OCCURRENCE OF COCONUT LEAF ROT IN RELATION TO ROOT (WILT) DISEASE

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INTRODUCTION

The coconut palm (*Cocos nucifera* Linn.) is prone to attack by several diseases in various parts of India. Among them the root (wilt) is one of the major diseases of coconut palm, prevalent mostly in Kerala State (Anon., 1985 b). In root (wilt) affected coconut gardens, incidence of leaf rot is of common occurrence. According to Radha and Lal (1968), nearly 16 to 40 per cent of the palms in the root (wilt) affected area developed leaf rot. Recent reports show that leaf rot disease occurs superimposed in about 30% of the root (wilt) affected palms (Anon. 1989). This leads to a sharp decline in the productivity of coconut (Thomas, 1963). Stray cases of leaf rot on young palms in root (wilt) disease free area (Kasaragod) was reported (Anon., 1967) but inoculation experiment on five year old palm showed mild infection at Kayamkulam (root (wilt) affected area) whereas Kasaragod results were negative. Pathogenic agents, nutritional factors, etc. were believed to be the cause of the leaf rot symptoms (Menon and Nair, 1951; Prasannakumari *et al.*, 1960; Radha *et al.*, 1961; George and Samraj, 1966). However, involvement of pathogenic fungi, especially *Bipolaris halodes* had gained significance as the possible cause of the disease. Although prevalence of leaf rot in root (wilt) affected palms, especially during the monsoon coinciding with periods of high humidity and low temperature (Radha *et al.*, 1961) is known, magnitude of its incidence and more so in different soil types is not fully understood. In this context, a knowledge on the incidence of leaf rot and its inter-relationship with root (wilt) disease has become warranted. With a view to bridge this gap, a study of representative gardens in different soil types in root (wilt) affected areas was undertaken.

MATERIALS AND METHODS

Earlier studies (Anon., 1967, 1968) on incidence of leaf rot were conducted in conjunction with root (wilt) based on flaccidity of leaves as the initial diagnostic symptom of root (wilt) among 450 palms in a single locality. Number of leaf rot affected palms have since been recorded in the course of attempts of sequential spraying of fungicides against the disease in root (wilt) affected area (Anon., 1984, 1985 a). For this study, coconut gardens to represent different soil types were selected in the districts of Alleppey, Kottayam and Pathanamthitta where root (wilt) infection is severe (Anon., 1985 b). The soil types and locations of gardens studied are given in Table 1. For each soil type 5 - 7 clusters of gardens were selected. In each garden studied among total number of bearing and non-bearing palms, the number of apparently healthy palms, palms with root (wilt) symptoms alone (George and Radha, 1973), root (wilt) affected palms superimposed by leaf rot, and incidence of leaf rot independent of root (wilt) symptoms (if any) were recorded and data processed. The natural incidence and inter-relationship between leaf rot and root (wilt) diseases in different soil types were compared.

RESULTS AND DISCUSSION

In this investigation, a total of 5485 coconut palms (comprising both bearing and non-bearing palms) were observed for incidence of leaf rot and root (wilt) diseases under different soil types. In each palm the spindle, inner whorl, middle whorl and outer whorl of the crown were observed for disease symptoms. The natural incidence of leaf rot in relation to different intensities of root (wilt) disease is given in Table 2. Among the total sampled palms, 4042 palms

Table 1
Soil types and locations of surveyed gardens

S. No.	Soil type	Locations		No. of palms observed
		District	Area	
1.	Sandy loam	Alleppey	Krishnapuram	1850
2.	Sandy	Alleppey	Mararikulam and Athikkadu	1021
3.	Alluvial	Alleppey	Mannar, Pandanad, Thalavady and Nedumpuram	798
4.	Clay	Alleppey	Thakazhi and Edathua	905
5.	Laterite	Kottayam	Pakkil, Pallom and Moolavattom	530
		Pathanamthitta	Adoor	381
			TOTAL	5485

Table 2
Incidence of leaf rot in relation to severity of root (wilt) disease in bearing and non-bearing palms.

Category	Total No. of palms and %		No. of bearing and non-bearing palms			
			Bearing		Non-bearing	
	No.	%	No.	%	No.	%
Total No. of palms	5485	-	4526	-	959	-
Apparently Healthy	1443	26.31	946	20.90	497	51.82
Diseased Palms	4042	73.69	3580	79.10	462	48.18
Total No. of diseased palms	4042	-	3580	-	462	-
Root (Wilt) alone	1445	35.75	1384	38.66	61	13.21
Root(wilt) with leaf rot	2597	64.25	2196	61.34	401	86.79
Early phase of root (wilt) :						
Total No. of diseased palms	1754	-	1501	-	253	-
Root (wilt) alone	1060	60.43	1000	66.62	60	23.71
Root (wilt) with leaf rot	694	39.57	501	33.38	193	76.29
Middle phase of root (wilt) :						
Total No. of diseased palms	1783	-	1625	-	158	-
Root (wilt) alone	377	21.14	376	23.14	1	0.63
Root (wilt) with leaf rot	1406	78.86	1249	76.86	157	99.37
Advanced phase of root (wilt) :						
Total No. of diseased palms	505	-	454	-	51	-
Root (wilt) alone	8	1.58	8	1.76	0	0
Root (wilt) with leaf rot	497	98.42	446	98.24	51	100.00

(73.69%) were found diseased (root (wilt) independantly and or root (wilt) super infected with leaf rot) and the rest were apparently healthy. Leaf rot incidence was confined to root (wilt) affected palms. Further among 4042 diseased palms, 2597 palms were found to be super-infected with leaf rot disease accounting to 64.25% of root (wilt) affected palms. The study indicates that 39.57% of palms in the early, 78.86% in the middle and 98.42% of palms in the advanced stages of root (wilt) disease have contracted leaf rot disease. The observations revealed that leaf rot can attack the palms in the early stage of root (wilt) disease and further progresses bringing about a decline in the condition of the palms. Hence a strong relationship appear to exist for incidence of leaf rot corresponding to incidence and severity of root (wilt) disease. The table also points out the relationship of leaf rot with root (wilt) in bearing and non-bearing palms. The natural incidence of root (wilt) free from leaf rot is higher in case of bearing palms as compared to non-bearing palms. Earlier report (Anon, 1967), based on observations in 450 young plants, showed that natural occurrence of leaf rot ranged from 3.0 to 14.1% in root (wilt) affected palms whereas 0.2 to 2.9% in apparently healthy palms. Subsequent observations of the palms (Anon., 1968), revealed that root (wilt) infection occurred in 70% of the palms; the incidence of leaf rot steadily increased in close correlation with the incidence of root (wilt) and typical wilt symptoms to have appeared within 5 months in leaf rot affected palms. Thus incidence of leaf rot is indeed favoured by root (wilt) which is corroborated by the present results.

Table 3 shows incidence of leaf rot in relation to root (wilt) disease in different soil types. Incidence of root (wilt) singly and superimposed by leaf rot, among different soil types ranged from 66.89% to 77.94%. The leaf rot superimposition varied from 53.68% to 75.98% of the root (wilt) affected palms. It is pointed out that the leaf rot infection could occur in root (wilt) diseased gardens even to the tune of 76% of the affected palms, as observed in clay and laterite soils in this study. The trend of natural incidence of root (wilt) higher in bearing palms as compared to non-bearing palms, is similar in all soil types. However, incidence of leaf rot is related to severity of root (wilt) both in bearing and non-bearing palms. Leaf rot appeared both in bearing and non-bearing palms, generally in root (wilt) affected palms under all soil types. Although the number of diseased cases among non-bearing palms are relatively less, the per cent root (wilt) affected non-bearing palms super-infected by leaf rot was relatively higher indicating the susceptibility of tender palms to superinfection by leaf rot.

The early visible sign of leaf rot was mostly observed in spindle and /or inner whorl of infected bearing and non-bearing palms. In root (wilt) affected palms, the spindle and younger leaves in the inner whorl of the crown exhibited reddish brown spots and water soaked patches often with marginal necrosis that coalesced and developed into leaf rotting stage. The leaf rotting subsequently appeared to spread extensively within the inner whorl of the corwn. The successively emerging younger leaves are also attacked by leaf rot and all the whorls of the crown at times can show leaf rot symptoms as the intensity of root (wilt) also advanced. The observations are generally in agreement with earlier reports on symptoms of leaf rot (Menon and Nair, 1951).

CONCLUSION

Incidence of coconut leaf rot is generally dependent on the relative incidence of root (wilt) disease irrespective of soil types in root (wilt) affected areas in Kerala. In root (wilt) affected gardens, the palms were not completely free from leaf rot infection. It is possible coconut leaf tissues weakened by root (wilt) (Mycoplasma-like organisms) could be readily attacked by other pathogenic agents leading to development of severe leaf rotting. Although leaf spots are observed in apparently healthy palms, severe leaf rotting develop in root (wilt) affected palms. Thus the study has brought out existence of a relationship of leaf rot with root (wilt) disease. Once the leaf rot infection is established on root(wilt) affected palms, the infection foci could favour rapid spread of the disease along with root (wilt) disease in affected gardens. Proper phytosanitation and other integrated control measures of leaf rot along with root (wilt) will go a long way in checking rapid spread of the disease and deterioration of coconut palms.

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Table 3

Incidence of leaf rot in relation to root (wilt) in Bearing (B) and Non-bearing (NB) palms in different soil types.

Soil type	Category	No. of palms			No. of palms	
		Total	App. Healthy	Diseased (and %)	Root (wilt) alone	Root (wilt) with leaf rot (and %)
Sandy loam	B	1496	180	1316 (87.97)	650	666 (50.61)
	NB	354	228	126 (35.59)	18	108 (85.71)
	Total	1850	408	1442 (77.94)	668	774 (53.68)
Sandy	B	860	263	597 (69.42)	249	348 (90.69)
	NB	161	75	86 (53.41)	8	78 (90.70)
	Total	1021	338	683 (66.89)	257	426 (62.37)
Alluvial	B	645	116	529 (82.02)	191	338 (63.89)
	NB	153	63	90 (59.48)	16	74 (82.22)
	Total	798	179	619 (77.55)	207	412 (66.55)
Clay	B	719	170	549 (76.36)	143	406 (73.95)
	NB	186	73	113 (60.75)	16	97 (85.84
	Total	905	243	662 (73.15)	159	503 (75.98)
Laterite	B	806	217	589 (73.30)	151	438 (74.36)
	NB	105	58	47 (44.76)	3	44 (93.62)
	Total	911	275	636 (69.80)	154	482 (75.79)

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