

*they still challenge researchers—*

# ‘ CADANG - CADANG ’ & ROOT (WILT) DISEASES\*

Dr. K. P. V. Menon\*\*

**T**WO important coconut diseases that have a lot in common are the “Cadang - Cadang” disease of the Philippines and the Root (Wilt) disease in Travancore-Cochin area of Kerala. The most important point of similarity is, perhaps, the fact that they have so far successfully baffled investigators. They have been known to be prevailing in their respective areas for more than half a century. A critical review of their symptoms etc., forms the subject matter of this article.

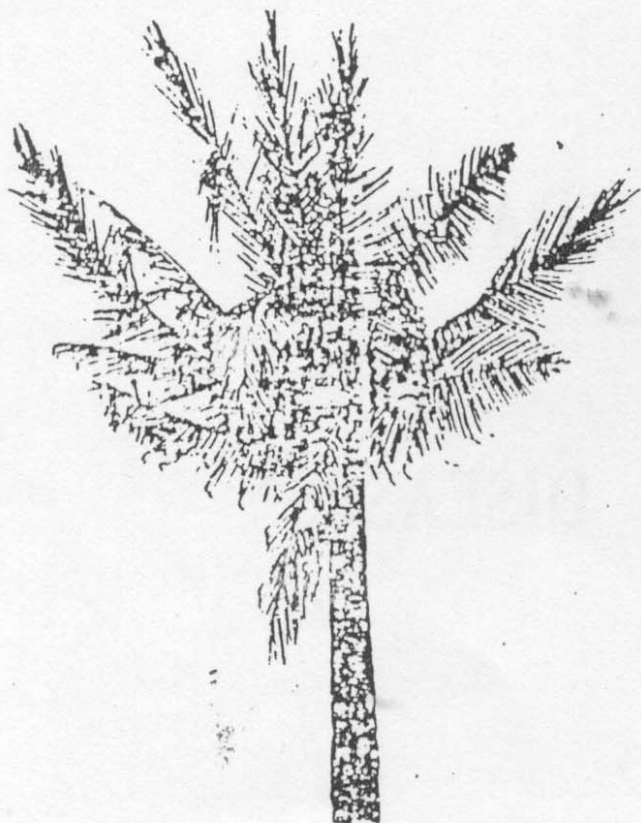
## “Cadang - Cadang”

In the Filipino language “Cadang-Cadang” means failure in growth. It is prevalent in a very severe form in the Bicol Province of the Philippines. In 1953 it was estimated that about 5,52,700 coconut trees were destroyed by the disease, representing a financial loss of about 22,000,000 pesos (Calica and Bigornia, 1953). The disease has been studied in detail by investigators like Ocfemia (1937), Celino (1947)

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\*\* Director, Central Coconut Research Station, Kayangulam



*Fig. 1*  
*Cadang-Cadang disease*  
*(after De Leon, 1951)*



*Fig. 2*  
*Root (Wilt) disease*

De Leon (1951) etc. An early noticeable symptom of disease incidence is a reduction both in size and in the number of nuts produced. Within three to four years after a tree becomes diseased the production of nuts ceases altogether. As the production of nuts decreases the outer leaves of an infected tree starts developing a bronze yellow colour. The pinnae of the leaves gradually turn orange yellow. Small spots are developed on the younger leaves which enlarge to about 3 mm. in diameter. Such spots coalesce giving a pale yellowish and chlorotic appearance to the leaves. The pinnae of the leaves are slender and they tend to bend over and break in the middle. They dry up earlier than those on the healthy palms. After the leaves become

yellow due to disease no nuts are produced in an infected palm even though a large number of spathes appear at frequent intervals. In such flower bunches female flowers are fewer in number. These female flowers do not set. In the later stages of the disease the dwarfed inflorescence that is put out bears only male flowers. Such inflorescences on opening quickly dry up and persist on the tree.

The leaves produced after disease incidence are shorter and smaller and they are also closely bunched at the top of the crown. Due to physiological interference in growth the stem starts tapering (Fig. 1.) The crown soon gets reduced to about 8-10 short, stiff upright bronze leaves. Afterwards the crown itself topples and falls off

leaving a pointed trunk. By this time the roots of the infected palm become discoloured and they soon get rotten and die. Within 2½ to 7 years after contracting the disease the palm dies. Recovery from the disease is very rare.

The disease is infectious in nature. So far no parasitic organism which could be considered the cause has been found associated with the tissues of diseased palms. Fajardo (1953) suspects nutrient deficiency as the cause, while Ocfemia, Celino and others suspect it to be of virus origin. Other palms that are susceptible to the disease are the areca palm, the umbrella palm (*Corypha* sp.) etc.

#### **The Root (Wilt) disease of Travancore-Cochin**

This is a very serious disease of coconuts which is at present confined to the Travancore-Cochin area of Kerala. Annual loss on account of this is computed to exceed a crore of rupees. As in the case of the "Cadang-Cadang" disease of the Philippines this wilt disease also is infectious and systemic and occurs in all the different soil types of the State. Here also recovery is rare.

The important symptoms of the disease are a general wilting of the leaves, flaccidity and ribbing of leaflets and necrosis of leaf tips. In many cases a general chlorosis or yellowing is seen in the older leaves. Closer examination of the inner leaves of an infected tree would show the leaflets having a large number of chlorotic streaks, which subsequently turn brownish and necrotic. With the advance of the disease the crown gets smaller due to progressive reduction

in the number and size of the leaves. Shedding of immature nuts, if the tree is in the bearing stage at the time of infection, is an important initial symptom in many cases. As a result of the disease the coconut palm produces smaller spathes with fewer female flowers. The size of the nuts is reduced. The copra obtained from such nuts is thin, soft and leathery. In advanced stages of the disease the tree is unable to produce fresh flower bunches or leaves (Fig. 2). Eventually the much reduced crown dries up and topples over in the wind leaving the headless pointed stem. The root system of infected palms shows considerable deterioration. Most of the main roots and smaller rootlets may be seen dying up from the tips backwards. Cracks occur on the older regions of the roots, the cortex turns brownish in colour and dries up in flakes. In certain cases the roots may remain apparently healthy even in advanced stages of the disease; but their absorbing region gets covered with a hard hypodermis which results in the cessation of normal functions. With the incidence of the disease the normal capacity of a tree to produce new roots is greatly impaired.

The disease has been investigated by several workers — Butler (1908), Varghese (1934), Menon & Nair (1951), Radha & Menon (1954), Nagaraj & Menon (1955) etc. The investigations carried out so far have revealed that certain fungi are seen associated with the roots of diseased trees. The possible disease causing role of the fungi was examined and it was found that the part played by them could be mostly of a secondary nature. Studies made on the nutritional aspect of the

etiology of the disease have failed to indicate that any major or micronutrient deficiency could be the direct cause. A comparative study of the soils from healthy and diseased areas was made. This included the examination of their chemical and mechanical composition, base exchange capacity, organic matter status, carbon-nitrogen ratio, pH. etc. As a result of this it was found that total calcium, available potassium, base exchange capacity, percentage base saturation, and pH was lower in the soils from diseased areas as compared with soils from healthy tracts. High water-table or poor drainage is generally a common feature of diseased localities. In general prolonged water-logging has a deleterious effect on the root system and it might decrease the capacity of the roots to resist the attack of normally weak facultative soil pathogenic organisms. Comparative chemical examination of the leaves of healthy and diseased trees has shown that there is a general tendency for plant nutrients like nitrogen, potassium, phosphorus etc. to accumulate in the tissues of infected palms. Whether such accumulation is the result of impaired physiological processes or it is due to inadequate translocation is under investigation.

The possibility of the disease being of virus origin is also being studied. Virus transmission experiments conducted so far at Kayangulam in the open under field conditions have indi-

cated that the disease may be a sap transmissible virus.

### **Conclusion**

That there is considerable similarity between the Cadang-Cadang of the Philippines and the Root (Wilt) disease of Travancore-Cochin is evident from the facts given above. While giving a resume of the comparable points, special mention may be made of the infectious nature of the diseases, the age of palms on disease incidence and the characteristic symptoms of the diseases. Palms affected by both the diseases rarely recover, although the period of longevity of the diseased palms may vary from 2½ to 10 or even 20 years. Indications are, that both the diseases may be of virus origin with pathogenic fungi, unfavourable soil conditions, deficiency of plant nutrients etc playing a role in the incidence and severity of the diseases.

The control measures recommended for the two diseases are: (1) the complete destruction of the diseased palms by burning, especially in gardens where the diseases are not widespread, since they are infectious, (2) use of suitable insecticides like DDT or BHC as spray to control the possible insect vectors, and (3) adoption and improvement of the cultural and manurial practices to improve the yield of diseased palms when they survive for long periods.

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