

## DISTRIBUTION AND INTENSITY OF ROOT (WILT) DISEASE OF COCONUT IN KERALA

N. GOPINATHAN PILLAI, S. B. LAL\* AND P. SHANTA

Central Plantation Crops Research Institute, Regional Station, Kayangulam, Kerala

### ABSTRACT

A survey conducted recently to study the distribution and intensity of "wilt" disease of coconut in Kerala revealed its incidence along with leaf rot disease in six districts: Trivandrum, Quilon, Alleppey, Kottayam, Ernakulam, and Trichur. In the north, the disease occurred upto Ala, Varandarappally, and Kalloor of Trichur District. In the south, palms in Nemum, Ottassekharamangalam, and Maranelloor were infected. Earlier reports of the disease were confined to gardens between Quilon and Vamanapuram in the south and Ochenthuruthy and Malayatoor in the north. Sporadic occurrence of this disease was also noticed in Kulasekharam and Vallom villages of Tamil Nadu. The spread was faster, more conspicuous, and rampant in sandy, sandy loam, and clayey soils and on the banks of rivers and canals. Intensity of disease was higher in sandy, sandy loam, and clayey soils than in laterite soils. Over 2.5 lakhs hectares of coconut plantations in Kerala are estimated to be affected by this disease.

### INTRODUCTION

VARGHESE (1934) gave the first report of coconut wilt disease from Erattupetta of Kottayam District after the floods of 1882 and subsequently from Kaviyoor, Kallooppara and Kayangulam of Alleppey District (Fig. 1). He recorded isolated centres of infection between Cochin and Kottarakara and suggested that the disease possibly broke out from more than one focus of infection. Menon and Nair (1951) conducted a comprehensive survey and observed that the areas bordered by Quilon in the south-west, Punaloor in the south-east, Ochenthuruthy in the north-west and Malayatoor in the north-east were affected by the disease (Fig. 1). Severe incidence of "wilt" was recorded by them in places around Kayangulam, Thiruvalla, Alleppey, Changanacherry, Meenachil, Pathanamthitta, Mattancherry, and Ernakulam. Verghese (1959) made a reconnaissance survey of the coconut growing tract of the erstwhile Travancore-Cochin State and recorded pockets of infection beyond Quilon in a few villages east of Attingal on the banks of Vamanapuram river (Fig. 1). In the present study, an intensive survey was therefore initiated for studying the extent of disease spread and intensity of "wilt" and leaf rot diseases of coconut in south and central

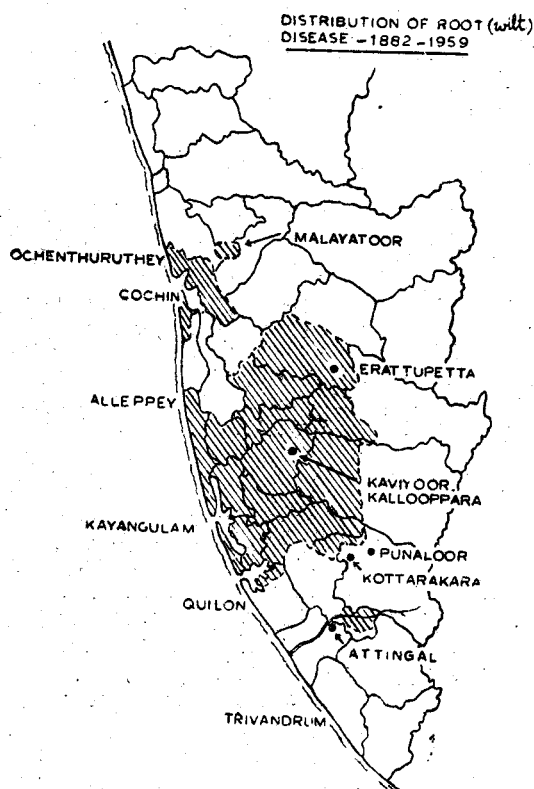


Fig. 1

\* Present Address : ITEC Virus Pathologist, C/o Embassy of India, Kabul, Afghanistan.

Kerala with special emphasis on "wilt". The results of the survey are summarised in this paper.

#### MATERIALS AND METHODS

The survey was conducted by random sampling design. Observations on percentage incidence of fresh outbreak of "wilt" and leaf rot, history of the disease, topography, soil types, and water table were recorded from a minimum of three plots each in 600 villages selected from 36 taluks of six southern districts of Kerala, viz., Trivandrum, Quilon, Alleppey, Kottayam, Ernakulam, and Trichur. An intensive garden to garden survey was also carried out in Mukundapuram, Trichur and Chowghat Taluks of Trichur District to delineate the border between healthy and diseased tracts.

#### RESULTS AND DISCUSSION

Table I presents the taluk and district-wise percentage incidence of "wilt" and leaf rot diseases. Their incidence in relation to different soil types is given in Table II. The intensity and distribution of the diseases are mapped out in Fig. 2.

#### *Extent of Diseased Areas in Kerala*

In general, "wilt" and leaf rot were present in varying intensities in almost all the taluks of Trivandrum, Quilon, Alleppey, Kottayam, and Ernakulam Districts and in the southern taluks of Trichur District (Fig. 2). The disease was observed to have established almost contiguously from Maranelloor and Ottassekharangalam in the south to Kallor and Varandappally in the north in the midland region and from Nenum to Ala in the coastal tract. The extreme south-eastern point of infection was recorded in Aryankavu village, west of Vallom. However, in between these places, as well as in heavily infected districts, pockets of healthy areas and gardens in which infection had only just made its appearance were not uncommon. Heavy infection was noticed in Karunagappally, Karthikappally, Kuttanad, Kanjirappally, Meenachil, and Kanayannoor Taluks. Menon and Pandalai (1960) had estimated the extent of diseased area to be forty thousand hectares. From the present survey, it is estimated that out of 7 lakh hectares of coconut plantations in Kerala, 2.5 lakh hectares are affected by this disease.

TABLE I  
*Incidence of "wilt" and leaf rot in Kerala in April 1971*

District	Taluks surveyed	Percentage incidence	Remarks
Trivandrum	Neyyattinkara	1.0	m
	Trivandrum	0.5	m
	Nedumangad	8.7	m
	Chirayinkil	6.3	m
Quilon	Quilon	13.8	m
	Kottarakkara	14.9	m
	Pathanapuram	35.7	M
	Pathanamthitta	37.8	M
	Kunnathur	29.9	M
	Karunagappally	55.4	S
Alleppey	Karthigappally	72.4	S
	Mavelikara	43.0	M
	Chengannoor	36.6	M
	Thiruvalla	43.5	M
	Kuttanad	77.4	S
	Ambalapuzha	22.4	m
	Shertallai	20.8	m
Kottayam	Changanacherry	49.5	M
	Kottayam	39.8	M
	Kanjirappally	57.6	S
	Peermade	37.8	M
	Meenachil	55.6	S
	Vaikom	36.2	M
	Udumbanshola	Nil	H
	Devikulam	Nil	H
Ernakulam	Thodupuzha	42.1	M
	Moovattupuzha	14.5	m
	Cochin	35.9	M
	Kanayannoor	52.8	S
	Kunnathunad	16.5	m
	Alwaye	21.0	m
	Parur	30.1	M
Trichur	Cranganoor	Nil	H
	Chowghat	0.6	m
	Mukundapuram	6.3	m
	Trichur	Nil	H

H—Healthy

M—Moderate—Above 25% but less than 50%.

S—Severe—Above 50%.

m—Mild upto 25%.

TABLE II  
*Incidence of "wilt" and leaf rot in relation to soil types*

Soil types	Total number of palms		Percentage incidence
	examined	diseased	
Laterite	17116	3763	22.0
Sandy	2818	987	35.0
Sandy loam	4426	1574	35.6
Clayey	758	354	46.7
Alluvial	2159	628	29.1



### *Distribution of Disease in Border Areas*

The survey of Trichur District revealed the occurrence of mild and moderate incidence of "wilt" in combination with leaf rot in 50% villages of Mukundapuram Taluk and Ala village of Chowghat Taluk. All the other villages of this district were free of the disease except for a few doubtful cases in Keezhppalikkara village. The disease was almost contiguous from Varandarappally in the east to Karalom in the west. The affected areas in between are on the banks of Karuvannoor-Kurumali river (Fig. 3). It would appear that the disease spread down the river banks from Varandarappally in the foot hills resulting in the formation of several pockets of infection. Sporadic incidence of disease was noticed in places further interior to the banks also. There is apparently no plausible explanation for such random distribution. Occurrence of discrete reservoirs of infection in such areas, spread to adjacent areas by effective carriers of the pathogen and/or distribution of the infected seed materials, could perhaps be possible answer.

In the south, many villages of Nedumangad and Chirayinkil Taluks, Nemum of Trivandrum Taluk, Maranelloor and Ottassekhra-

mangalam of Neyyattinkara Taluk in Trivandrum District presented both 'wilt' and leaf rot (Fig. 4); villages other than the three mentioned above, of Trivandrum and Neyyattinkara Taluks were free of the diseases. An isolated pocket of infection was noticed in Kulasekhar in Kanyakumari District (Tamil Nadu) which was the southernmost point of infection.

### *Disease Incidence in Relation to Topography/Soil Conditions and Water Movements*

Traversing from Punaloor to Shenkottai in the eastern hill slopes, infection of mild and moderate intensities was noticed in scattered patches in Piravanthur, Edamon and Aryankavu villages. Similarly, heavy incidence of disease was recorded around Kulathupuzha, Keni, Ranni, Kanjirappally and Poonjar in the foot-hills of the Western Ghats; population of coconut in this area is, however, low as compared to the coastal sandy area. In the lateritic midland region, disease is prevalent throughout the areas specified, but there are scattered healthy pockets in between. There are instances of individual diseased palms standing in laterite areas for many years without any fresh outbreak in the neighbourhood. On the other hand, the spread

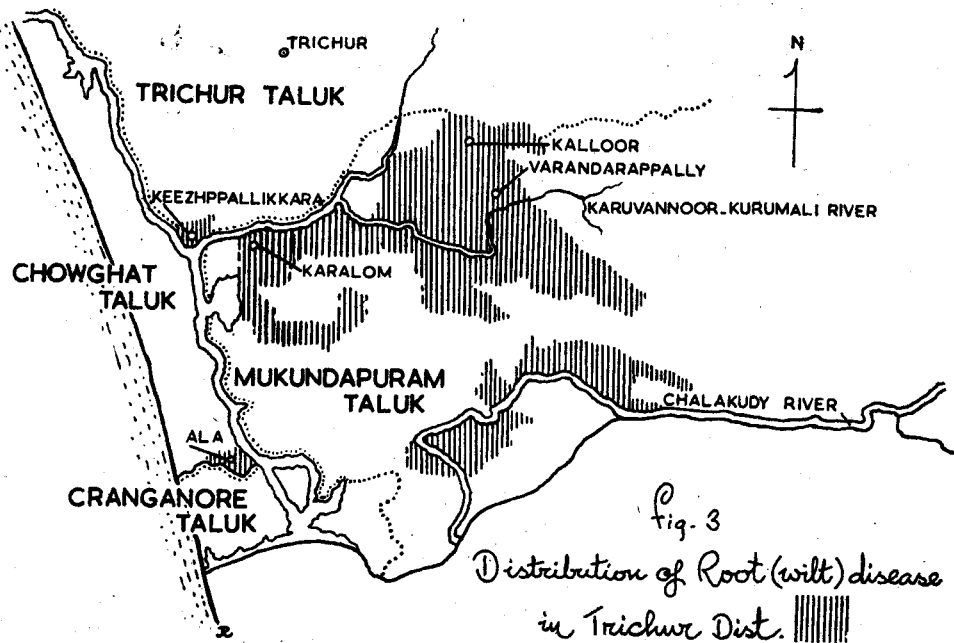


FIG. 3

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

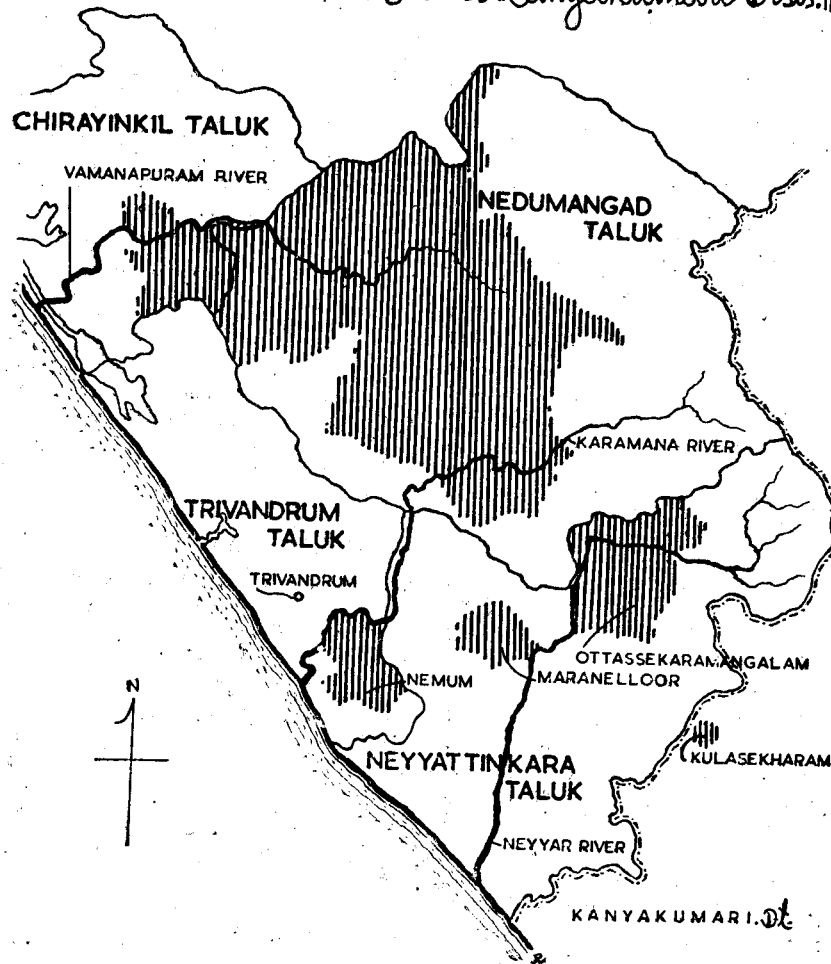


FIG. 4

of the disease was noticed to be faster and more acute in sandy, sandy-loam, clayey, and alluvial soils than in the laterite (Table II). A similar trend was noticed in the waterlogged low-lying areas and banks of rivers and canals where the soil is poor in its moisture retentive capacity and aeration. Incidence of "wilt" and leaf rot was noticed in many gardens of the reclaimed 'Kari' soils near Thottappalli, where the soil has a low pH and is rich in organic matter and soluble salt contents. In Kuttanad, a badly affected area, which is periodically subjected to inundation, reclaimed bunds with healthy palms were frequently seen. Rejuve-

nation of old plantations with quality seedlings from healthy areas probably accounts for this.

*Role of River Water in the Spread of Disease*

A possible association of river water with the spread of the disease has been suggested by many workers (Varghese, 1934; Menon and Nair, 1951; Pillai and Pushpadas, 1966). The data collected in the present survey support this view as the coconut palms in the banks along the course of all the rivers from Trivandrum to Trichur were invariably heavily infected by both the diseases. However, banks of the lower

tidal parts of Karuvanhoor and Chalakudy rivers in the north and Vamanapuram and Neyyar rivers in the south were found to be disease-free.

Wild woody plants are often known to harbour plant viruses (Varney, 1966). For instance, Quiaoit and Fulton (1966) found *Rhamnus cathartica* to be a potential source of cucumber mosaic virus. No viruses have, so far, been reported on trees or woody shrubs of Western Ghats. Nevertheless, the possibility of some infective principle, probably of a virus nature, being washed down from hill tops is suggested by (1) reports that the first outbreak of the disease took place after the floods of 1882, (2) the absence of any disease in the lower tidal part of the rivers in the areas bordering the diseased tracts, and (3) the occurrence of moderate to severe infection in villages near the Western Ghats. Once the disease is established in an area, subsequent transmission of the pathogen can be effected by various means. The Higher intensity of the disease on the banks of the rivers and in waterlogged low-lying areas suggests the importance of water in the occurrence of root (wilt) disease. Silt and clay fractions have been reported to be carriers of viruses in Japan where wheat and barley yellow mosaic viruses are soil-borne (Miyamoto, 1959). The coconut "wilt" pathogen has also been reported to be soil transmissible (Menon and Shanta, 1962; Holmes *et al.*, 1965; Shanta *et al.*, 1972). The disease becomes more conspicuous and spreads extensively when it reaches low-lying areas. The spread from one tree to another may occur in localised areas through soil or by aerial means. The pattern of spread at higher altitudes is obscure. Soil fauna or flora, water, seed, insect or mechanical methods may be playing a role in the spread of the disease either singly or in combination.

#### ACKNOWLEDGEMENT

The authors are grateful to Shri K. V. Ahamèd Bavappa, Director, Central Plantation Crops Research Institute, Kasaragod, and Dr. (Mrs.) K. Radha, Joint Director, CPCRI, Regional Station, Kayangulam, for their support of the present study, M/s. Jacob Mathew and M. V. George for compiling the data and Shri K. K. Achary for the preparation of the map. Thanks are also due to the Department of Agriculture, Kerala, for the help rendered in carrying out the intensive survey in Trichur District.

#### REFERENCES

- HOLMES, F. O., LAL, S. B. AND SHANTA, P. 1965. Cow pea inoculation test for diagnosis of coconut wilt disease in India. *F.A.O. Plant Prot. Bull.* 13: 30-34.
- MENON, K. P. V. AND NAIR, U. K. 1951. Scheme for the investigation of the root and leaf diseases of the coconut palm in South India—Consolidated report of the work done from 8th March, 1937 to 31st March, 1948. *Indian Coconut J.* 5: 5-9.
- MENON, K. P. V. AND PANDALAI, K. M. 1960. *The Coconut Palm. A Monograph.* Indian Central Coconut Committee, pp. 229.
- MENON, K. P. V. AND SHANTA, P. 1962. Soil transmission of the coconut (wilt) virus. *Curr. Sci.* 31: 153-154.
- MIYAMOTO, Y. 1959. Further evidence for the longevity of soil-borne plant viruses absorbed on soil particles. *Virology* 9: 290-291.
- PILLAI, N. G. AND PUSHPADAS, M. V. 1966. Spread of root (wilt) disease of coconut. Some interesting observations. *Coconut Bull.* 20: 55-60.
- QUIAOIT, A. R. AND FULTON, R. W. 1966. A disease of *Rhamnus cathartica* caused by cucumber mosaic virus. *Plant Dis. Repr.* 50: 613-614.
- SHANTA, P., GOPINATHAN PILLAI, N. AND LAL, S. B. 1972. Additional evidence on soil transmission of coconut root (wilt) pathogen. *Indian J. Agri. Sci.* 42: 623-626.
- VARGHESE, M. K. 1934. *Diseases of the Coconut Palm.* Dept. of Agriculture and Fisheries, Travancore, pp. 48.
- VARNEY, E. H. 1966. Mechanical transmission of viruses from woody plants. In Abstracts of papers, *International Symposium on Plant Pathology*: pp. 32-33. Indian Phytopathological Society, New Delhi.
- VERGHESE, E. J. 1959. Chemical studies on the leaf and root wilt disease of coconuts in Travancore-Cochin. I. Some observations on the incidence of the diseases. In *Proc. First Conf. Coconut Res. Workers in India*, pp. 306-309. Indian Central Coconut Committee, Ernakulam.

#### DISCUSSION

- SRIVASTAVA : Was there any distinct relationship between disease incidence and pH of soil? How about the occurrence of disease and its intensity on hill slopes? Is the disease prevalent in all soil types?
- PILLAI : No such relationship with soil pH was noticed. The disease is not very severe on hill tops but is serious lower down. The disease is found in all soil types.
- SHAMA BHAT : How does it spread from the upper reaches to the plains and then intensify there?
- PILLAI : A theory has been advanced that the pathogen native to wild plants, when brought down by rivers and floods into the plains, finds a more susceptible cultivated crop.
- JONES : It is suggested that soil at the surface as well as at different depths may be examined for all types of pathogens.
- KANWAR : A group of specialists from all disciplines may analyse this survey data for more information.
- NAIR : A plan for qualifying, quantifying, and computerising all available data has been drawn up.