

FUNGI ASSOCIATED WITH LEAF ROT DISEASE OF COCONUT*

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INTRODUCTION

The coconut palm (*Cocos nucifera* L.) is affected by different diseases in India. Leaf rot disease is prevalent and superimposed on root (wilt) affected palms in Kerala State (Radha and Lal, 1968; Srinivasan 1991). The early symptoms of leaf rot generally appear in the spindle leaves as tiny brown, watersoaked, necrotic lesions. These lesions enlarge, coalesce and advance into rotting of tender tissues under favourable environmental conditions (Menon and Nair, 1951). The disease has been attributed to fungal etiology.

Earliest report of fungal isolation from leaf rot affected tissues was made by McRae (1916) and followed by Sundararaman (1925). Menon and Nair (1948, 1951, 1952) reported isolation of *Helminthosporium halodes*, *Gloeosporium* sp., *Gliocladium roseum*, *Fusarium* sp. and *Pestalotia* sp. from leaf rot affected palms and the pathogenic relation of the first three fungi among them with the disease. Radha and Lal (1968) reported isolation of *H. halodes* from coconut leaves in Kasaragod, a relatively root (wilt) free area. Parasitic relation of *H. halodes* (= *Bipolaris halodes*) with leaf rot was further reported (Lily, 1963, 1981; Anonymous, 1979). Isolation of *Curvularia* sp. and *Diplodia* sp. from diseased tissues, besides the aforementioned fungi has been indicated (Anonymous, 1985).

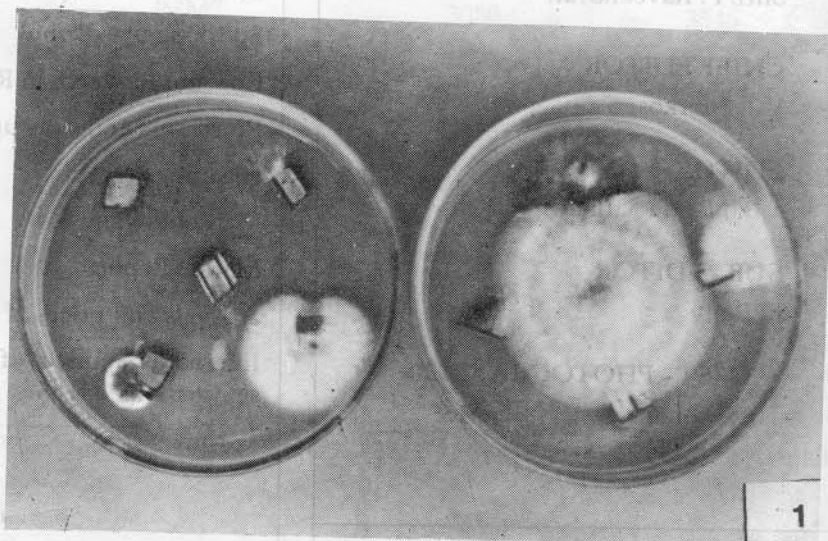
Although these reports have established the fungal etiology of leaf rot, the frequency of isolation of each of the fungi or their combination etc. involved have not been worked out. Hence to fill up this lacuna, the present studies were taken up.

MATERIALS AND METHODS

Coconut palms affected with leaf rot and showing symptoms in spindles were selected. The affected spindles were excised from crown and brought to laboratory. The leaflets showing early symptoms of leaf rot were separated. The tissue portions with individual lesions/spots were cut into small pieces of ap-

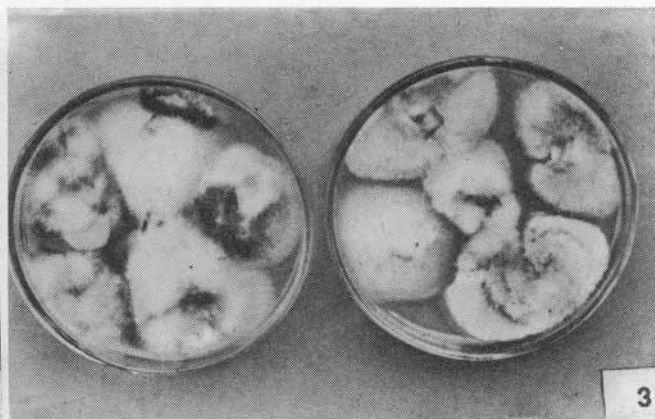
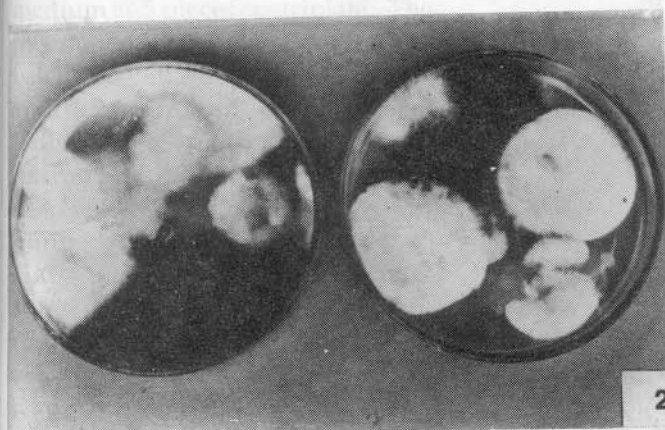
proximately 0.5 cm size. A total of 1500 leaf pieces derived from 250 spindles @ 5-10 pieces per spindle were utilized for fungal isolations during February-August. In another experiment 900 leaf pieces derived from 50 spindles @ 15-20 leaf pieces per spindle, sampled during wet season (June-August) were also utilized in the isolation to record the fungi associated with individual palms.

The leaf pieces were surface sterilized in 0.1% mercuric chloride solution for 1 minute followed by rinsing thrice in sterile distilled water. The pieces were aseptically inoculated onto Potato-Dextrose Agar

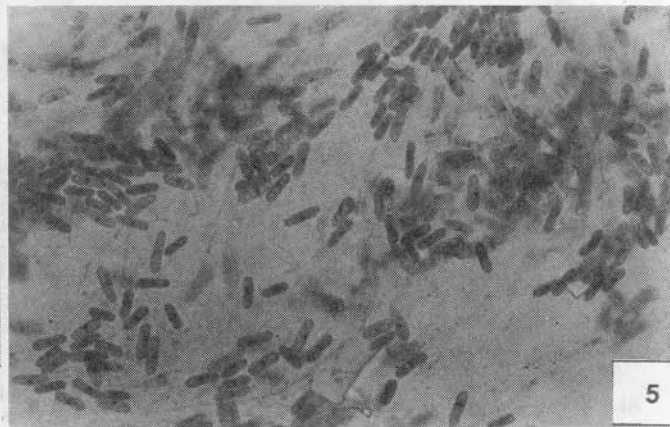
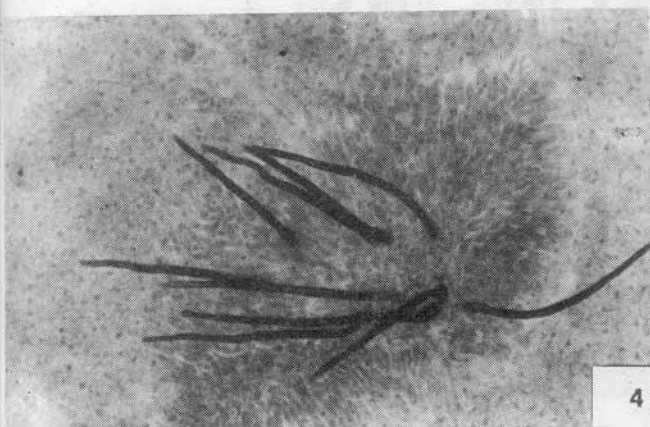


Figs. 1-3 Fungi growing *in vitro* independently/in combination from infected leaf pieces on potato-dextrose agar medium.

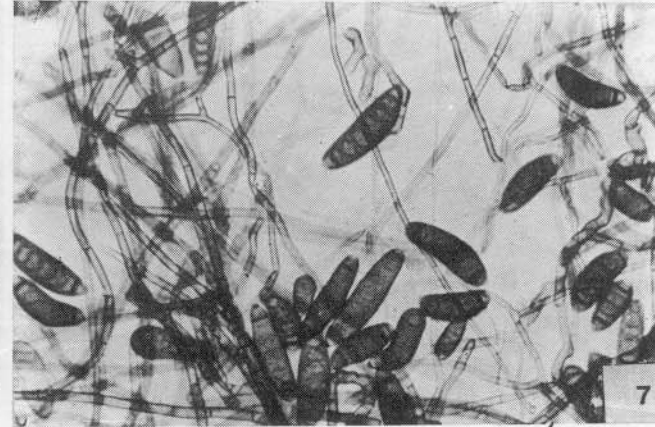
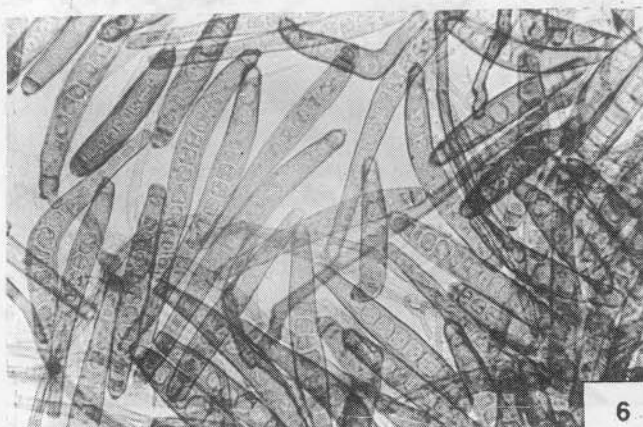
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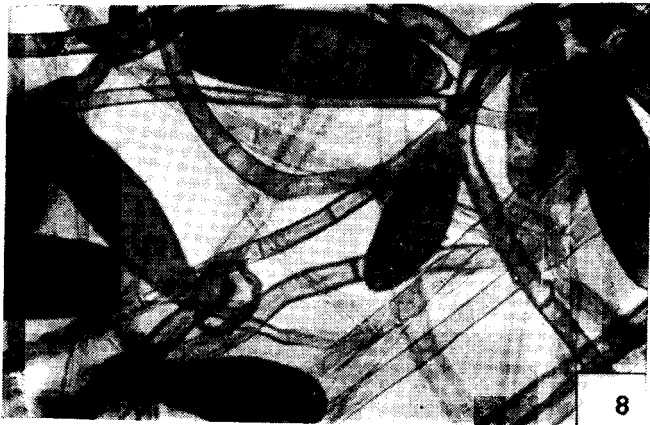
Figs. 4 to 15 Photomicrographs of fungi isolated from spindle leaves with early symptoms of leaf rot



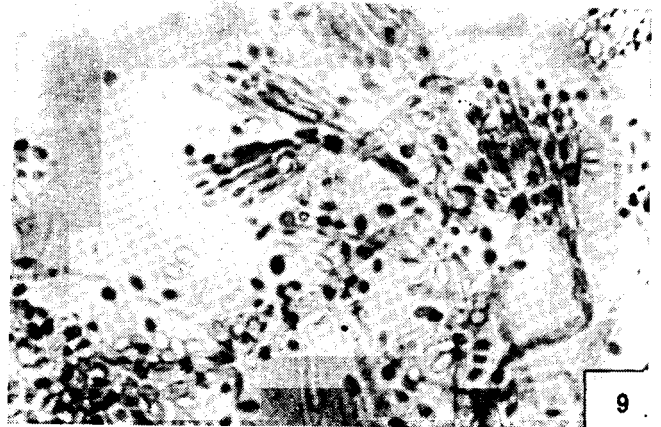
Colletotrichum gloesporioides Acervulus with setae and conidia (4) and individual conidia (5)



Exserohilum rostratum - conidia and conidiophores (6 - 8)



8



9

Gliocladium vermoeseni - conidia and conidiophores (9)



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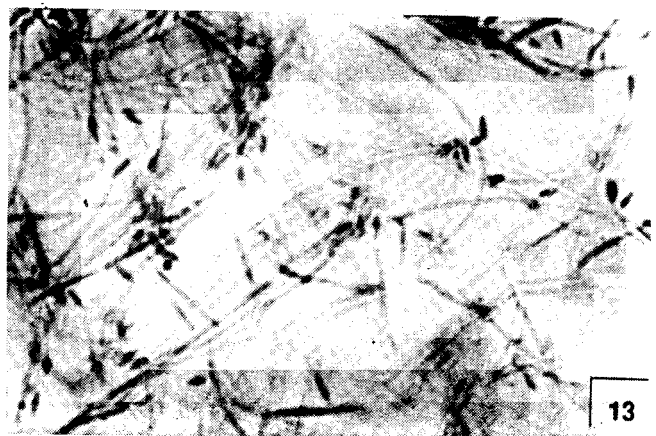


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Fusarium solani - conidia from different isolates (10 - 12)



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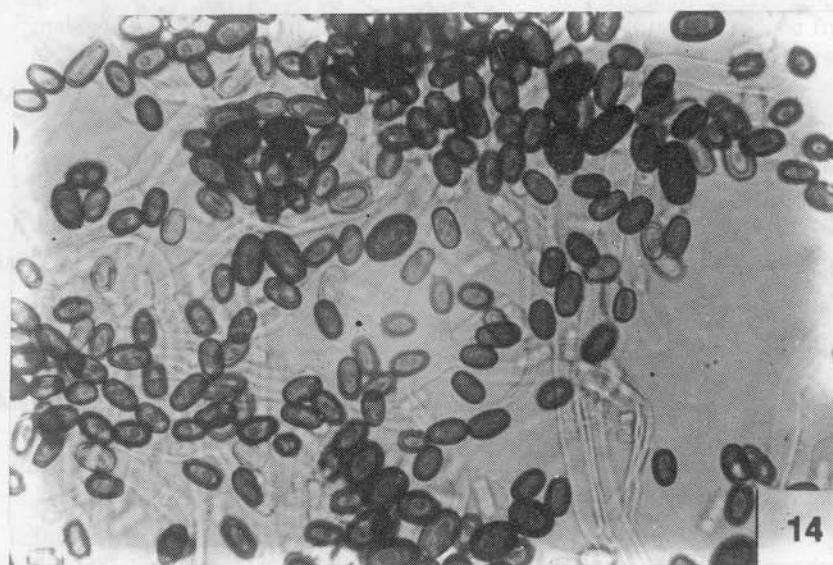
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Fusarium moniliforme var. *intermedium* - mycelium with conidia (13)

medium @ 5 pieces/petriplate. The inoculated petriplates were incubated in a BOD incubator at $30 \pm 1^\circ\text{C}$ and fungal growth emerging from individual leaf pieces was recorded, microscopically examined and provisionally identified. Representative purified cultures were also sent to CAB - International Mycological Institute, England for authentic identification.

RESULTS AND DISCUSSION

The fungi isolated (Fig. 1-3) and their frequency *in vitro* from leaf pieces are presented in Table 1. Among 1500 leaf pieces sampled from 250 spindles during February - August, and inoculated, percentage of fungal recovery was 48.27. The

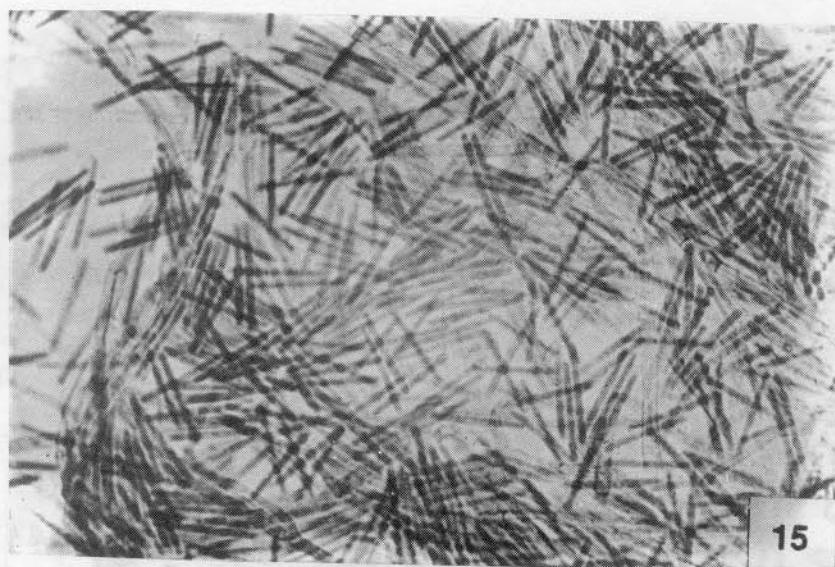


Thielaviopsis paradoxa - conidia (14)

Table 1. Frequency of fungi isolated from spindle leaves with early symptoms of leaf rot

S.No.	Fungi	Pooled Samples from 250 spindles (February-August)*		Individual palm samples from 50 spindles (June-August)**		
		No. of pieces established growth	Relative occurrence (in per cent)	No. of pieces established growth	Relative occurrence (in per cent)	No. of palms
I.	Independently Isolated:					
1.	Colletotrichum gloeosporioides	372	51.38	367	64.61	48
2.	Exserohilum rostratum	59	8.15	33	5.81	10
3.	Gliocladium vermoseni	29	4.01	4	0.70	2
4.	Fusarium spp.	118	16.30	31	5.46	15
5.	Thielaviopsis paradoxa	4	0.55	2	0.35	1
6.	Cylindrocladium scoparium	1	0.14	-	-	-
	Total	583	80.53	437	76.93	
II.	Isolated in certain combinations:					
1.	C. gloeosporioides + E. rostratum	77	10.64	77	13.56	14
2.	C. gloeosporioides + Fusarium spp.	51	7.04	48	8.45	20
3.	E. rostratum + Fusarium spp.	8	1.10	3	0.53	1
4.	C. gloeosporioides + E. rostratum + Fusarium spp.	3	0.41	3	0.53	2
5.	G. vermoseni + Fusarium spp.	1	0.14	-	-	-
6.	Fusarium sp. + C. scoparium	1	0.14	-	-	-
	Total	141	19.47	131	23.07	
	Grand total	724		568		
	Total recovery from inoculated leaf pieces	48.27%		63.11%		

* Total No. of leaf pieces inoculated : 1500 ** Total No. of leaf pieces inoculated : 900



Cylindrocladium scoparium - conidia (15)

fungi isolated were : *Colletotrichum gloeosporioides* (Penzig) Penzig & Sacc., *Exserohilum rostratum* (Drechsler) Leonard & Suggs, *Gliocladium vermoeseni* (Biourge) Thom, *Fusarium solani* Martins (Sacc.), *Fusarium moniliforme* Sheldon var. *intermedium* Neish & Leggett, *Thielaviopsis paradoxa* (Dade) C. Moreau and *Cylindrocladium scoparium* Morgan (Fig. 4-15). It is evident from the data that different fungi occur in different frequencies in the affected tissues. A total of 80.53% of leaf pieces showed the growth of different fungi individually while the remaining leaf pieces yielded fungi in combination.

Among the various fungi isolated independently from leaf pieces, *C. gloeosporioides* was the predominant fungus (51.38%) followed by *Fusarium* spp. (16.3%), *E. rostratum* (8.15%) and *G. vermoeseni* (4.01%). *T. paradoxa* and *C. scoparium* were present in negligible frequency (less than 1%). The frequency of isolation of *C. gloeosporioides* in combination

with other fungi was also high.

In the second set of isolation, using 900 leaf pieces sampled from 50 spindles during June-August, 568 leaf pieces (63.11%) established fungal growth (Table 1). All the above mentioned fungi, except *C. scoparium* were recorded in this isolation also. The data have confirmed consistent association of one or more fungi with leaf rot disease. Among the different fungi, *C. gloeosporioides* was isolated in higher frequency (64.61%) from 48 palms. This was followed by *E. rostratum* (5.81%) and *Fusarium* spp. (5.46%) from 10 and 15 palms, respectively.

Out of 50 palms sampled, 18 palms (36%) showed association of *C. gloeosporioides* and *Fusarium* spp., 9 palms (18%) with *C. gloeosporioides* and *E. rostratum* and in 12 palms (24%) with *C. gloeosporioides* alone. Association of *C. gloeosporioides*, *E. rostratum* and *Fusarium* spp. was found in 7 palms. Palms yielding *E. rostratum*, *G. vermoeseni*, *Fusarium* spp. or *T. paradoxa* independently

was either negligible or nil. Isolation of different fungi independently from more number of leaf pieces from individual spindles, with early symptoms of leaf rot point out the involvement of more than one fungi in the disease. As such in 36 palms more than one genera of fungi are associated.

Menon and Nair (1951, 1952) showed pathogenic relationship of *H. halodes*, *Gloeosporium* sp. and *G. roseum*; however, more emphasis was given to *H. halodes* as a major pathogen of leaf rot (Radha and Lal, 1968; Radha *et al.*, 1961; Lily, 1981; Anonymous, 1979). The frequency pattern of fungi observed in the present study suggests a reassessment of pathogenic role of each fungus in the leaf rot disease. The fungi identified previously as *Helminthosporium* (= *Bipolaris*) *halodes*, *Gloeosporium* sp. and *Gliocladium roseum* have now been identified as *Exserohilum rostratum*, *Colletotrichum gloeosporioides* and *Gliocladium vermoeseni*, respectively based on certain specific taxonomic criteria. Association of different fungi with the leaf rot disease indicates the complex nature of the disease. Studies on the inter-relationship of these fungi with the disease, the seasonal difference in their occurrence etc. are important aspects of further investigations.

SUMMARY

Studies on *in vitro* isolations of different fungi from leaf rot affected spindles showing early symptoms in a total of 300 palms revealed association of *Colletotrichum gloeosporioides*, *Exserohilum rostratum*, *Gliocladium vermoeseni*, *Fusarium solani*, *Fusarium moniliforme* var. *intermedium*,

Thielaviopsis paradoxa and *Cylindrocladium scoparium* with tissues of diseased spindles in differential frequencies. Independent recovery of *C. gloeosporioides*, *E. rostratum* and *Fusarium* spp. (*F. solani* and *F. moniliforme* var. *intermedium*) from individual spots (leaf pieces) could be made in greater frequency. Isolations of fungi in various combinations was also obtained in different frequencies. The presence of only a single fungus or in combinations in individual palm is revealed. Association of more than one fungus with greater number of diseased palms has been brought out and can be attributed to the complex nature of the disease.

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REFERENCES

- Anonymous. 1979. *Annual Report for 1977*. Central Plantation Crops Research Institute, Kasaragod. pp. 204.
- Anonymous. 1985. *Annual Report for 1983*. Central Plantation Crops Research Institute, Kasaragod. pp. 249.
- Lily, V.G. 1963. Host parasitic relation of *Helminthosporium halodes* on coconut palm. *Indian Cocon. J.* 16 : 149-153.
- Lily, V.G. 1981. Host parasitic relations of *Bipolaris halodes* (Drechs.) Shoemaker on the coconut palm. *Indian Cocon. J.* 11 : 1 - 4.
- McRae, W. 1916. Communication to the Dewan of Cochin. In Menon, K.P.V. and Nair, U.K. 1948. The leaf rot disease of coconuts in Travancore and Cochin. *Indian Cocon. J.* 1: 33-39.
- Menon, K.P.V. and Nair, U.K. 1948. The leaf rot disease of coconuts in Travancore and Cochin. *Indian Cocon. J.* 1 : 33-39.
- Menon, K.P.V. and Nair, U.K. 1951. Scheme for the investigation of the root and leaf diseases of the coconut palms in South India. Consolidated final report of the work done from 8th March 1937 to 31st March, 1948. *Indian Cocon. J.* 5: 3-19.
- Menon, K.P.V. and Nair, U.K. 1952. Scheme for the investigation of the root and leaf diseases of the coconut palms in South India. Consolidated final report of the work done from 8th March 1937 to 31st March, 1948. *Indian Cocon. J.* 5 : 81-100,113.
- Radha, K. and Lal, S.B. 1968. Some observations on the occurrence of leaf rot disease of coconut and associated factors. 3rd Sessn. FAO Tech. Wkg. Pty. Cocon. Prod. Protc. and Proc. Jogjakarta : 1-5.
- Radha, K., Sukumaran, C.K. and Prasannakumari, T.O. 1961. Studies on the leaf rot disease of coconut. Fungal infection in relation to environmental conditions. *Indian Cocon. J.* 15 : 1-11.
- Srinivasan, N. 1991. Occurrence of coconut leaf rot in relation to root (wilt) disease. *Indian Cocon. J.* 21 : 14-18.
- Sundararaman, S. 1925. Preliminary note on coconut leaf rot of Cochin. Year, Book, Madras Agri. Dept. pp. 6 - 8.

