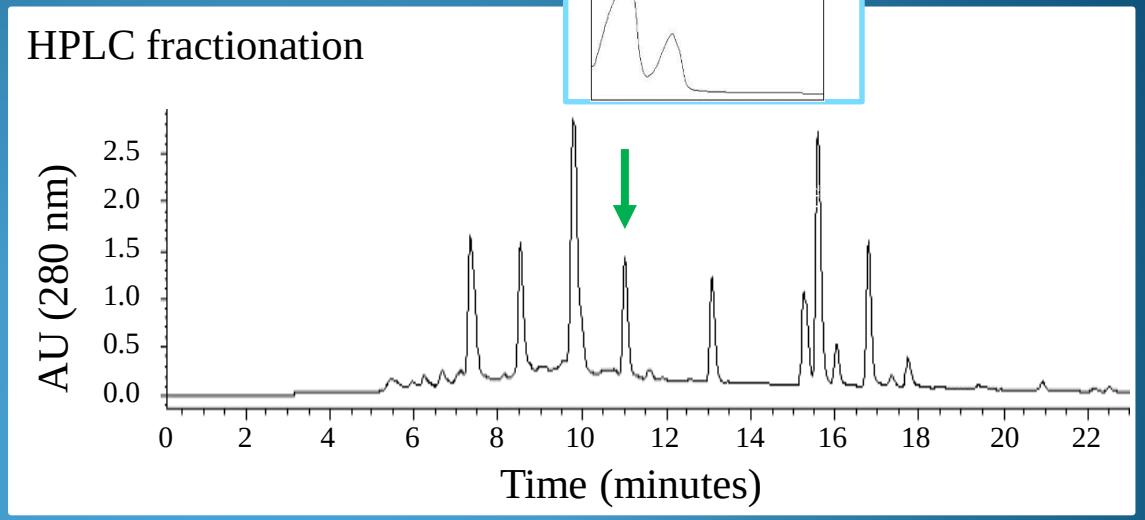
Modulation of **Quorum Sensing**:
a new approach to fight bacteria




# Study of *Combretum albiflorum*

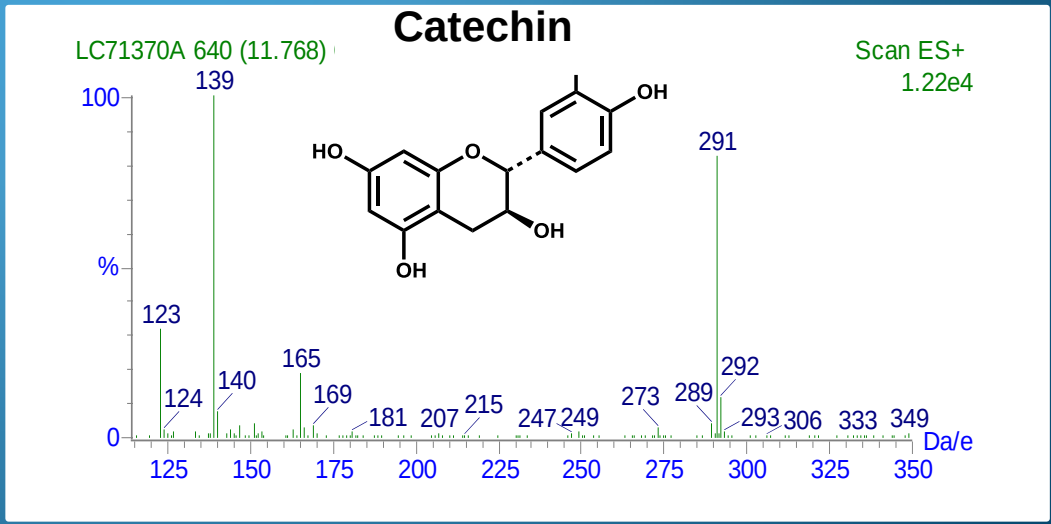



*Pseudomonas aeruginosa* PAO1
(production of pyocyanin)



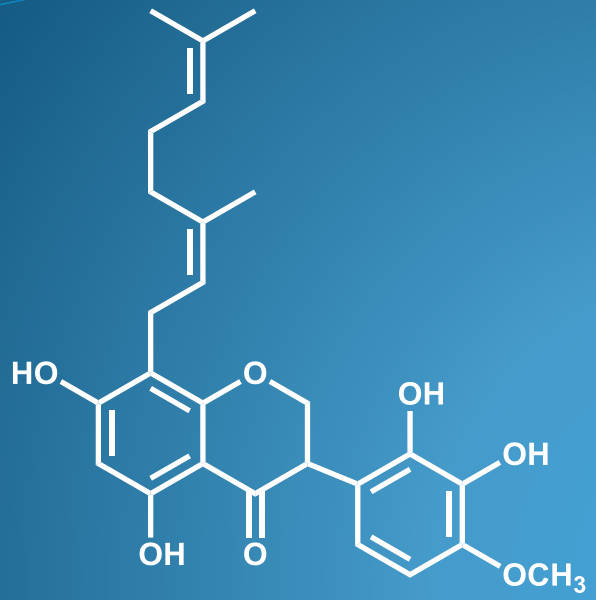

Bio-guided isolation of catechin and naringenin, flavonoid derivatives that:

- ✓ Inhibit the production of pyocyanin, a virulence factor in *P. aeruginosa*
- ✓ Do not affect the growth and viability of the bacteria

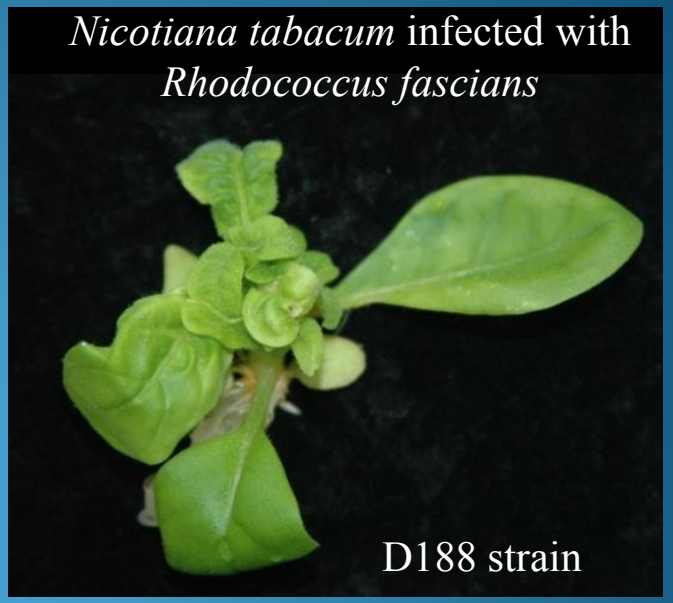


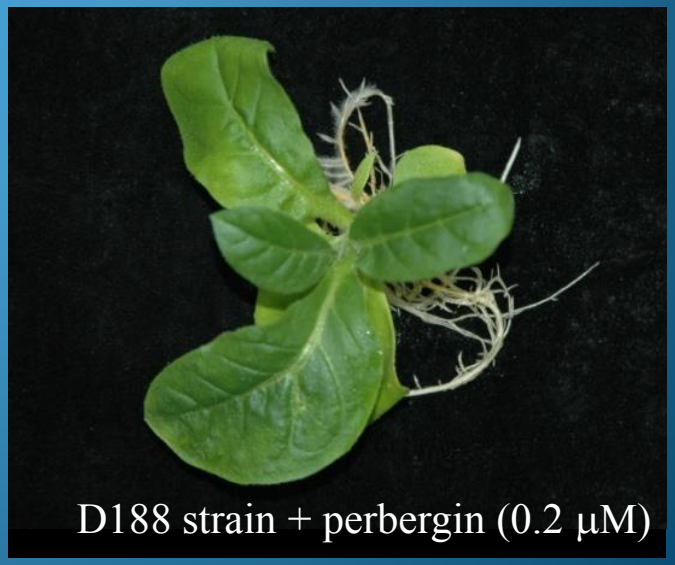

Vandeputte et al, Appl Environ Microbiol. 2010,76(1):243-53

# Study of *Dalbergia pervillei*




**Perbergin**
***(an original structure: prenylated isoflavone)***



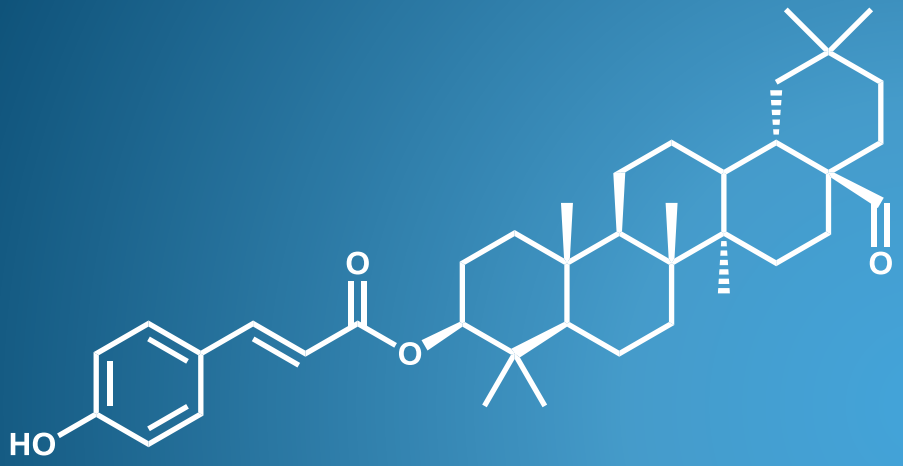

**Bio-guided isolation of perbergin that:**

- ✓ **Inhibits the production of virulence factors in *Rhodococcus fascians***
- ✓ **Does not affect the growth and viability of the bacteria**

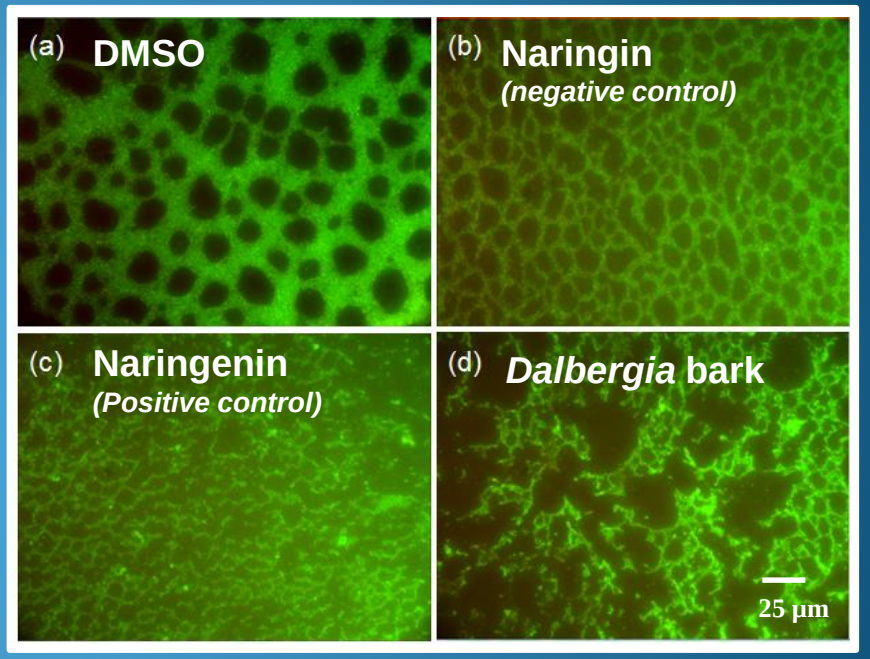


Rajaonson *et al*. 2009, Environmental Microbiology, 13, 1236-52

# Study of *Dalbergia trichocarpa* (1)




Oleanolic aldehyde coumarate
*(an original structure)*




Fluorescence microscopy (x400)

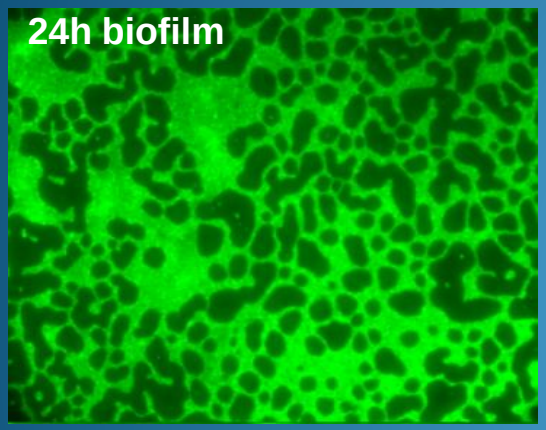
**Bio-guided isolation of a new triterpene coumarate that:**

- ✓ **Prevents the formation of *Pseudomonas aeruginosa* biofilm**
- ✓ **Does not affect the growth and viability of the bacteria**

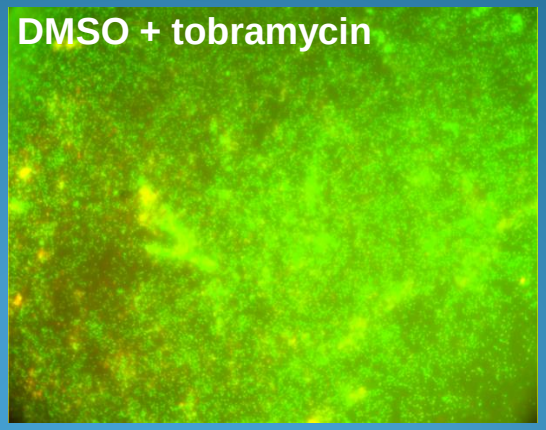


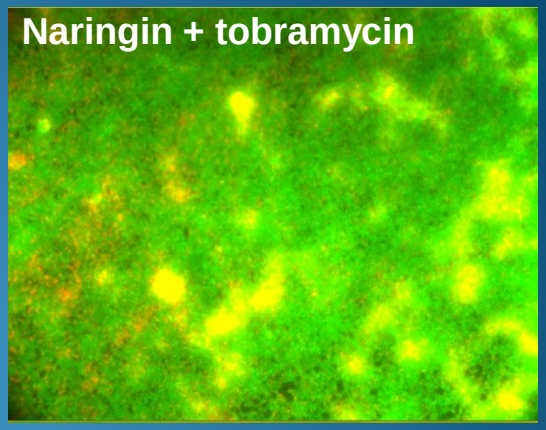
Razamiravaka et al, PLoS One, 10(7): e0132791

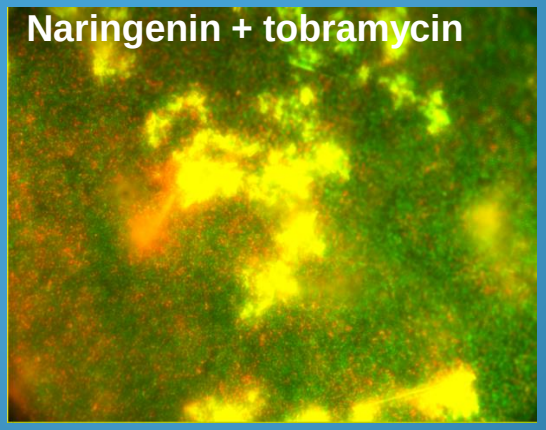
# Study of *Dalbergia trichocarpa* (2)

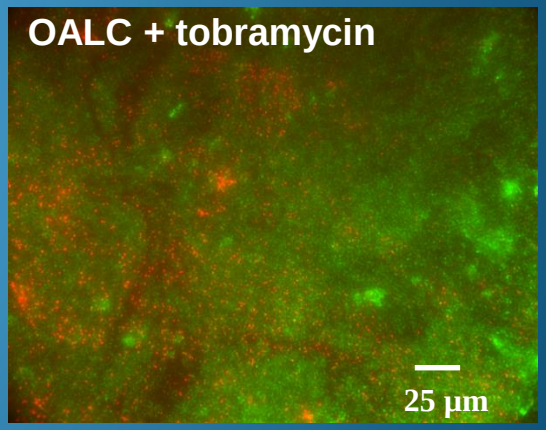



+ 24h




Fluorescence microscopy (x400)

**The new triterpene coumarate:**

- ✓ **Helps an antibiotic to efficiently disrupt a formed biofilm of *Pseudomonas aeruginosa***



Razamiravaka et al, PLoS One, 10(7): e0132791

# Thank you for your attention