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RECENT STUDIES ON THE ROOT (WILT) DISEASE

by

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...ction

...e root (wilt) disease of coconut has been the subject of intensive study recently, ...of its economic importance. The surveys have confirmed its continuous spread, ...lly along river banks. The causal organism has been still elusive but recent ...ments hold out promise of a tolerant hybrid variety which may be of help to the ... cultivator.

...

...l (1968) reported that the infected tree slowly declines in vigour and is not ...lly killed. It is the super imposition of the leaf rot disease caused by *...thosporium halodes* on the root (wilt) diseased tree that contributes to its rapid ...ration.

...Radha and Lal (1972) reported that the symptoms of the disease are complex and ...le. Of the visual symptoms, flaccidity of leaves and leaflets, yellowing of leaves ...rginal necrosis of leaflets are frequently associated with the advanced stages of ...se. They reported that flaccidity was the common symptom and in the majority of young ... the only symptom. Foliar yellowing and marginal necrosis often appeared at a later ...(Radha & Lal, 1972). George and Radha (1973) evolved a formula to index disease intensity ...ding the weighted average grade points of the different symptoms on all the leaves of ...m, thereby reducing the disease-intensity complex to a single numerical expression. ...diseased palms have a very poorly developed or defective root system. Percentage of ... roots is greater in the diseased palms (Michael, 1964).

... Indira and Ramadasan (1968) reported internal browning, disorganization of the ...ular tissue and formation of tylosis in metaxylem element in the tip region of roots ...ing no outward damage, of palms growing in the diseased areas. More recent studies ...icate that 4 to 30 percent roots in apparently healthy palms show this internal ...ning. (Potti and Radha, Unpublished).

Epidemiology

In our underplanted population of 216 West Coast Tall seedlings growing in a heavily infected garden at Kayangulam a close correlation between age of bearing and susceptibility to disease was noticed by Ramadasan et al. in 1971 (Fig. 1).

The possible association of river water with the spread of the disease was stressed by Gopinathan Pillai et al. (1972). They reported heavy incidence of the disease on coconut palms on the banks along the course of all rivers from Trivandrum to Trichur. They made the interesting observation that the banks of the lower tidal parts of Karuvannoor and Chalakudy rivers in the north and Vamanapuram and Neyyar rivers in the south were disease free whereas their upper parts near the foot hills were heavily infected (fig. 2 and 3). They also reported occurrence of healthy pockets in diseased tract and diseased patches in healthy tracts near the borders of the diseased tract.

The disease is prevalent in an almost continuous tract from Neyyattinkara the southernmost taluk of Kerala, to Amballoor in Trichur district of the same State, an area of about 250 thousand hectares. Kulasekharam in Kanyakumari district of Tamil Nadu which is adjacent to Neyyattinkara taluk is also diseased.

Losses due to the disease

It is difficult to estimate the loss in yield due to the slow and debilitating nature of the disease. A recent field study undertaken on crop losses indicates 101 and 55 million nuts per year in Alleppey and Quilon districts respectively. Percentage of reduction over healthy reported in this study that is, 31.5 in the early stage of disease and 71.5 in the advanced stage of disease is comparable to that reported by Ramadasan et al. (1971). Based on this data an overall annual loss of about 300 million nuts due to this disease may be estimated (George, personal communication).

Ramadasan et al. (1971) pointed out that trees that got diseased before flowering may not flower at all. Also, younger plantations (under plantings and replantings) in the infected areas show faster deterioration after getting diseased (Lal, 1964). This would seem to indicate that actual losses due to the disease are more than what would be estimated from a standing crop of bearing trees alone.

Aetiology

Transmission trials

The involvement of a biological agent with the disease is best evident from its spreading nature. In a field experiment conducted at Trichur just outside the northern border of the diseased tract, coconut seedlings and young palms were inoculated with buffer extracts of infected leaf tissue by abrasion. No symptoms were noticed. In another experiment, West Coast Tall seedlings were raised in large (120 cm x 180 cm) cement tanks containing soil collected from the same locality (Trichur), but which also contained a large quantity of roots from infected trees. Typical symptoms of flaccidity appeared on 5 out of 5 seedlings maintained at Kayangulam and 5 out of 6 seedlings maintained at Trichur. 2 of the 5 seedlings at Kayangulam have also developed leaf rot disease subsequently. This experiment adds more evidence to the soil-borne nature of the disease reported by Shanta et al. (1964).

Virological studies

Earlier work indicated the association of a mechanically transmissible, soil-borne pathogen responsible for producing the diagnostic foliar symptom of flaccidity on inoculated coconut seedlings. Apart from direct transmission tests on coconut, these studies were conducted using cowpea (*Vigna sinensis* Endl.) as an indicator host. The symptoms produced on the inoculated cowpea seedlings were malformation and sometimes necrosis of the uninoculated first trifoliate leaf (Shanta and Menon, 1960, Holmes et al. 1965). Since 1964-65, the degree of susceptibility of cowpea to infection was variable reported by Lal in 1968. The progress of work therefore has been seriously recent years. It was noted that the susceptibility of cowpea was affected by ations of atmospheric temperature. For instance, when average atmospheric was above 30°C, incubation of inoculated plants at 25 to 26°C for 24 to 48 hours fection. Also, sudden cooling of the atmosphere by summer showers seemed to ctivity. Because of this erratic behaviour of cowpea, search for other possible indicator hosts has been attempted.

mar et al. (1969, 1971) reported the occurrence of a rod shaped virus 320-360 mμ in association with the disease and suggested that this may be the causal agent ase. This virus was later isolated from trees in disease free tract also. They the virus on Chenopodium amaranticolor and reported its positive reaction with saic virus antiserum. Pathogenicity and serology studies done by others however nfirm these results (Hariharasubramanian and Shanta, 1971). More recent studies, ous tubular particles (1.0 to 2.0 μ x 19 -23 mμ) which break up into shorter g high speed centrifugation. These resemble tobacco mosaic virus in size and large numbers in developing root and leaf tissue of healthy as well as diseased

al studies

ctonia solani and R. bataticola are the fungi associated with excessive root diseased trees. This root damage or rot appears subsequent to the appearance of mptoms. However, the observation that internal browning of roots may precede mptoms kindled new interest in the fungi isolated from these roots and in their disease incidence.

logical studies

ivastava et al. (1969) observed a characteristic streaming movement of bacteria tively identified as Pseudomonas sp.) in the vascular tissues of the roots of d trees.

ogical studies

udies on nematodes were primarily initiated when a search for biological agents transmission through soil was necessitated. Preliminary observations indicated sence of Xiphenema and Longidorus, species of which are reported as virus itters in other crops (Weischer, 1967, Mathen, 1969). A wide distribution of lus similis has been found in Kerala soils. A higher percentage of soil and root s from the diseased localities yielded this nematode as compared to those from y areas.

onditions and nutritional studies

he soil conditions responsible either directly or indirectly, for the incidence disease still remain rather undetermined. An impaired nutrient balance in the of the diseased tract was indicated in general. A lower exchangeable Ca and Mg in soils from diseased areas was seen in earlier studies. It was therefore idered that this was probably one of the factors predisposing the palm to infection. fore an experiment was done to study the progressive deterioration if any, in the um and magnesium status of soils and tissues to serve as predisposing factors. dical sampling and analysis of soil and leaf samples from diseased pockets km south of the northern border of the diseased tract, as well as from healthy area d the border, were done. The results do not show any correlation between Ca and Mg s of soil or leaf tissues and disease incidence. An extensive field survey showed Mn, Mo and Zn were low both in soil and leaf samples collected from root (wilt) ted areas (Pillai, et al. 1975).

Diagnosis of the disease

The primary foliar symptom of the disease i.e. flaccidity of leaves, is rather difficult to be discerned due to the mildness and variability of its expression. A diagnosis of the disease thus becomes essential for purposes of research and also f detection of the disease in the field when checking up fresh outbreaks.

Intensive work to develop a test such as a dependable test plant, serodiagnosi test based on biochemical or physiological aberration, is in progress. A remote sen project carried out on coconut showed that the crowns of healthy coconut trees appe in infra-red false colour films whereas apparently healthy recorded a weaker infra-r reflectance in the film as measured by microphotometer. It would therefore appear th disease could be detected by this technique even before visual symptoms appeared (Dakshina-moorthy et al. 1971). A follow up study on the appearance of symptoms woul probably help to confirm these observations.

Control

A field survey (Rawther and Pillai, 1972) of the disease affected tract undertak study the performance of various hybrids and varieties along with a large number of West Coast Tall (WCT) palms showed that the Dwarf x Tall (DxT) and Tall x Dwarf (TxD) hybrids have significant field tolerance to the disease. A more extensive survey is i keeping with the above observations when only 9.3 percent disease incidence was notic the DxT hybrids as against 11.4 percent in the TxD and 40.7 percent in the WCT. The percentage reduction in yield in the different groups are 20.4 in DxT, 18.2 in TxD and in WCT. Large scale trials to test the susceptibility of 72 cultivars in gardens hav been in progress since 1972. Field Trials are also in progress at the farm of the Res Station at Kayangulam where 16 cultivars/hybrids are being tested.

Under a project on mixed farming started in 1970 to develop a system of alternate husbandry in coconut gardens, fodder crops like hybrid napier, Pueraria javanica and Stylosanthes gracilis are raised as intercrops and milch cows maintained. The fodder raised under irrigated conditions. Observations on the condition of coconut trees aff by root (wilt) disease in this plot showed considerable reduction in yellowing of the l but no remission of other symptoms like flaccidity or necrosis was noticed. An increa about 29 percent in yield of nuts was also recorded from this plot.

Discussion

In spite of the fund of information available on the various aspects of the root (w disease, no clear evidence as to its aetiology is available. The possibility of a "virus-like" pathogen being the causal agent of the disease has been surmised (Menon, 1961, Lal, 1964 and Holmes et al. 1965). However, in the absence of any direct evidence by way of a reliable test plant or detection by electronmicroscopy or indirect evidence such as positive response of diseased trees to tetracycline treatments, this cannot be confirmed.

The field observations strongly indicate the involvement of a pathogen, probably that is carried over by water or through a vector that moves through water. The detecti of the nematode Radopholus similis in large numbers in the diseased tract compared to healthy has created an interest in that group of organisms, which had not been studied in relation to the root (wilt) disease so far. Work on bacteria is also expected to clarify the role of Pseudomonas sp. in disease incidence. The exact nature of internal browning reported to be found in roots with no external injury and the particular pathogen associated with it are engaging the attention of scientists now working on this disease.

…s quite probable that the imbalance of cations and anions noticed in diseased …ots the imbalanced nutrition of the tree that would predispose it to the attack …tive parasites. Thus any single factor may not by itself be able to bring out …mages to the crop evident today. In fact the nutritional studies in progress on …ing at Kayangulam are expected to throw light on the role of major nutrients in …ance of disease and its development. These trials and the large scale testing of …and cultivars for field tolerance to the disease form the two major approaches …ds achieving a partial "control" of this disease.

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Data other than those in published papers are taken from the Annual Reports of the Central Plantation Crops Research Institute.

Fig. 1 - Age and commencement of bearing in coconut palms in relation to the development of root (wilt) disease

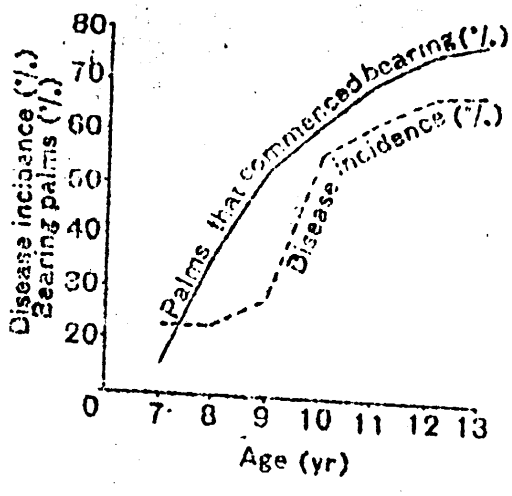

Fig. 2 - Distribution of root (wilt) disease in Trichur District

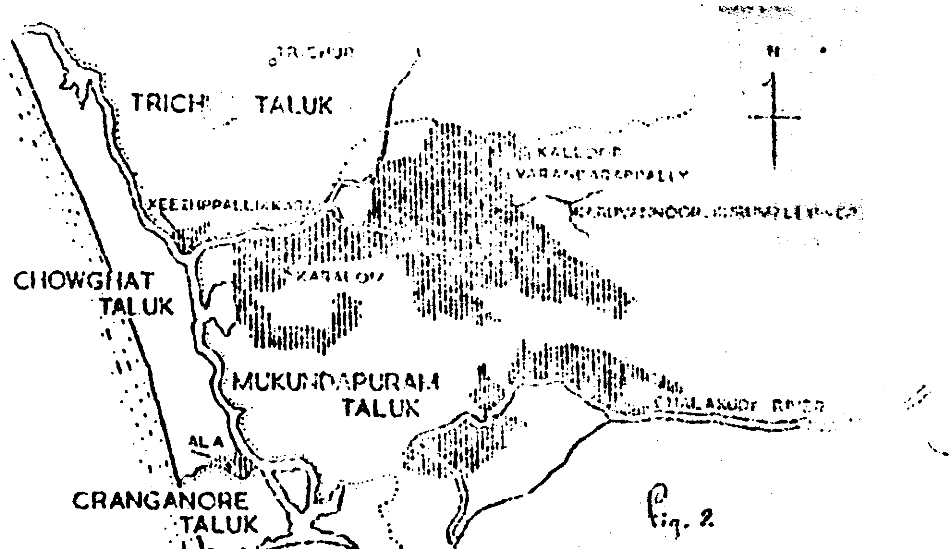

Fig. 2
Distribution of Root (wilt) disease in Trichur Dist.

Fig. 3 - Distribution of root (wilt) disease in Trivandrum and Kanyakumari Districts

Fig. 3
Distribution of Root (wilt) disease in Trivandrum and Kanyakumari Dist.