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RED RING DISEASE AND PALM WEEVIL - THREATS TO THE COCONUT PALM

by

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INTRODUCTION

The red ring disease is a lethal malady of coconut palms((Cocos nucifera) and is widespread in Central and South America. It is very difficult and costly to combat, and Departments of Agriculture should be on the alert against its possible accidental introduction into the South Pacific region. The author studied the problem during two visits to Mexico in 1975 and 1977, and it is hoped that the information summarized in this Circular will be useful to agricultural workers in the South Pacific.

Large numbers of palms aged 3 to 10 years are killed by red ring disease each year in the Mexican state of Tabasco (Fig. 1), and these losses discourage producers and hamper plantation rehabilitation programmes. Sanchez Potes (1967) estimated that in certain Pacific coastal regions of Colombia, 30-80 per cent of the palms had been killed, destroying the livelihood of more than 2,000 small scale producers. The oil palm Elais guineensis is also attacked.

WHERE THE DISEASE OCCURS

Red ring disease affects palms from Mexico (Bedford, Ocampo and Reyes, 1978) through Central America to Brazil, and has been particularly studied in Trinidad, Venezuela, Mexico, also Colombia and El Salvador.

CAUSE OF RED RING DISEASE

The disease is caused by a nematode worm, Rhadinaphelenchus cocophilus, about 1 mm long, which destroys cells in the stems, petioles, and the cortex of roots. Eggs are laid between the cells, and they hatch into juvenile worms which puncture cells, leading to the disintegration of the cells and the formation of microscopic cavities filled with worms. The presence

of the worm in the stem is associated with blockages or abnormalities in the xylem vessels which normally conduct sap upwards.

SYMPTOMS OF RED RING

Symptoms may vary somewhat from country to country, probably due to differences between local coconut varieties, and also ecological differences (Dean and Velis, 1976).

1. In Trinidad and Mexico, first symptoms are usually seen in palms 3 to 10 years old. In El Salvador they commonly occur in trees up to 25 years old, and even in trees 60 or more years old.

2. Golden-yellowing begins at the tips of the older fronds and moves inwards and upwards to the younger leaves. Or, the dying leaves may turn brown from the tips inwards; this may be associated with some nut fall.

3. When the trunk is cut across, a red or brownish-red ring is seen, about 3-4 cm wide, located 4-5 cm inside the outer circumference of the stem (Fig. 2). Sometimes the ring is diffuse, giving a very wide discoloured area.

4. Heart liquefaction or "crown rot" may occur, often with an unpleasant odour.

5. In Trinidad the palm normally dies within 12-18 weeks of the first clear symptoms, but in El Salvador it is reported that infected palms continue to live for several years, producing some nuts.

Fig. 1: Palms killed by red ring disease (arrows) in a plantation in Tabasco, Mexico (July 1975).

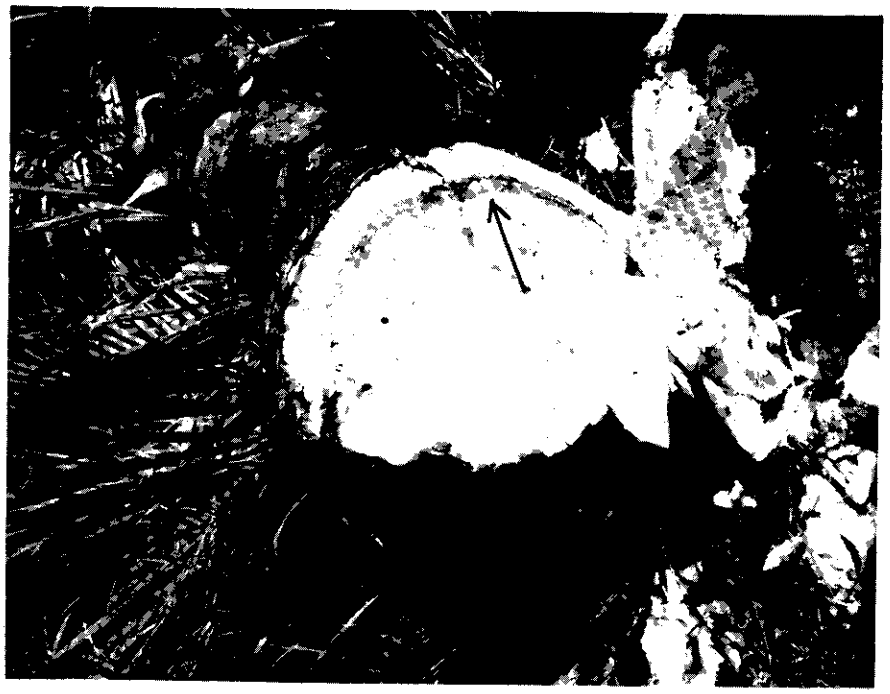

Fig. 2: Arrow indicates red ring in trunk of diseased coconut palm.

THE PALM WEEVIL (RHYNCHOPHORUS)

Various species of Rhynchophorus, which belong to the weevil family (Curculionidae) (Figs. 3, 4) of the beetles (Coleoptera), are important pests of palms in various parts of the tropical world. One species, R. bilineatus, is an important pest in Papua New Guinea.

Fig. 3: A. Rhynchophorus palmarum adult male; B. female.

The weevils are often attracted to wounds or existing damage, especially on young palms. The female makes holes with her long proboscis in the soft tissue of the palm. In the bottom of each hole she places an egg with her ovipositor. Larvae hatching from the eggs feed on and destroy the

soft internal tissues, and also open the way for secondary bacterial rotting in the stem, producing a stench of decay. The palms usually die following weevil infestation, and often the crowns fall over, due to weakening of the stem by the tunnelling larvae. After moulting 6-10 times the larvae build cocoons of tangled fibres in which they pupate.

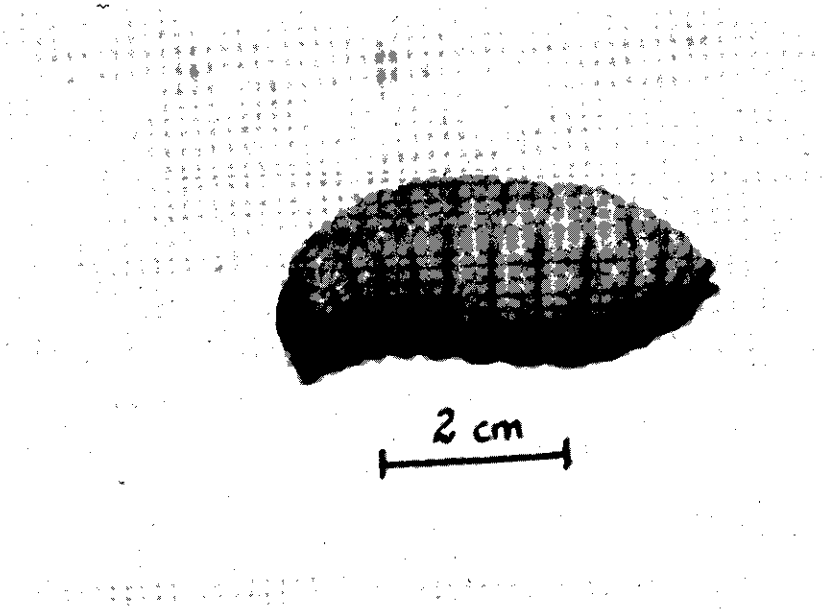

Fig. 4: Rhynchophorus palmarum larvae

TRANSMISSION OF RED RING DISEASE

The red ring nematode appears to be mainly transmitted by the weevil Rhynchophorus palmarum (Hagley, 1963, 1965; Blair, 1969; Fenwick, 1969). The following account is based on the work of Griffith (1968) in Trinidad.

To cause the disease, a sufficient number of nematodes, the inoculum potential, must be injected into the palm. Certain small-sized weevils (less than 30 mm long) have large numbers of nematodes in their body cavities, especially near the ovipositor. When they oviposit in the soft tissue, a sufficient number of nematodes to cause infection is inoculated into the tree along with the eggs, resulting in the development of both red ring symptoms and weevil larvae. (Unmated weevils may lay infertile eggs and deposit nematodes, and in those cases only the red ring disease develops subsequently).

Usually, further weevils are attracted to the leaf axils of diseased trees. The injected nematodes become adult and multiply in the tree, and new generations of juvenile worms are produced as the disease follows its course. Most of the nematodes die off in the decomposing palm tissue 15 to 20 weeks after infection. However, weevil larvae developing and feeding in the

diseased palm become infected with these juvenile nematodes. Many nematodes are destroyed by the insect's defence reaction in its body against infection. But up to 6,000 nematodes can survive and persist in the body cavity of the small-sized weevil strain when it transforms into an adult. The nematodes do not multiply in the insect. These small insects make up only about 16 per cent of the weevil population in an area, and half of them are females. They are the first to emerge from the decomposing palm, and usually fly to inflect healthy palms within a radius of 20-30 m of the original diseased palm. Other weevils emerging later are attracted to the now diseased trees to feed and oviposit. Thus much of the weevil population does not normally attack healthy palms. Only about three per cent of palms in a plantation show weevil attack without red ring disease.

Small body size appears to be an inherited characteristic of the weevil, and this appears to be correlated with an inherited inability to remove large numbers of nematodes from the body cavity by defence reaction. The presence of many nematodes in the body reduces the quantity of fat tissue in the adult vector insect, so it lays fewer eggs than non-vector females. Some small vector females are not able to mate successfully with larger weevils, but would still deposit eggs, although infertile ones, and inoculate nematodes into palms. This accounts for some palms in a plantation showing red ring disease without accompanying weevil infestation.

In Trinidad, disease occurs as a result of weevil activity in the crowns, whereas in El Salvador weevil attack and thus nematode infestation can occur at the base of the palm, or in the crown.

CONTROL MEASURES

Direct control of the nematode is not possible at present, so control measures are aimed at controlling the vector weevil.

1. Destruction of diseased palms

   Trees dying or dead from red ring should be cut down as soon as possible to prevent escape of weevils from them. The wood should be burned, but this is cumbersome and costly. Alternatively, the wood may be used to make traps.

2. Traps

   A successful trap has been used in El Salvador (Dean and Velis, 1976), It consists of eight pieces of split palm stem soaked with a solution of the insecticide Lannate, piled up and covered with leaves. In Tabasco, palm stumps have been slightly hollowed out on top to form a dished cavity into which Lannate solution is poured. Weevils are attracted to this and die on contact. Although considerable numbers of weevils are killed by this method, it is expensive and has to be repeated continually.

3. Attractants

   Hagley (1965) tested a number of chemicals and caught significant numbers of both sexes of the weevil in field traps baited with a mixture of malt, skatole and iso-amyl acetate. Unfortunately, this work has not been followed up.

4. Biological control

Very little is known about natural enemies of Rhynchophorus. Ants may enter weevil holes and force the larvae to leave the palm where they die from desiccation (Dean and Velis, 1976). Bedford (1974) found the palm weevil R. bilineatus in New Britain to be parasitised by a nematode. Candia and Simmonds (1965) reported a tachinid fly parasite emerging from Rhynchophorus pupal cocoons in Bolivia, but there has been no further investigation of this. In 1977 Bedford (personal observations) carried out sets of laboratory experiments in Tabasco, in which spores of the entomopathogenic fungus Metarrhizium were applied to the surface of R. palmarum larvae and adults, which subsequently were killed by characteristic growth of the fungus. Further experiments with this and other pathogens could lead to the development of useful control aids.

IMPORTANCE TO THE SOUTH PACIFIC

It would be advisable for agricultural officers in the South Pacific to be aware of the red ring disease problem, as it is conceivable that nematode-infested weevils might reach Polynesia, Hawaii, or points further west, on shipping originating in Central or South American ports.

ACKNOWLEDGMENT

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