

Coconut lethal yellowing diseases

For an integrated control strategy

Coconut lethal yellowing diseases, caused by phytoplasmas, have destroyed numerous coconut plantations in the Caribbean zone and Africa. Over the last 20 years, they have devastated the coconut plantations of the Atlantic coast of Mexico, in Honduras and Jamaica, leaving hundreds of thousands of families without resources, and are now affecting new islands in the Caribbean. Several countries in East and West Africa have also been seriously affected. There is still no remedy, despite international research programmes primarily implemented in the Caribbean and Florida. Research on these diseases is one of CIRAD's priorities.



Coconut lethal yellowing in a fishing village on the Atlantic coast of Honduras. © Michel Dollet

CIRAD diagnosis

It is important to have a method and tools which ensure that this type of disease is not confused with other disorders of the plant. CIRAD therefore proposes:

- A service for the identification and molecular characterization of phytoplasma strains for disease diagnosis.
 - The services of acknowledged experts for a field diagnosis of lethal yellowing type coconut diseases.
 - A full set of diagnosis tools for checking the quality of the seednuts produced.
- The search for vector insects, from tests in cages to molecular analyses designed to determine whether insects are carriers, or even vectors, of pathogens calls for know how over which CIRAD has an increasingly strong command.



For more information

Michel Dollet
Coconut Lethal Yellowing
and Citrus Greening (UR)
CIRAD
TA A-29 / F
34398 Montpellier Cedex 5
michel.dollet@cirad.fr



Phytoplasmas in the sieve tubes of a coconut inflorescence affected by lethal yellowing in Togo. © Michel Dollet

Phytoplasmas, a little-known family of pathogens

Phytoplasmas are cell wall-less bacteria which live exclusively in the sap-transporting vessels (phloem) of plants. It is not known how to grow them *in vitro* or to isolate them. In collaboration with its partners, CIRAD has undertaken important work on studying the sequence of a specific gene making it possible to differentiate between phytoplasma strains associated with lethal yellowing diseases, and to distinguish them from phytoplasmas found on other plants. The results have been used to fine-tune molecular diagnosis tools and are useful for research on vector insects.



Myndus adiopodoumeensis, one of the insects suspected of transmitting coconut lethal yellowing in Ghana. © S. Reignard

Searching for vectors

Phytoplasma diseases are transmitted by sap-sucking insects whose identification is complex. In Florida, the vector is the Homoptera *Myndus crudus*. However, that remains to be confirmed in the other countries of the region. Moreover, is it alone? For Africa, no vector has yet been found, though some species such as *Myndus adiopodoumeensis* (Cixiidae) and some Derbidae are strongly suspected

Gaining a clearer understanding of disease transmission

Although lethal yellowing spread along the Atlantic coast of Mexico like wildfire, its dissemination in Jamaica and Mozambique appears to be much more random. CIRAD is to study the dynamics of disease transmission using spatial statistics methods combined with the use of geographic information systems. Data on the climate, fauna, flora and cultural practices will be gathered in the field. These complementary approaches will provide some very valuable information in the search for vectors and for developing IPM strategies.

Identifying more resistant coconut varieties

Although no resistant coconut variety has yet been identified, tests undertaken suggest that resistance factors are primarily to be found in Southeast Asia and on the Pacific coast of Latin America. Those tests consist in planting candidate varieties ahead of the advancing disease front and waiting for the disease to occur. It can take several years. Material planted in mass in Jamaica following such tests seemed to be suitable for 20 years, but ultimately succumbed massively to the disease. CIRAD is looking into the reasons—genetic or other—for this new epidemic, in order to propose more suitable varieties. One avenue of research being considered consists in seeking the regions of the genome involved in resistance, by studying the evolution of a large number of genetic markers in populations subjected to the disease.



Lethal yellowing in a coconut estate in Honduras. © Michel Dollet

- CIB (Coconut Industry Board), Jamaica
- CICY (Centro de Investigaciones Científicas de Yucatan), Mexico
- CNRA (Centre national de la recherche agronomique), Ivory Coast
- COGENT (Coconut Genetic resources network)
Colegio de Postgraduados, Mexico
- CSIR/IIFT (Instituto de Investigaciones en Fruticultura Tropical), Cuba
- CSIR/OPRI (Council for Scientific and Industrial Research/Oil Palm Research Institute), Ghana
- IPGRI (International Plant Genetic Resources Institute) – Generation challenge programmes
- MNHN (Museum national d'histoire naturelle), France
- University of Arizona, USA

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