

## MYCOLOGICAL INVESTIGATIONS

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Butler (1908) observed Botryodiplodia theobromae Pat. commonly occurring in the roots of diseased palms and suggested that the root-rotting due to this fungus could be the cause of the disease. His studies failed to reveal the occurrence of any other fungi having a pathogenic role. Subsequent investigations (Menon and Nair, 1949) showed the constant association of the species of Rhizoctonia viz. R. solani Lutu and R. bataticola (Taub) Butl. in the roots of diseased palms besides B. theobromae. Comparative studies on the occurrence of these two fungi in healthy and diseased areas indicated that R. solani is more specific than R. bataticola, being confined to the roots of disease affected palms. (Radha and Menon, 1954). However, in a heavily diseased area like Kayangulam its presence was occasionally encountered even in the healthy roots of apparently healthy palms. Detailed studies on the frequency of occurrence of these organisms in relation to foliar condition of palms showed that R. solani is present in the roots of 16.0% of the apparently healthy palms and 45.0% of palms showing definite symptoms of the disease (Radha, Unpublished). Other fungi recorded by Radha and Menon (1954) were Neocosmospora vasinfecta Smith, Gloeosporium sp., Gliocladium sp., Pestalotia sp., Fusarium sp., Curvularia sp., Chaetomium sp. and Trichoderma sp. Roots of Arachis hypogaea, Vigna sinensis and Cajanus indica grown in between diseased palms were found to harbour R. bataticola, B. theobromae, Pestalotia sp., Neocosmospora sp., Fusarium sp., Chaetomium sp. and Trichoderma sp. (Lily, 1964).

Rotting of roots to the extent of 50 to 60% has been observed in the healthy palms as compared to 64 to 94% in diseased palms at Kayangulam. Percentage of root-rot in a disease free area viz. Kasaragod ranged from 3.6 to 13.0% (Radha, unpublished). However, Thomas Joseph and Jayasankar observed in 1980 (unpublished) that the rate of root rot was not statistically different between apparently healthy and root (wilt) affected palms. Indira and Ramadasan (1968) observed internal browning of vascular elements sometimes extending into the cortex at the apical region of actively growing roots of diseased palms and mild internal browning of roots of apparently healthy palms growing in disease.

affected gardens. Lily and Thomas Joseph (1975) reported the frequency of occurrence of Cylindrocarpon effusum and Fusarium equiseti in roots of apparently healthy palms as 12 to 20%. Many healthy looking roots from apparently healthy and diseased palms had fungal hyphae in metaxylem (Govindankutty and Vellai-chamy, 1976). Thomas Joseph (1978) reported occurrence of Cylindrocarpon effusum Bugn., Fusarium equiseti (Corda) Sacc., Monocrosporium bembicodes (Drechesler) Subram., Penicillium javanicum var. Bayma, P. spiculisporum Lepman and Graphium sp. in similar material. Cylindrocarpon sp. were also isolated from burrowing nematode lesions on roots from lowlying and irrigated plots (Lily, 1977).

Inoculation experiments with R. solani and R. bataticola in the field as well as under pot culture conditions brought about rotting of roots but failed to produce the foliar symptoms characteristic of root (wilt) disease (Menon and Nair, 1951). Infectivity of these organisms was aggravated by waterlogging and acidity (Menon, Nair and Pandalai, 1952). Lily (1960) confirmed the effect of R. solani in developing localised rotting of roots in young palms where again the foliar symptoms failed to manifest.

Inoculations on healthy and diseased palms under field conditions resulted in higher incidence of root rot in the latter group. The fungi got established in only 19.0 to 55.0% of the inoculated roots of healthy as compared to 85.0 to 100.0% in the diseased. In the healthy group of palms infectivity increased from 19.0 to 100.00% with the development of disease. Further trials on potted palms which developed flaccidity of leaves consequent to mechanical transmission (Shanta, Thomas Joseph and Lal, 1964) showed root rotting on inoculation with R. solani (Radha unpublished).

Observations of Radha and Menon (1954) revealed that the rhizosphere microflora of coconut progressively decreased with the onset and progress of disease. Radha and Menon (1957) reported differential behaviour of R. solani and R. bataticola with regard to their moisture requirement. While R. solani preferred moderate soil moisture above 20% for mycelial growth R. bataticola was found to tolerate a wider range of soil moisture. Radha and Rawther (1959) subsequently observed a comparable reduction in soil microflora during rainy season. Low soil microbial activity in terms of CO<sub>2</sub> evolved from a unit quantity of soil in unit time was recorded in the diseased area (Rawther and Radha, 1963). Besides the soil environment the altered host physiology is an important factor in determining the establishment of fungal infection. Increase in amino acids in root

exudates of diseased palms and increase in the in vitro growth of R. solani in the presence of such exudates have also been recorded (Radha unpublished). In the light of the above findings it is considered that the infectivity of R. solani is conditioned by various factors which induce the soil inhabiting fungus to assume the role of a root infecting pathogen. Recent observation of Lily and Jayasankar (1974) that R. solani elaborated pectin methyl esterase, polygalacturonase and pectin transeliminase in culture filtrates further support the role of R. solani in causing the rotting of roots in the disease complex.

Preliminary pathogenicity trials with F. equiseti and C. effusum isolated from externally healthy roots having internal damage indicate that they are capable of establishing infection in coconut roots. Their presence in the vascular tissues has been observed in the inoculated roots of potted seedlings maintained in sterile soil. As the infection progressed roots of the coconut seedlings exhibited black necrotic patches on the mature parts and also rotting of the root tips. The number of rotted roots increased as the period of incubation prolonged resulting in a deteriorated root system as occurring in root (wilt) affected palms (Lily, 1979). Seedlings inoculated with C. lucidum also developed deteriorated system as compared to the uninoculated. In vitro studies with C. effusum, C. lucidum and F. equiseti indicated their ability to develop PPO activity and to degrade pectic substance in liquid culture. Study on total phenol content of the inoculated roots with the above fungi revealed reduction of total phenols (Lily, unpublished). Preliminary studies also indicated the ability of F. equiseti to elaborate a toxic principle in vitro and to produce necrotic patches on leaf blades of coconut sprouts. Vein clearing, yellowing and necrosis etc. developed in tomato test plants when treated with the culture filtrate of the fungus. (Lily, unpublished). Investigations on the role of these organisms as vascular pathogens initiating root damage and the disease syndrome are justified.

Studies on the fungal flora associated with the leaves of palms exhibiting various symptoms like flaccidity, necrosis and yellowing were also carried out on 52 young palms (Radha, unpublished). The results indicated that healthy leaflets from a palm free of any disease symptoms as well as those having flaccidity on older leaves do not harbour any fungi. On the other hand externally healthy leaflets from palms showed necrosis, yellowing or leaf spot/blight on older leaves were found to yield Pestalotia palmarum Cooke in 50.0 to 80.0% of the samples. Nearly 60.0 to 100.0% of leaflets presenting any one of these symptoms were also colonised by fungi like Curvularia sp., Gloeosporium sp. or Diplodia sp. (Radha, unpublished).

## REFERENCES

- BUTLER E.J. 1908. Report on coconut palm diseases in Travancore. Agric. Res. Inst. Pusa Bull. No. 9
- GOVINDANKUTTY M.P. and K. VELLAICHAMY. Histopathology of roots of coconut palm affected with root (wilt) disease. Int. Symp. Cocon. Res. Devel. Abst. 46.
- INDIRA, P. and A. RAMADASAN. 1968. A note on the anatomical derangement in the root (wilt) diseased coconut palms. Curr. Sci. 37 : 290-291
- LILY, V.G. 1960. Studies on some fungi parasitic on the coconut palm. M.Sc. Thesis, Kerala University. 165 pp.
- LILY, V.G. 1964. Studies on the fungi associated with the root (wilt) disease of coconut palm. Indian Cocon. J. 17 : 77-84
- LILY, V.G. and N.P. JAYASANKAR. 1974. Pectinolytic properties of certain fungi associated with the diseased coconut palms. J. Plant. Crops. 2 : 17-19.
- LILY, V.G. and THOMAS JOSEPH. 1975. Ann. Rept. CPCRI. p.48.
- LILY, V.G. 1979. Preliminary studies on the association of Fusarium equiseti (corda) Sacc and Cylindrocarpum effusum Bugn with coconut root (wilt) disease. Proc. PLACROSYM II pp. 325-329.
- LILY, V.G. 1977. Annual Report, CPCRI, Kasaragod, Kerala. p.53.
- MENON, K.P.V. and NAIR, U.K. 1949. The wilt (root) disease of coconuts in Travancore and Cochin. Indian Cocon. J. 3 : 40-44.
- MENON, K.P.V. and NAIR, U.K. 1951. Schème for the investigation of the root and leaf diseases of the coconut palms in South India. Consolidated final report of the work done from 8 March 1937 to 31 March 1948. Indian Cocon. J. 5 : 5-19.
- MENON, K.P.V. and NAIR, U.K. and PANDALAI, M.M. 1952. Influence of waterlogged soil conditions on some fungi parasitic on the roots of the coconut palm. Indian Cocon. J. 5 : 71-79.
- RADHA, K. and MENON, K.P.V. 1954. Studies on the wilt (root) disease of the coconut palm. A comparative study of the coconut palm. A comparative study of the rhizosphere microflora of coconut from diseased and healthy areas. Indian Cocon. J. 7 : 99-106.
- RADHA, K. and MENON, K.P.V. 1957. The genus Rhizoctonia in relation to soil moisture. 1. Studies on Rhizoctonia solani and Rhizoctonia bataticola. Indian Cocon. J. 10 : 29-36.
- RADHA, K. and RAWTHER, T.S.S. 1959. Observation on the seasonal variations in the rhizosphere microflora of coconut with special reference to fungi. Proc. 1st Conf. Cocon. Res. Workers Trivandrum India. 298-305.
- RAWTHER, T.S. and RADHA, K. 1963. Studies on the microflora of coconut soils - Observations on the microbiological activity of coconut soils with reference to the root (wilt) disease. Indian Cocon. J. 16 : 115-126.

SHANTA, P., THOMAS JOSEPH and LAL, S.B. 1964. Transmission of root (wilt) disease of coconut. Indian Cocon. J. 18 : 25-28.

THOMAS JOSEPH. 1978. Some fungi associated with the root system of coconuts in the root (wilt) affected area. Curr. Sci. 47 : 586-587

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