

Diseases of the Coconut Palm*

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The diseases of the coconut palm (*Cocos nucifera* L.), including some that have not been reported to occur in the United States, will be discussed in a series of papers to appear in this journal. It is anticipated that each issue will contain information useful to the palm fancier in the way of disease description, names of causal organisms, and recommended control measures. The information to be presented here and in future issues was obtained in part through cooperation with the State Plant Board of Florida, who made possible trips to the Caribbean area to obtain information and illustrations of the various diseases of the coconut palm.

The diseases to be discussed in this series of articles have been classified into two groups—major and minor—based upon relative importance only. Thus any disease, after further research has been accomplished, may be reclassified. The diseases considered to be of major importance drastically affect the yield and/or kill the trees. These are the diseases of lethal yellowing (unknown disease), bronze leaf wilt, red ring, bud rot, yellow mottle decline (cadang-cadang), and frond drop. The minor diseases 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.

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The etiology or causal organism is definitely known for only two of the major diseases, red ring and bud rot. The red ring disease is caused by the nematode *Aphelenchoides cocophilus* Cobb, and bud rot is caused by the fungus *Phytophthora palmivora* Butl. Yellow mottle decline and lethal yellowing are suspected to be caused by viruses. The bronze leaf wilt disease in Trinidad has been attributed to physiological drought. Since diseases similar to bronze leaf wilt have been reported from other countries, it now appears that factors other than physiological drought are needed to explain its cause or etiology. Frond drop was originally thought to be caused by a genetical controlled structural weakness of the fronds, but lately this disease and the wilt (root) disease of coconut palms in Travancore-Cochin are also suspected of being virus in origin.

When consideration is given to the difficulty in conducting research with the coconut palm, it immediately becomes apparent why so little is known about the causal agents (etiology) of its many important diseases. The lack of basic information and research on the anatomy, histology, physiology, and nutritional requirements of the coconut palm has greatly hindered any research program on the etiology of the diseases that affect it.

For further information the reader is requested to consult the literature cited at the end of each article and Briton-Jones' book *Diseases of the Coconut Palm* which reviews the literature on coconut diseases prior to 1940.

1.—LETHAL YELLOWING OR UNKNOWN DISEASE

Lethal yellowing or unknown disease is not of recent origin and has been reported from several of the Caribbean islands. Probably the first account of it, according to Johnson (5), is that given by Fawcett, who reported its occurrence in Montego Bay, Jamaica, in 1891 and in the Island of Grand Cayman in 1889. The disease has since been reported from Jamaica, Haiti, Bahamas, and Cuba (2, 3, 6, 7, 9). The

disease was originally known as bud rot until Ashby (1) termed it west-end bud rot to distinguish it from the common bud rot caused by the fungus *Phytophthora palmivora*. The term west-end bud rot was used to indicate its restriction to the west end of the Island of Jamaica. Leach (6), while making a comparison of a similar disease in Trinidad with the bud rot disease in Jamaica, suggested the name unknown



1. Young coconut palm in Key West, Florida, exhibiting symptoms similar to those attributed to the lethal yellowing or unknown disease.

disease for the latter. This name has been quite widely used and accepted. Although the name does not necessarily define the symptoms of the disease, it certainly has described its etiology or cause. Recently Nutman and Roberts (10) working with the disease in Jamaica suggested the name lethal yellowing. In Cuba the disease is referred to as *podricion del cogollo* (rot of the heart or young leaves).

A disease of coconut palms heretofore unreported in the United States occurs in Key West, Florida. At present only a comparison of the symptomatology between this and the other diseases of the coconut palm has been made. It appears that the disease is similar to or identical with the lethal yellowing disease of coconut palms in Cuba and Jamaica.

The difficulties and misinformation that may arise from such a comparison are immediately realized when consideration is given to the fact that diseases with similar symptoms may be caused by different organisms and diseases with different symptoms may be caused by the same organism.

The disease was first noticed in a small area of Key West, Florida, in 1955. Since then more than 800 diseased trees have been removed and destroyed. One of the first symptoms is a premature dropping or shedding of the nuts or fruit. The young inflorescence while still in the spathe may be a deep brown (necrotic) instead of the normal creamy yellow. The inflorescence when opened soon dries up and becomes blackened. The lower fronds become yellow and the upper ones progressively yellow until the entire crown consists of yellowish-bronze fronds. Figure 1, photograph taken in Key West, Florida, shows a coconut palm in an

early stage of the disease. The lower fronds are yellowish-bronze. The tree was devoid of fruit and the inflorescences were dry and black. The tree was eventually removed by the owner. Hydrotic or water-soaked spots occur at the base of the still folded leaves and may eventually result in a soft rotting of the heart or bud. The heart or bud of the palm dies and secondary organisms enter and cause decay.

Figure 2, photograph of a palm in Key West, illustrates the more advanced stages of the disease. The remaining upright fronds are almost completely yellow. The fronds that are hanging down by the trunk have dried up and are brown in color. The fronds are easily removed from the tree and the heart gives off a very offensive odor.

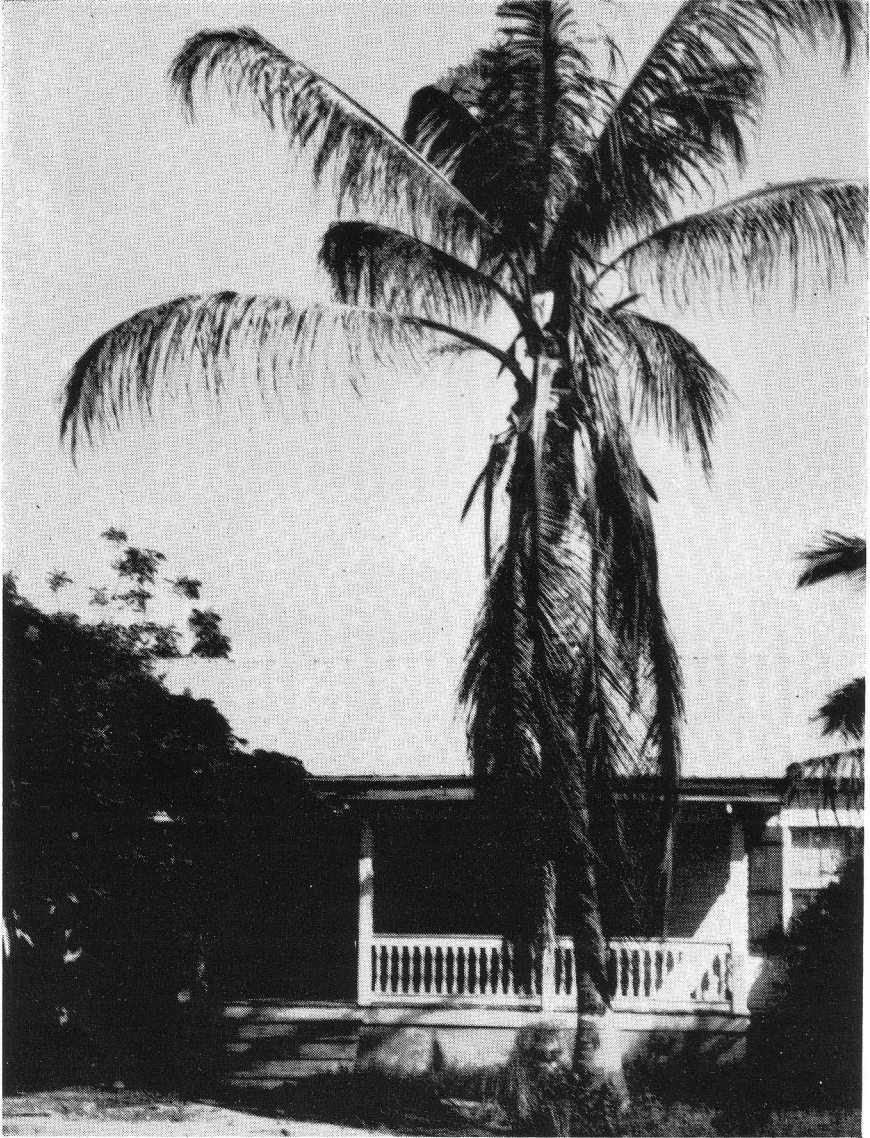
Figure 3 illustrates the advanced stages of the disease in Jamaica. The heart fronds have collapsed and the remaining fronds are yellowish bronze. The inflorescences are blackened and dried and the tree is devoid of fruit. The yellowing of the fronds continues over a period of two to four months, at which time the entire crown is yellow and the heart dies. The coconut palm has but one growing point; thus the tree is doomed when the heart or bud dies. There are no reported cases of recovery from the disease (10).

The fronds continue to fall until all that remains is the naked trunk. Figure 4 illustrates the devastating nature of the disease in a coconut plantation in Jamaica, which is worthless for coconut production although a few have escaped infection.

This disease has been attributed to several different agents. Deficiencies and toxicities of the soil (4) or bacterial and fungal infections have been implicated as the causal agents. Pres-

ent information indicates that the disease probably is not caused by soil conditions because palms become infected on many different soil types (6, 8, 10). The failure by many workers to detect a bacterial or fungal pathogen seems to

eliminate these strongly suspected causal agents. The pattern of field spread, infectious nature of the disease, and lack of a visible pathogen strongly support the hypothesis that the disease is caused by a virus. Nutman and Roberts (10)



2. Coconut palm in Key West exhibiting symptoms of advanced stages of the disease. The crown fronds are yellowish-bronze and the fronds that are hanging down are dry and brown. The tree is devoid of fruit.

have demonstrated the presence of binucleate cells in infected plants. This abnormality does not occur in healthy palms. Since the binucleate condition

has been reported by other workers to occur in other hosts as an internal symptom of virus infection, Nutman and Roberts have used this information, sup-



3. Advanced stages of lethal yellowing in Jamaica. Note collapse of heart fronds and blackened necrotic inflorescences.

ported by serological results and pattern of field spread, to support the virus hypothesis.

At present no known control measures are available. No chemical cures are known, and once a tree becomes infected it eventually dies. In Jamaica the disease apparently is limited in its spread

by the removal and destruction of diseased trees (10).

The Malayan dwarf coconut palm appears to be highly resistant to or immune from infection (3, 10). Although inoculation experiments have not been conducted, palms of the Malayan dwarf variety that have been growing in the



4. Dead coconut palms resulting from the devastating effects of the unknown disease in Jamaica.



5. Malayan dwarf coconut, green variety, growing in the area affected by lethal yellowing in Jamaica. Note height of palm and yield of fruit.

diseased areas of Jamaica and Cuba for more than ten years have exhibited no symptoms of the lethal yellowing disease (3, 10). This coconut variety, because of its apparent natural resistance, is being used for replanting purposes in the disease affected areas of Jamaica and Cuba (3, 10).

The dwarf coconut, contrary to the implications of the terms, grows to considerable heights (Figure 5). The palms are dwarfed only in the sense that they start to produce fruit approximately three to four feet above ground level (Figure 6). The Malayan coconut occurs in several varieties based upon the color of the fruit. The three most commonly occurring varieties are the green, yellow, and golden.

Seed nuts of the Malayan dwarf coconut for replanting purposes should be obtained from parent trees in pure stands. The dwarf variety will hybridize

with the tall susceptible variety and the offspring or progeny from such a cross may not possess the high degree of resistance or immunity exhibited by the parent.

At present the following control practices are recommended for the area affected by the disease in Key West, Florida: 1) Remove and destroy by burning all diseased trees; 2) if possible, spray the diseased and healthy surrounding palms with a mixture of insecticides before removal of the diseased trees; 3) replant seedlings of the Malayan dwarf coconut.

Acknowledgments

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6. Malayan dwarf coconut, yellow variety, growing in Cuba. Note height of fruit production.

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EDITOR'S CORNER

Volume 3 commences a new palm year with articles by some authors already familiar as former contributors. New names are those of Douglas Knapp, a native Floridian and graduate of the University of Florida, who is Assistant County Agricultural Agent of Dade County, Florida; of Robert W. Read, a New Jerseyite recently graduated from the University of Miami, who has worked at the Fairchild Tropical Garden and who is continuing his studies in the graduate school at Cornell University; of Dr. M. K. Corbett, a native of Nova Scotia, graduate of McGill University with a Ph.D. in plant pathology from Cornell University in 1954, and now on the staff of the University of Florida. Dr. Corbett's article is the first of seven which will appear in PRINCIPES.

Mrs. Wait has forwarded several interesting letters which lack of space prevents printing in this issue. They will appear in succeeding issues. If you have notes or comments which may be of interest to other members of the Society they will be welcomed in this or other columns.

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