

COCONUT CADANG-CADANG DISEASE PRIMER

The contents of this primer were taken from the various publications on Cadang-cadang from 1973 to 2000 by PCA, FAO/UNDP and ACIAR

For more information please contact:

ESTER P. PACUMBABA

Department Manager III

PCA-Albay Research Center, Banao, Guinobatan, ALBAY

Telefax 052 484-6686



Philippine Coconut Authority

Cadang-Cadang Disease of Coconut

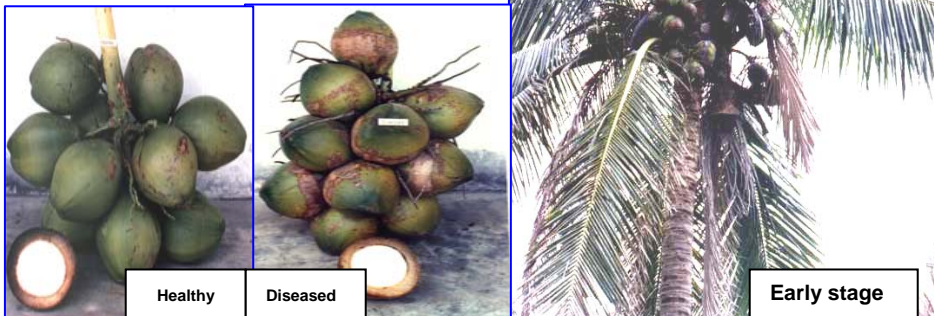


The name Cadang-cadang is derived from the Bicol term 'gadan-gadan' which means dead or dying. It now refers to a premature decline and death of coconut palms in the Philippines associated with viroid infection. The cadang-cadang disease is the only record of a malady that has caused tremendous economic losses in the coconut plantations in the Philippines.

Symptoms of Cadang-Cadang

Palms infected with Cadang-cadang pass through a well-defined series of changes culminating in death. For convenience, diseased palms in the field are classified as being Early, Medium or Late stage.

In the early stage, newly developing nuts become more rounded and have equatorial scarifications. Chlorotic leaf spots begin to appear and inflorescences become stunted. In the medium stage, spathe,



Eradication

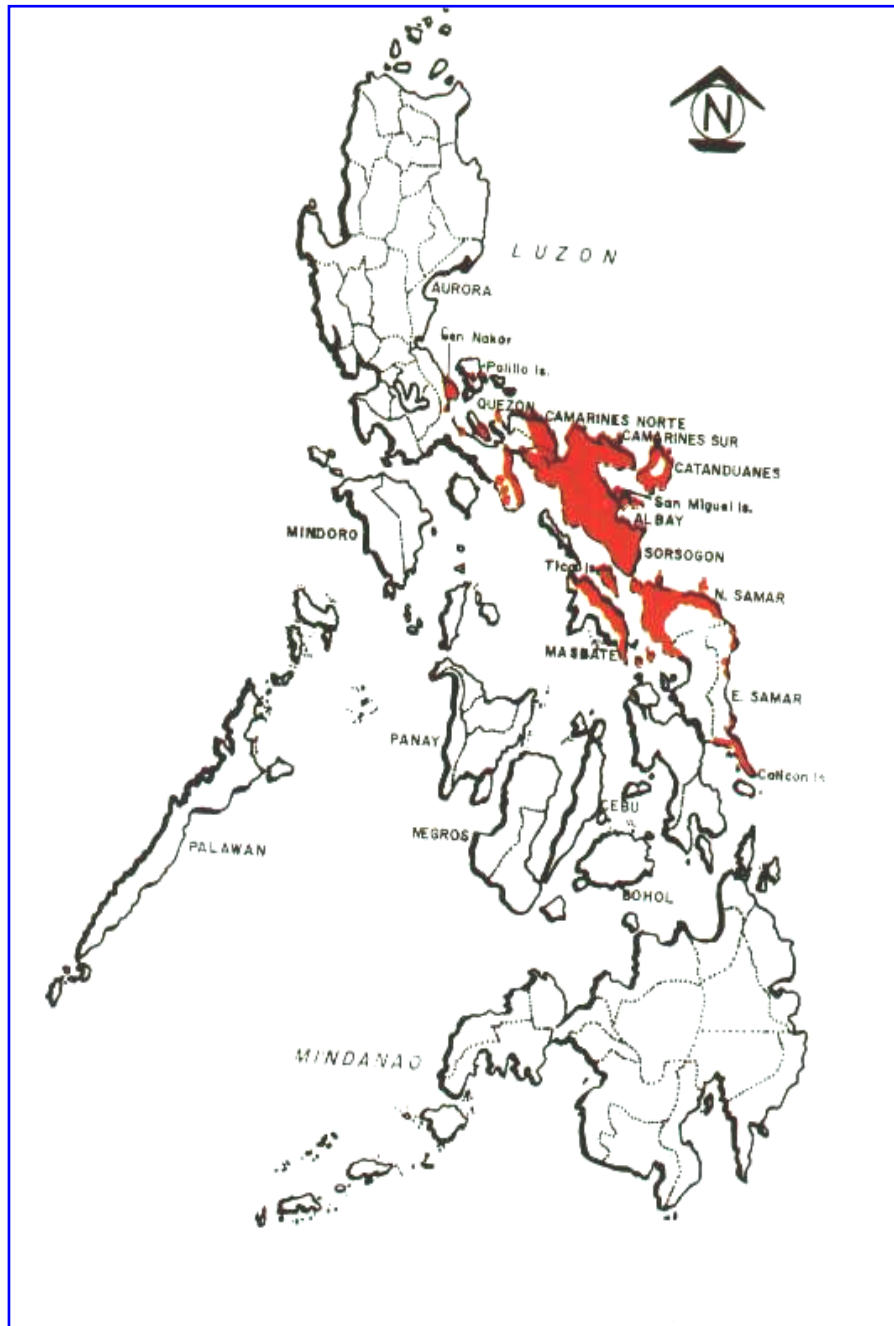
Control by removal of diseased palms has been attempted since the early 1950's. However, early attempts to eradicate the disease from apparently new outbreak areas have not succeeded as infected palms still appear in these areas. With the current advances in disease detection using molecular methods, control by eradication of all palms with viroid detectable by molecular means should be tested.

Quarantine

Strict enforcement of quarantine regulations by concerned government agencies on the safe movement of coconut germplasm from infected areas will prevent further spread of cadang-cadang into disease-free areas.

Resistance

Continued research on cadang-cadang runs parallel to the coconut improvement program in the Philippines. To minimize the risk of an epidemic occurring in new plantings, attempts have been made to find individuals or populations that are resistant or tolerant to cadang-cadang



Map of the Philippines showing Cadang-cadang infected areas (red-shaded)

Geographical location

Cadang-cadang is widely distributed on the Bicol peninsula, Masbate, Catanduanes, Northern Samar and other smaller islands in this zone. Outbreaks have been found in and around Infanta, Quezon, in Eastern and Western Samar and Maripipi Is., Biliran. Small isolated groups of infected palms have been found northeast of the main boundary at Atimonan. At present, the northernmost boundary of disease occurrence is at General Nakar, Quezon and the southernmost at Calicon Is. Guiuan, Eastern Samar.

No diseased palms have been found in the provinces of Batangas, Laguna, Cavite, Aurora and other parts of northern Luzon, the rest of the Visayas and the whole of the island of Mindanao including Basilan.

Coconut Cadang-cadang Viroid (CCCVd)

The detection of two small disease-associated RNAs in 1975 provided the initial clue to the etiology of cadang-cadang. Electron microscopy, nucleotide sequencing and transmission experiments that demonstrated the infectivity of these RNAs finally proved that cadang-cadang is caused by a viroid. It is now referred to as the coconut cadang-cadang viroid or CCCVd.

Viroids are the smallest known pathogens and have been found only in plants. Unlike viruses, they do not have a protein coat, and consist solely of a small circular, single-stranded infectious RNA molecule that can replicate in the host cell and be transmitted independently of any other microorganism. Most viroids known so far have been found in cultivated plants (*e.g.* tomato, coconut, avocado, grapes, hops) and are transmitted mechanically by human cultural practices. Most viroids (like CCCVd) appear to be present in their hosts in very low concentrations and the nature of the host tissue may make it difficult to extract the viroid RNA.

Mode of transmission

The mode of natural inoculation in the field is not known. No insect vector has been found. Positive transmission was obtained through assisted pollination of mother palms with pollen from diseased palms. A small percentage of the progenies produced as well as seednuts collected from cadang-cadang-infected palms were positive for CCCVd. CCCVd was also successfully transmitted to palms thru contaminated harvesting scythes.

Alternate Hosts

Coconut, Anahaw (*Livistona rotundifolia*), Buri (*Corypha elata*) and African oil palm (*Elaeis guineensis*), are the only known natural hosts of CCCVd and only members of the Arecaceae family have been successfully inoculated with CCCVd, for example, Betel nut (*Areca catechu*), Palmera (*Chrysalidocarpus lutescens*), Royal palm (*Oreodoxa regia*) Date (*Phoenix dactylifera*), Manila palm (*Adonidia merillii*) and Macarthur palm (*Ptycosperma macarthurii*). Most of those infected showed stunting and yellow leaf spotting. So far, no inoculated plants in 44 species from 12 other families have become infected after inoculation.

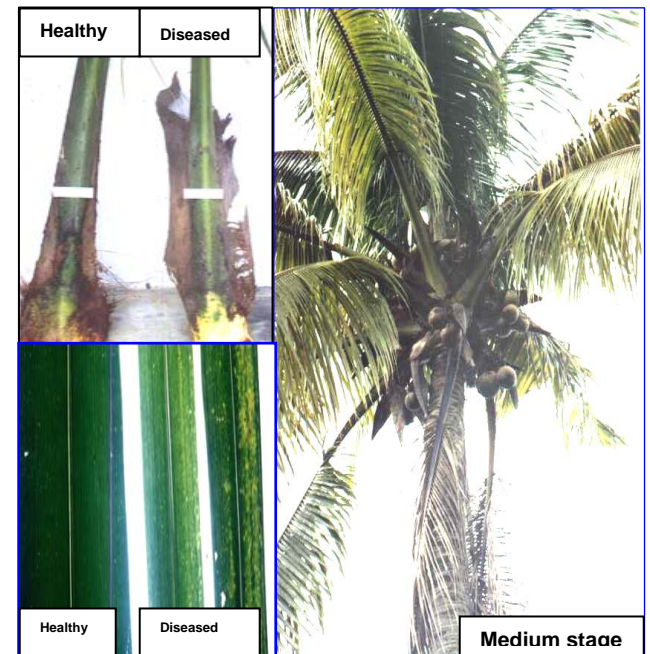
Possible Strategies for Disease Control

Cadang-cadang is contagious and is not likely to be due to soil, physical, biological or chemical factors. At present, there is no direct control measure that can be recommended to control cadang-cadang but several possible strategies can be considered.

. Replanting

The replacement of infected palms or replanting of infected plantations is the earliest recommended means to reduce the losses due to cadang-cadang. This practice has allowed coconut production to continue in cadang-cadang areas.

inflorescence and nut production decline and then cease. Leaf spots become more numerous. By the late stage, the fronds decline in size and number and the leaflets become brittle. Leaf spots coalesce, giving a general chlorosis. The crown size is reduced and later, the palm dies.



This progression of symptoms is remarkably constant with some variation in intensity. The Early stage lasts an average of about 2-4 years, the Medium stage about 2 years and the Late stage about 5 years. Palms inoculated with the CCCVd show similar leaf spot development, reduced frond production, reduced crown size and slower growth.

