

Search for the vector of Cape Saint Paul wilt (coconut lethal yellowing) in Ghana

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Abstract

Phytoplasmas are associated to coconut lethal yellowing disease in several tropical and sub-tropical areas of the world and many coconut palms have been destroyed by this disease. A report of more than 15 years of search to detect insect vector(s) of coconut lethal yellowing disease (Cape Saint Paul wilt - CSPW) in Ghana is presented.

Key words: coconut lethal yellowing, phytoplasma, insect vector, molecular analyses.

Introduction

Phytoplasmas are associated to coconut lethal yellowing disease (LY) in several tropical and sub-tropical areas of the world and infection is usually fatal. Many coconut palms, over the years, have been destroyed by this disease. Phytoplasmas are difficult to isolate and visualize from these plant species and therefore DNA-based molecular techniques for detection and diagnosis were applied (Harrison *et al.*, 1999; Harrison *et al.*, 2002). However, the knowledge about specific disease insect vector(s) is of utmost importance for management towards containment of disease spreading (Been, 1995).

Phytoplasmas are also associated with a coconut lethal yellowing disease (Cape Saint Paul Wilt – CSPW) in Ghana. The known vectors of phytoplasma diseases are either leafhoppers (Membracidae, Cicadellidae), or planthoppers (Delphacidae, Cixiidae, Derbidae, etc.) or Psyllidae.

In our research on the vector(s) of CSPW, all the species of Homoptera Auchenorrhyncha were therefore taken into consideration starting from 1990.

Materials, methods and results

In the 1990s, research mainly focused on the species *Myndus adiopodoumeensis*, *Nzinga palmivora*, some Derbidae, along with Auchenorrhyncha collected from diseased coconut palms and mass released into cages containing healthy young coconut palms. From July 1992 to October 1993, despite 18,000 to 20,000 insects being released into each cage, no proven case of CSPW were obtained.

At the end of 2002, further transmission trials were attempted with cages, each containing 7 coconut palms aged 6 months to 1 year. A sleeve was placed over each palm in order to know precisely the number of insects released onto each plant. The insects (*M. adiopodoumeensis* and all the species of Derbidae) had spent 3 days beforehand in a large sleeve installed on a diseased coconut palm. It was thus possible to release 300 to 600

Myndus and 500 to 900 Derbidae per plant in 4 months. PCR analyses to search for CSPW phytoplasmas in the coconut palms proved negative.

Since July 2005, transmission trials have been resumed on a new footing: construction of cages under shade to avoid excessive temperatures, insects collected from 6 am to 8 am and from 4 pm to 5:30 pm, avoiding the hottest hours, and daily releases. Cages of different sizes were set up depending on the age and size of the coconut palms. Small palms were fitted with a sleeve, whilst the oldest palms were completely covered. In 11 months, 38,116 *Myndus* were released, i.e. around 7,623 adults per plant. However, adult mortality was very high. In fact, the adults had clear positive phototropism and flew to the top of the cages where sunlight, heat and any spiders or ants present soon led to their death. Mortality was considerably reduced by installing mosquito netting over the plants which kept the insects on the coconut palms for much longer. PCR analyses every 2 months to detect CSPW phytoplasmas in the coconut palms exposed to the various insects have remained negative to date (July 2007).

In a “Derbidae” cage, three batches of two coconut palms with individual sleeves received either *Metaphenice stellulata*, or *Patara armata*, or a mixture of 4 species of *Dioscrombus* (*D. luteus*, *D. dilattatus*, *D. nitidus*, *D. mayumbensis*) (table 1). One of the two coconut palms exposed to 4,380 “*Dioscrombus*” tested positive in PCR for CSPW (verification by cloning and sequencing) 4 months after the first releases. However, that palm did not develop any symptom of the disease and

Table 1. Tests with species of Derbidae.

Derbidae	Number of adults per plant	
	July - Nov 05	Dec 05 - Oct 06
<i>Metaphenice stellulata</i>	1,320	10,030
4 species of <i>Dioscrombus</i>	4,380	24,050
<i>Patara armata</i>	1,800	5,500

subsequent PCR analyses remained negative.

Cicadellidae, Cercopidae, Pentatomidae collected by sweeping have also been tested, without success to date.

Since the beginning of 2007, we have been using PCR to seek for the existence of CSPW phytoplasmas in Auchenorrhyncha insects collected from disease-infected zones. Tests are carried out on individual insects, or in pairs or sets of 5. Trials began with *M. adiopodoumeensis*, and Derbidae. A single insect, a *Diostrombus* has proved to be carrying CSPW phytoplasmas to date. Given that the only positive PCR result on caged coconut palms was obtained with a release of *Diostrombus*, those results now lead us to seriously consider the Derbidae option for CSPW transmission.

Nevertheless, as no CSPW syndrome has been obtained on coconut palms exposed to flying insects since research began in the 1990s, it has been decided to widen our investigations to soil-borne insects, scale insects, particularly the *Margarodidae*.

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