

AN APPRAISAL OF SYMPTOM EXPRESSION IN COCONUT DUE TO LEAF ROT DISEASE

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INTRODUCTION

Several diseases affect coconut palm (*Cocos nucifera* Linn.) in different parts of India. The leaf rot disease occurs in association with root (wilt) bringing about severe economic losses in Kerala. The leaf rot is attributed to fungal infection (Menon and Nair, 1951; Radha *et al.*, 1961; Lily, 1963). The leaf rot is observed in palms of all ages and generally severe during monsoons. The superimposition of leaf rot in root (wilt) affected palms occurs irrespective of soil types and intensity increased with the advancement of root (wilt) disease (Varghese, 1934; Radha and Lal, 1968; Srinivasan, 1991).

Earlier reports on leaf rot have dealt with the general symptoms of the disease. The disease appears in the earliest phase as minute, water soaked lesions like brown spots and manifests generally on the spindle leaf at distal portions or intermittently on leaflets. These lesions enlarge, coalesce and the tender leaflets rot under favourable environmental conditions. The rotting of affected portions may extend into the interior of the affected spindle, but rotting slows down in the mature leaflets. The leaf rot symptoms would appear in successively emerging spindle leaves (Menon and Nair, 1951; Radha *et al.*, 1961; Joseph and Rawther, 1991). A distinct feature of the disease is the cementing together of rotten leaflets of spindle with occasional failure of spindle tips to split open even

while the leaflets at the base of spindle open.

In leaf rot affected gardens it is common observation that the disease symptom is seen as fan like appearance of leaves in the crown, indicating that all leaves in such palms had contracted leaf rot earlier. Nevertheless, the extent of natural successive appearance of leaf rot in emerging spindles of affected palms has not been reported earlier. A study was undertaken earlier on the occurrence of leaf rot (Srinivasan, 1991) and in the present paper the incidence of leaf rot symptom in different whorls of naturally infected palms under different soil types has been reported

and possible disease recurrence discussed.

MATERIALS AND METHODS

Spindles from 300 palms naturally infected with leaf rot disease were excised from the crown and the details of symptoms recorded. The prevalence of leaf rot symptoms in different whorls of affected palms was also recorded. The expression of natural symptoms of leaf rot was examined in 2597 diseased palms under the following five different soil types during October to March: Sandy loam (Krishnapuram), sandy (Mararikulam, Athikkadu), alluvial (Mannar,



Fig. 1 Minute lesions and spots as consistently observed in spindle leaflets

Pandanadu, Thalavady, Nedumpuram), clay (Thakazhi, Edathua) and laterite soil (Pakkil, Pallom, Moolavattom, Adoor). For this purpose, the leaves starting from spindle/first opened leaf to the oldest one in the crown of every sampled palm were grouped into Inner whorl (First one-third), Middle whorl (Second one-third) and Outer whorl (Third one-third) as units for observation and the leaf rot symptoms in different whorls were recorded.

RESULTS AND DISCUSSION

The examination of disease symptoms in 300 leaf rot affected spindles revealed consistent prevalence of minute lesions and brown sunken spots in several cases (Figures 1-3). The spots occurred either at distal portions of the leaflets or at intermittent areas, or along the mar-

gin close to the tips. In the leaflets the lesions enlarged and coalesced in- or the mid-vein. There were different shades of colour in the severely



Fig. 2 Expansion of lesions and rotting of tissues in spindle leaflets

Table 1. Symptoms of leaf rot observed in different whorls of coconut palm in different soil types*

S No.	Soil type	No. of palms affected	No. of palms exhibited leaf rot**							No. of palms exhibited leaf rot in various whorls of crowns ***		
			In specific whorls along			In different whorl combinations				Inner	Middle	Outer
			Inner (I)	Middle (M)	Outer (O)	I+M	I+O	M+O	I+M+O			
1.	Sandy loam	774	453 (58.53)	--	36 (4.65)	2 (0.26)	94 (12.14)	--	189 (24.42)	738 (95.35)	191 (24.68)	319 (41.21)
2.	Sandy	426	111 (26.06)	--	79 (18.54)	--	53 (12.44)	--	183 (42.96)	347 (81.46)	183 (42.96)	315 (73.91)
3.	Alluvial	412	134 (32.53)	--	68 (16.50)	--	77 (18.69)	--	133 (32.28)	344 (83.50)	133 (32.28)	278 (67.47)
4.	Clay	503	98 (19.48)	--	149 (29.62)	--	66 (13.12)	--	190 (37.78)	354 (70.38)	190 (37.78)	405 (80.52)
5.	Laterite	482	106 (21.99)	--	62 (12.86)	--	130 (26.97)	--	184 (38.18)	420 (87.14)	184 (38.18)	376 (78.01)
	Total	2597	902 (34.73)	--	394 (15.17)	2 (0.08)	420 (16.17)	--	879 (33.85)	2203 (84.83)	881 (33.92)	1693 (65.19)

* Figures within the paranthesis are in percentages

Chi-square value :

** Specific whorl and in different whorl combinations : 414.66

*** Various whorls : 133.90

affected spindle tissues such as light to dark brown, black etc. Mould growth was frequently seen on the surface of affected areas of the leaflets. If the spindle contracted leaf rot in the early period of its emer-

of palms showing leaf rot in the inner whorl plus outer whorl ranged from 12.14 to 26.97. Marginal necrosis of leaflets is usually observed in root (wilt) affected palms following flaccidity and yellowing (George and

Radha, 1973). The occurrence of leaf rot has been related to incidence/severity of root (wilt), and tissue necrotization in the older leaves is noticed under severe root (wilt), infection (Radha *et al.*, 1968). It is possible in a few palms that some degree of discontinuity occurs in the perpetual infection of successively emerging leaves under certain circumstances and hence the disease symptoms could be visible in older leaves only.

Leaf rot symptom was also noticed in the entire crown of affected palms. The percentage of palms under this category ranged from 24.42 to 42.96 in different soils (Table 1). Infection of successively emerging leaves could have only led to this situation wherein all the leaves in the inner, middle and outer whorls contracted the disease (Fig. 4 and 5). Thus at least one third of leaf rot affected palms appear to contract successive infection of freshly emerging leaves.

The data on prevalence of

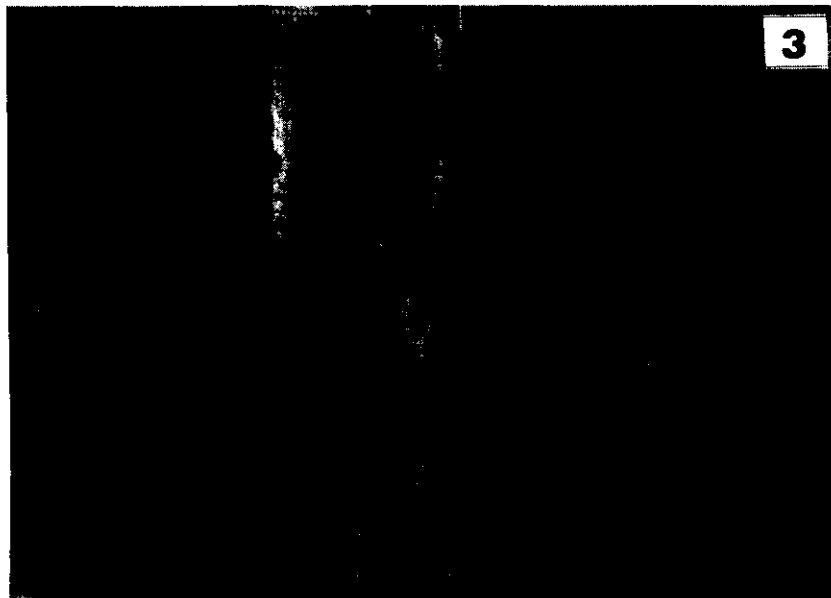


Fig 3. Brown sunken spots coalesce leading to tissue rotting.

gence, faster was the expansion of lesions under favourable conditions.

The distribution pattern of disease symptoms in the different whorls of crown in affected palms is presented in Table 1. Among 774 palms observed under sandy loam soil 453 palms (53.53%) exhibited leaf rot in inner whorl. In other soil types the number of palms showing the disease in inner whorl ranged between 19.48% and 32.53%. Leaf rot expression exclusively in middle whorl was not generally observed in any of the soil types. Palms expressing disease symptoms in the middle whorl in combination with either inner whorl or outer whorl were generally negligible or nil. A few palms in each soil type showed some symptoms in outer whorl (4.65% - 29.62%). But the percentage



Fig 4. Leaf rot symptom expression in inner whorl of affected palm

leaf rot symptom were computed to obtain the number of palms exhibiting disease symptoms in inner, middle and outer whorls as such, irrespective of the symptom presence in other whorls (Table 1). Palms showing disease symptom in the inner whorl constituted the major portion (84.83%). Among different soil types the number of palms showing symptoms in inner whorl ranged between 70.38% and 95.35%. In middle and outer whorls the disease symptom was observed on an average of 33.92% and 65.19% of affected palms respectively. Leaf rot infection generally occurs in monsoon and cooler months (Menon

repeat year after year. The lack of symptom expression in middle whorls of certain palms as observed in the present investigation may be partly due to this phenomenon. The enhanced number of palms expressing the symptoms in outer whorl than in middle whorl in the present study further indicated the likely interacting factor of necrosis with leaf rot in overall symptom expression in older leaves. The trend of expression of natural symptoms of leaf rot among different whorls was similar in all soil types but Chi-square analysis of data indicated significant difference in intensity pattern among soil types.

The preponderance expres-

leaf rot disease could perpetuate in the crown through reinfections in emerging leaves under congenial conditions. The younger leaves and particularly the spindle play a greater role in the disease incidence and perpetuation of the disease in coconut palms.

CONCLUSION

Coconut leaf rot is extensively prevalent in root(wilt) affected region irrespective of soil types in Kerala. Early symptoms of leaf rot as minute lesions, brown sunken spots are consistently observed in spindles of affected palms. Distribution of disease symptoms in inner, middle and outer whorls are observed but preponderance expression of leaf rot has been recorded in younger leaves (inner whorl). At least one third of leaf rot affected palms seem to undergo successive reinfection of freshly emerging leaves. Absence of leaf rot symptom in certain whorls may be due to influence of unfavourable environmental conditions. In older leaves of affected palms, the likely interacting factor of root(wilt) necrosis with leaf rot in over all symptom expression is pointed out. The trend of expression of natural symptoms of leaf rot is generally similar in all soil types.

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Fig 5. Severe pattern of the symptoms of leaf rot in different whorls of the affected palm

and Nair, 1951; Radha *et al.*, 1961; Radha and Lal, 1968; Mathai, 1980). The spindles emerging during such periods have greater chances of being affected by the disease. It is likely that the leaves emerging in intermittent period before the next monsoon got escaped from infection due to unfavourable weather conditions and this cycle is likely to

sion of leaf rot symptoms in the inner whorl indicated that the younger tissues are vulnerable to pathogen invasions. Lily (1981) reported that the tender unopened leaf having thinner epidermal layer but with maximum moisture content, as compared to matured leaves, acted as an initial focus of leaf rot infection. Since the disease symptoms are found in all leaves, the

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ACIAR APPROVED RESEARCH PROJECT ON WORLD MARKET FOR COCO PRODUCTS

The Australian Centre for International Agricultural Research (ACIAR) is to commence a coconut industry related research project on, The World Market for Coconut Products: An Economic Analysis from the perspective of the Philippines. This project is an expansion of the earlier of proposal by APCC on Development of Computer Simulation Models for Forecasting Supply, Demand and Prices of Coconut Products. Commissioned to undertake the project is the Centre for Applied Economic Research, University of New South Wales with collaboration from the Department of Economics, University of the Philippines at Los Banoz. A primary aim of the study is to provide a comprehensive explanation of the factors which drive international coconut markets, together with a quantitative assessment of factors which determine demand in the major consumer nations of the world. This will enable not only the Philippines but other coconut producing countries as well to adopt domestic policies which will facilitate the growth or contraction of sectors in the coconut industry. It likewise will indicate major sources of competition for coconut product end uses and will identify the benefits or drawbacks associated with expanding or contracting in certain markets.

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INDONESIA EQUIPMENT FOR COCO SHELL CARBONIZATION

The Government of Indonesia is offering a transfer of technology for the manufacture of coconut shell carbonization equipment. The coconut shell is carbonized in double drum kiln and carbonization is controlled by means of valves. The equipment is simple, can be manufactured locally and is suitable for the rural areas. With a recommended economic scale of 200 kg/unit, the equipment costs US\$ 150 (FOB, Jakarta). For further information, interested parties can contact the Institute for R & D of Agro-Based Industry. J In. H. Juanda No. 11 Bogor, Indonesia.

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