

Diseases Of The Coconut Palm*

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VII. — MINOR DISEASES

This seventh and last article on the diseases of the coconut palm will include those which at present are not considered to be of major importance. They include: wilt (root) disease, root diseases, bitten leaf, St. Mary disease, leaf spots, smut disease, *Exosporium* leaf spot, sooty mold, coconut thread blight, yellowing, drought wilt, pencil point, stem bleeding, and the phenomenon of lightning strike. Any of these diseases, upon further research, may be shown to be of major importance. The main reason why they are now classified as minor diseases is that so little is known about their cause and effect that it is impossible to determine their importance. It was thought desirable to include them in this series so that the reader may have a complete story and a fuller appreciation of the diseases of the coconut palm. Unfortunately, it has not been possible to secure illustrations of the various diseases; and most of the information contained in this article was obtained from the available literature.

The Wilt (Root) Disease of Coconut Palms in Travancore-Cochin

This disease is considered to cause serious damage to the coconut planta-

tions in Travancore-Cochin, India (11, 14). It has been estimated that nearly one fourth of the total area under coconuts in the state of Travancore-Cochin is affected by this disease (14).

The diagnostic symptom of the disease is a flaccidity and ribbing of the leaflets on the outer whorl of leaves, which exhibits wilting, drooping, and an abnormal curvature or bending of the rachis. The vigor of the affected palm is greatly reduced and in advanced stages of the disease the production of fruit is greatly affected, even to the extent of being completely inhibited. In addition to these symptoms, the palms may exhibit yellowing of the fronds and a premature dropping of the fruit (13). Some affected trees may exhibit necrosis of the young leaves (14), which become greyish-black (necrotic) from the tip downward and have a tendency to curl. The necrotic symptoms when observed are associated invariably with the wilt disease (13). Three to fifteen years may elapse from the first manifestation of symptoms until the palm becomes barren. Root decay appears to be closely associated with the disease. As the disease progresses, the number of decayed roots increases and the production of new ones is inhibited (14).

Nagaraj and Menon (13) obtained seven isolates of three species of fungi, *Rhizoctonia solani* Kuehn, *R. bataticola* (Taub.) Butl., and *Botryodiplodia theo-*

*For previous articles in this series, see PRINCIPES 3:5-12; 49-52; 83-86; 117-120. 4:6-9; 40-44.

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bromae Pat., from coconut roots or soil. They attempted inoculation of coconut root tips in artificial media and found that only *Rhizoctonia solani* could parasitize the root tip, thus causing cessation of growth and brown rot of the internal tissues. They could not find any definite correlation between the amount of root decay and the external symptoms of wilt. Some of the plants they designated as healthy controls had decay of the horizontal roots for a depth of three feet. These trees apparently were maintaining what appeared to be a normal healthy condition on their vertical roots alone. Since some palms in the early stages of wilt had no root decay, the authors suggested the name "wilt" as an appropriate term for the disease. They suggested that root decay in the case of the wilt disease is probably of secondary importance (13).

In view of the infectious nature of the disease, lack of visible pathogen (13), failure to detect any nutritional deficiency (19), and similarity to lethal yellowing (unknown disease) in Jamaica (15) and the yellow mottle decline (*cadang-cadang*) disease in the Philippines (8, 17), Nagaraj and Menon suggest that a virus may be the cause of the wilt disease of coconut palms in Travancore-Cochin (14).

These same authors working under field conditions have reported successful transmission of the virus by either mechanical inoculation using Carborundum, or by the banana lace-wing bug (*Stephanitis typicus*) and subsequent symptom manifestation within eight to twelve months from the date of inoculation (14). Other attempted methods of transmission were unsuccessful, including the sap-transfusion method of Nagaraj et al. (12). This disease, in all

probability, should be classed under the group considered in this series as major diseases of coconut palms.

Root Diseases

Besides the root (wilt) disease there are other reports of root decay causing or associated with diseases of the coconut palm. Butler in 1906 (6) recorded *Ganoderma lucidum* (Leysser) Karsten as causing a root disease of coconut palms in India. Since then it has been reported from several countries (4). The symptoms of the diseases are varied, but usually are noted as a withering and dropping of the older fronds. The young fronds may remain green for some time, but the new fronds are successively smaller and yellowish. Flowering dwindles and the palm soon becomes barren. The disease may take three or more years to kill the palm (4).

The fungus *G. lucidum* occurs on many hosts throughout the temperate and tropical regions. The fruiting body of the fungus is described as follows by Britton-Jones, 1940: "The fruit body is bracket-shaped and is stalked. Its size varies from less than one to more than twenty inches in diameter. The thickness of the fruit body likewise varies up to five inches. The stalk measures upwards to four inches in length by about half an inch in thickness; it is cylindrical in shape, erect, and brown to black in color. The upper surface of the bracket is shiny, light to dark brown or almost black, and concentrically furrowed. The shiny surface of the cap and stalk is most characteristic and suggests Japanese lacquer. The margin is generally white and so is the whole of the under surface. Examined closely with the naked eye or lens, numerous minute holes or pits will be seen all over the under surface. It is in these tiny pores

that the fungus produces its spores, which when released are disseminated by the wind" (4).

Besides the root diseases caused by the fungus *Ganoderma*, species of the fungus *Fomes* have been implicated by several investigators as causing diseases of the coconut palm (4).

Control of root diseases may be obtained by the removal and destruction of the diseased palm as soon as it becomes evident that it is infected with either *Ganoderma* or *Fomes*. To prevent spread, it is recommended by Briton-Jones (4) that a trench two feet deep be dug around the infected tree and left open for at least a year. The advisability of such a trench in Florida, especially in urban areas, would be doubtful. It is the opinion of Briton-Jones (4) and Dwyer (7) that root rotting diseases are not likely to be serious where vigor and health of the palms are maintained.

Bitten Leaf

The term "bitten leaf" is used when the young leaves of a palm are deformed upon emergence from the heart. The new leaves often assume various shapes, depending upon the extent of damage to the young pinnae and rachis. These deformities have been attributed to infection by several different organisms (2, 10).

Briton-Jones (4) considers bitten leaf to be a stage of recovery resulting from infection by the fungus *Phytophthora palmivora*, with the severity of the disease depending upon the extent of damage to the heart or bud tissues. Ashby (2) describes two types of bitten leaf diseases in Jamaica: the "hard type" which he associates with a species of yeast; and the "pineapple leaf bitten disease" which he attributes to infection by

the fungus *Thielaviopsis (Ceratostomella) paradoxa* (De Seyn.) Hoehn. Martyn (10) reports reproducing the symptoms of bitten leaf disease by mechanical injury to the heart tissues. He has also isolated *T. paradoxa* from lesions on bitten leaves, but he considers the fungus to be purely a secondary organism. Martyn agrees with Briton-Jones on his interpretation of bitten leaf disease, but considers that the disease may be aggravated by the feeding of beetles or other insects.

Since the symptoms may actually be the result of some predispositional factor such as mechanical injury or insect feeding and/or infection by *Phytophthora palmivora*, it is often difficult to determine the factor or factors responsible for the bitten leaf condition.

St. Mary Disease

The disease owes its name to St. Mary Parish in Jamaica where it has attracted considerable attention at various times. The disease is not necessarily confined to that area but has occurred elsewhere under the names of "leaf disease," "wet weather disease," or "leaf stalk rot." According to Martyn (10), the most conspicuous form of the disease consists of a withering of the leaves. Sometimes only the tip of the frond is affected, which dries out and breaks over. In some cases the entire leaflets turn greyish-brown, but the frond does not collapse. Palms that are constantly subjected to the disease frequently shed their fruit. Sometimes the pinnae in the middle of a frond will wither and drop off, leaving a portion of the midrib bare. Martyn has isolated several species of fungi from brown spots on the leaves, but has never been able to reproduce the disease with them. He suggests that, during stages of vigorous growth, the midrib is very susceptible

to fungus infection or insect feeding, which may cause an injury of considerable extent. It is assumed that the breakdown of the tissue in the petiole could also be attributed to lack of proper nutrients during this period of rapid growth (10).

Ashby (3) isolated the fungus *Phytophthora parasitica* Dastur from palms exhibiting dark brown sunken lesions on the leaf stalks or midribs. The rot often extends through the midrib causing the frond to break at this point. He could not control the disease with Bordeaux mixture or paste, but did achieve fair control by firing or burning. Briton-Jones (4) suggests that probably the firing treatment would cause as much damage as the disease.

The St. Mary disease is not fatal and outbreaks resulting from wet weather right themselves as the weather changes. Martyn suggests that, when the disease is chronic, if cultural practices do not lessen the effects considerably, then it is inadvisable to cultivate coconuts (10).

Leaf Spots

A number of fungi have been associated with leaf spots of coconut palms. Briton-Jones (4) reports that the fungi isolated are only weak parasites at most and are actually not the cause of any specific disease. Briton-Jones (4) and Martyn (10) associate the occurrence of these fungi with some physiological predispositional factors, insect damage, or any condition that weakens the palm to such an extent that these weak or facultative parasites may become established. The fungi *Pestalotia* (*Pestalozzia*) *palmarum* Cke. and species of *Diplodia* have been isolated from spots on coconut palm leaves (4, 10). Ashby (1) has recorded these two fungi and also

species of *Sphaerella*, *Cytospora*, and *Phyllosticta* in association with various leaf spots on unthrifty trees.

The damage caused by *Diplodia* has been termed "die-back" and the disease associated with *Pestalotia palmarum* has been termed "leaf blight," according to Briton-Jones (4) and Martyn (10). *P. palmarum* occurs only in spots on leaves that have taken on a premature yellowing due to other causes. The individual leaflets exhibit yellowish-brown or grey spots (10). Sometimes the tips or margins of the leaves are dead and it is possible to isolate both *P. palmarum* and *Diplodia* species from these areas (4). If the condition that weakens the palm develops quickly, only *Diplodia* species may be isolated; but if it develops gradually, then *P. palmarum* may be isolated. Briton-Jones reports cases in Trinidad where leaves have wilted and fallen from the tree so quickly that *Diplodia* has not started to grow on them. *Diplodia* species are often isolated from the older senescent fronds on the healthiest and heaviest bearing palms.

Briton-Jones (4) and Martyn (10) consider that these fungi, from a practical point of view, cause no damage, so no direct action need be taken against them. If coconut palms are maintained in a healthy condition, then these fungi will only perform their natural functions—the decay of already weakened tissues.

Smut Disease

This is an unimportant disease caused by the fungus *Graphiola cocotis* (*G. cocoina* Pat.). The main symptom of the disease is small raised black pustules surrounded by a pale yellow ring on the upper surface of the coconut leaf (4). According to Briton-Jones, the disease has been reported by Simmonds from Fiji.

Exosporium Leaf Spot

The disease caused by the fungus *Exosporium durum* Sacc. was reported by Reinking (18) from the Philippines as being responsible for scattered or densely crowded wartlike fructifications on the leaves of coconut palms. It is not common and is reported to cause little damage.

Sooty Mold

Sooty mold is characterized by a black, sooty appearance on the coconut leaves produced by the fungus *Capnodium footii* Berk. & Desm., which grows on the honeydew of coccids. Reinking (18) reports its occurrence in the Philippines but does not consider it serious.

Coconut Thread Blight

Coconut thread blight was first described by Bryce (5) in 1924 from New Guinea and was attributed to the fungus *Corticium penicillatum* Petch. It has been redescribed by Dwyer (7) from New Guinea. One case of a similar thread blight disease caused by an unidentified fungus was reported from Trinidad (4).

The mycelium of the fungus grows along the under surface of the midrib (rachis) in the form of thread-like strands. The fungus remains superficial but may kill large areas of the leaflets (4). The older or bottom fronds are attacked and sometimes as much as one third of the crown may be involved. Bryce recommended cutting and burning infected fronds, with a supplemental spray application of Bordeaux mixture. Briton-Jones (4) does not believe that such treatments would control thread blight because of the impossibility of removing all the diseased tissue and the difficulty of spraying the under surface of coconut fronds. Since the disease occurs mostly under conditions of high

humidity and moisture, Briton-Jones suggests the possibility of planting palms further apart to reduce the moisture-retaining capacity of the foliage. He also mentions the financial aspect of such an operation and suggests that it may be better to have a diseased crop under low cost production than a healthy crop under high costs.

Yellowing

Martyn (10) describes two types of yellowing: a) yellowing due to lack of drainage and b) nutritional yellowing. Yellowing of coconut leaves may be due either to a loss or disorganization of the chlorophyll or chloroplasts, or to a partial failure of the green color in the chlorophyllous tissues. Palms on poorly drained soils may yellow to the extent that the central column is affected. The degree of yellowing caused by poor drainage may fluctuate with changes in the water level and is seldom fatal, as palms have grown for years under waterlogged conditions.

Coconut palms exhibiting yellowing due to lack of proper nutrition vary with soil types. They may show a true chlorosis due to the lack of iron caused by an excess of lime in the soil, or they may exhibit a pale yellow during the dry season. A third type of yellowing distinguished by Martyn (10) occurs in palms on good soil in areas of ample rainfall. This is the type of yellowing which occurs in palms affected with the unknown disease or bronze leaf wilt disease. The yellowing in this case is quite intense and usually the whole crown is affected.

Nagaraj and Menon (13) report two types of yellowing in coconut palms in Travancore-Cochin. In one case the yellowing of the outer leaves is associated with shedding of the fruit. They de-

scribe the symptoms of the disease as a yellowing of the tips of the outer whorl of leaves and a premature shedding of young fruit. The inflorescences become discolored and the palms do not necessarily exhibit symptoms of wilt. They have noticed that healthy bearing palms have developed such symptoms and that the disease appears to be infectious. From this brief description the disease sounds very similar to the lethal yellowing (unknown disease) or the bronze leaf wilt disease, but they do not consider the condition serious (13).

The second type of yellowing Nagaraj and Menon class as a general chlorosis that persists throughout the year. They report that palms that have exhibited this general chlorosis over a period of years produce very few nuts.

Drought Wilt

Dwyer (7) used the term "drought wilt" for the condition of wilting in coconut palms due to lack of water. The condition may result in the death of the palm, depending upon the length of time it is without water. Martyn (10) reported similar cases of wilt in Jamaica due to the lack of water. Palms grown on sandy soil without water may start to wither and die. Yellowing of the fronds does not necessarily accompany the condition, and a general shedding of the nuts does not occur. The lower fronds dry up and collapse but the heart leaves remain green for a period of months. Palms in the advanced stages of wilt do not exhibit decay of the heart or bud tissues. Mature nuts from affected trees appear to be dried up and the endosperm is abnormal in color (10). The young inflorescences dry up and are often discolored.

A similar wilt condition has been described from Ceylon (16) and Trinidad

(10). Affected palms may recover with application of water.

Pencil Point

Briton-Jones (4) describes the disease under the term "tapering stem wilt." Martyn (10) considers the term "wilt" misleading and prefers "pencil point." The disease has been known for some time in the Caribbean islands, and similar symptoms have been reported associated with different diseases throughout the world. Several species of fungi have been isolated from trees exhibiting tapering stem, but Briton-Jones does not consider them to be responsible for the condition.

The main symptom of the disease is, as the name implies, a tapering of the stem below the crown. The trunk may dwindle down until it is only a few inches in diameter. The fronds are reduced both in number and size until the crown fails to produce new leaves and death of the palm results. Although palms in the advanced stages of tapering will not respond to nutritional treatments, they will not necessarily die for a period of years (10).

No organism has been found that will produce the disease, and the physiological or environmental factors that cause it are not always clear (4, 10). The exact explanation of why some palms exhibit symptoms of pencil point and others in the same vicinity remain healthy is not understood (10). The symptoms appear frequently with senility of coconut palms. Drought, nutritional imbalance, starvation caused by the loss of soil due to erosion, and poor drainage have been suggested as some of the conditions that will cause pencil point or tapering stem wilt disease (4, 10). Nagaraj and Menon (13) have reported the disease to occur in Travancore

core-Cochin, India. They have never noticed any cases of a vigorous, healthy young palm developing symptoms of tapering stem.

In the cases where the tapering stem symptom occurs with other diseases such as yellow mottle decline (*cadang-cadang*) the condition could possibly result from starvation or nutritional imbalance brought about as a secondary effect of the disease upon the vascular system of the palm.

Stem Bleeding

The stem bleeding disease is usually the result of a previous injury to the trunk of the palm (4, 10). The fungus *Thielaviopsis (Ceratosomella) paradoxa* obtains entry through the wound and causes an internal rot of the stem tissue (14). The presence of the disease is indicated by a reddish-brown liquid that oozes out through cracks in the stem, then may trickle down the stem for a distance of a few feet, and dry up and turn black (4). The internal tissues of the trunk below the original point of entry may be rotted or yellow in color. Infection may occur anywhere in the trunk where there is an injury. Young palms may be killed by the disease since the entire trunk is of soft tissue and very susceptible to the decaying and rotting action of the fungus (4).

Most of the wounds are caused by carelessness of workers, especially with machetes, in coconut plantations. If care is practiced not to wound the trunk of the coconut palm, then the disease will be of little importance. If the disease occurs, then the diseased portion should be excised and the exposed area treated with a fungicide or wood preservative (10).

Lightning Strike

Lightning strike is not a contagious disease but does take its annual toll of coconut palms. The phenomenon is not too serious in the Caribbean area, but is of considerable importance in Malaya where electrical storms are frequent and violent (9). Palms that are struck exhibit symptoms of a collapse of the crown, splitting of the stem, and exudations from the stem (4, 9). The stem is very soon attacked by boring insects and saprophytic fungi (9). The extent of the damage and severity of the symptoms depend upon the strength of the electrical charge. Britton - Jones (4) draws attention to the fact that the weeds at the base of the palm and some of the adjoining palm fronds may be scorched by lightning, thus making diagnosis comparatively easy.

Palms killed by lightning should be removed and others planted in their places (9).

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