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LEAF SCORCH DECLINE OF COCONUT

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SUMMARY

What is recognized as " Leaf Scorch Decline " of coconut is a disorder the cause of which is unknown. It occurs in the Gonapinuwela—Baddegama—Elpitiya area, in the Southern Province of Ceylon.

The most characteristic symptoms of " Leaf Scorch Decline " are a necrosis on the leaves, root decay and reduction in nut production. *Fusarium* spp. and *Cylindrocarpon* sp. appear to be associated with root decay. Present investigations suggest that the disorder is more prevalent in areas where the soil affords a physical barrier to root penetration and where the soil is badly drained. This paper gives an account of the work carried to for.

SYMPTOMS

The symptoms of Leaf Scorch have been described earlier (Abeygunewardena 1963, Davis 1962, Ekanayake 1963, Kranz 1967, Peries and Kirthisinghe 1967, Peries 1968). Davis (1966) compared the symptoms of Leaf Scorch and the Root Wilt of India. Maramorosch (1964) described the diseases of coconut of unknown etiology.

The most characteristic visual symptom of the disease is a necrosis or scorching of the tips of the leaflets of the lower leaves. So far, typical symptoms have been recorded only in adult palms which bear nuts. The scorching extends along the leaflets towards the mid ribs of the leaves. The lower leaves are the first to show the symptoms. The scorched leaves tend to remain on the palm for a longer time than usual, and when they fall, the abscission is such that prominent leaf scars may be left on the trunks. The scorching is followed by tapering of the trunk and a reduction in yield.

It is found that the roots of affected palms are decayed. An attempt is being made to assess the extent of root decay with increasing intensity of Leaf Scorch. In a preliminary experiment, roots of healthy palms, palms in the mild, moderate and advanced stages of Leaf Scorch and those of palms which had died as a result of the disease were examined at distances of 1 ft., 3 ft., and 6 ft. from the base of each palm. Six palms were selected in each category. It was found that at all distances (from the base of the palms) there was a significant reduction in the quantity of healthy roots as the disease developed. It appears that the reduction in the quantity of the roots at about 1 ft. from the base of palms does not occur until the disease is in an advanced condition. There is a tendency (though not significant) for an increase in the quantity of healthy roots to occur at the incipient (mild) stage of the disease. At present detailed studies of the root symptoms are being made. The results of these studies will be reported later.

MODE OF SPREAD

In 1963 four blocks in which the disease was present were selected in order to study the mode of spread of Leaf Scorch. The objectives being to determine, (*a*) the pattern of spread (*b*) whether affected palms occur at random or whether they congregate. Records of the condition of each of the palms in the different blocks were made at regular intervals. Table 1 shows the spread of the disease in the different blocks. It is seen that there has been an increase in the number of affected palms in all four blocks from 1963 to 1968. However, there have been more affected palms in 1964 than in 1966. Our records indicate that palms in the incipient stage of the disease at one time, may appear to revive later on. A similar pattern is observed with the other classes of disease intensity. The figures for 1964 are as a result of this.

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	Total No. of Palms	No. of palms showing symptoms of Leaf Scorch			
		1963	1964	1966	1968
Block A ...	390	24	55	41	42
Block D ...	149	23	35	27	27
Block C ...	100	1	11	10	8
Block B	97	10	12	13	15
Total ...	736	58	113	91	92
% affected ...	...	7.9	15.3	12.4	12.5

TABLE I. Spread of Leaf Scorch in four Blocks.

SOIL FACTORS AND DISEASE INCIDENCE

Perera (1965) carried out a Soil Survey of the area in which Leaf Scorch occurs. He distinguished three main soil types, (*a*) the " Baddegama Series " consisting of a lateritic soil on the elevations and slopes ; (*b*) the " Hikkaduwa Series " characterised by loamy sands along the basins of minor streams and (*c*) the "Ginganga Series" consisting of heavy textured alluvial soils.

At our request, Perera (1968, unpublished data) is carrying out a detailed soil survey of Block A and the surrounding area. In this survey, the " Baddegama Series " has been classified further into two types, a shallow type characterised by a gravelly-clay-loam hard pan ranging from 3 to 17 inches from the soil surface ; and a deeply weathered type characterised by the absence of a hard pan. The " Hikkaduwa Series " has been classified into a well drained type and a poorly drained type.

We have estimated the intensity of the incidence of Leaf Scorch on the different soil types. We have used this information and the results of the detailed soil survey, in relating the incidence of the disease to soil conditions.

The information available indicates that the disease occurs to a greater extent on the lateritic soil which has a hard pan (i.e. Baddegama Series, Shallow Type). It is found that root growth is greatly impeded in these soils. The disease also appears to be prevalent in the poorly drained alluvial soils (Hikkaduwa Series, poorly drained type); here the water table is between 30-40 inches. The incidence of Leaf Scorch is much less in the well drained red loamy lateritic soils (Baddegama series, deeply weathered type).

MYCOLOGICAL STUDIES

Kirthisinghe (1963) and Ekanayake (1964) reported the isolation of fungi from the leaves and roots of soil near Leaf Scorch affected palms. Peries (1967) found an increase of *Fusarium* populations in the soil around palms showing signs of advanced Leaf Scorch as compared with healthy palms. Kranz (1967) found a preponderance of *Fusarium* spp. on decayed roots from affected palms. He also found *Fusarium* spp. and *Cylindrocarpon* spp. to be consistently associated with root decay. The species of fungi isolated from leaves, roots and soil are listed in Table 2.

Inoculation trials using *Fusarium* spp. and *Cylindrocarpon* spp. are in progress. It is, however, too early to comment on these.

FROM LEAVES	*FROM ROOTS*
Botryodiplodia theobromae Pat *Echidnodes cocoes* Sydow *Phomopsis* sp. *Pestalotiopsis palmarum* (Cke) Stey *Fusarium* Sp. *Alternaria* Sp. *Periconia* Sp. *Zygosporium* Sp.	*Fusarium javanicum* Koord *Fusarium solani* Wr. *Cylindrocarpon* sp. *Cylindrocarpon* sp. (near *C. destructans* (Zins) Scholten =*C. radicicola* Wr.) *Fusarium oxysporum* Schl. *Fusarium moniliforme* Scheld. *Fusarium sambacinum* f.*b.* Wr. *Cylindrocladium* Sp. *Penicillium* Sp. *Aspergillus* Sp. *Trichoderma viride* *Mucor* Sp. *Botryodiplodia theobromae* *Botryodiplodia* Sp. *Rhizopus stolonifer* *Nigrospora* Sp. *Curvularia* Sp. *Rhizoctonia* Sp. *Ceratocystis* Sp. *Colletotrichum* Sp. *Phytophthora* Sp. *Poria* Sp.
FROM SOIL	
Fusarium Spp. *Aspergillus* Spp. *Botryodiplodia theobromae* *Curvularia* Spp. *Cylindrocarpon* Spp. *Mucor* Spp. *Nigrospora* Spp. *Penicillium* Spp. *Phytophthora* Spp. *Rhizoctonia* Spp. *Rhizopus* Spp. *Trichoderma viride* *Helminthosporium* Spp.	

TABLE 2. Fungi isolated from leaves, soil and roots of palms showing the symptoms of " Leaf Scorch " (from Kirthisinghe 1963, Ekanayake 1964, Kranz 1967, Peris 1968).

NEMATODE STUDIES

Ekanayake (1964) reported the presence of nematodes from the soil near and roots of affected palms. Subsequently Robertson (1966) found that Leaf Scorch was not due to a nematode. Table 3 gives the species of nematodes recovered from the roots and soil.

FROM ROOTS	*FROM SOIL*
Caloosia longicaudata Loos	*Caloosia longicaudata* Loos
Aphelenchoides parietinus	*Tylenchorhynchus nudus* Allen
Aphelenchoides Sp.	*Rotylenchulus reniformis* Linford & Oliveira
Aphelenchus avenae	*Helicotylenchus* Sp.
Ditylenchus Sp.	*Xiphenema* Sp.
Tylenchus Sp.	*Radopholus* Sp.
Tylenchorhynchus Sp.	*Trichodorus* Sp.
Rhabditis Sp.	*Monohystera* Sp.
Acrobeloides Sp.	
Radopholus Sp.	

TABLE 3. Nematodes recovered from roots of and soil near palms showing the symptoms of Leaf Scorch (Ekanayake 1964, Ekanayake and Wickramaratne 1964, Robertson 1965).

NUTRIENT STUDIES

Santhirasegaram (1967) carried out studies on the nutrient status of the lateritic gravel of the Gonapinuwela area, using indicator plants. He found the soil to be deficient in nitrogen, phosphorus, potassium, magnesium and boron. However, the nutrient deficiencies and the patterns of responses obtained were similar to lateritic soil types of other coconut growing regions, in which Leaf Scorch is absent.

Nethsinghe (1965, 1966) and Balakrishnamoorty (1968) are carrying out a series of trials to determine whether the application of any particular nutrient (or nutrient combination) restores the affected palms and whether unaffected palms are rendered less susceptible to Leaf Scorch.

Nethsinghe (personal communication) found that " palms sprayed with boron, although they showed no recovery appeared to be static—showing little or no indication of deterioration ". Whether deficiencies in the soil may be predisposing factors to the incidence of Leaf Scorch is being studied by Nethsinghe and Balakrishnamoorty (personal communication).

DISCUSSION

It is found that there is a considerable amount of root decay in the Leaf Scorch affected palms. The precise cause of this root decay is not yet known. Robertson (1965) eliminated nematodes as being a possible cause. Peries (1968) and Kranz (1967) found a striking increase of *Fusarium* populations in the soil near and roots of palms showing the symptoms of Leaf Scorch. It is not established whether *Fusarium* is the causal agent of Leaf Scorch. As yet no definite conclusions can be drawn from the nutrient studies in progress.

The present investigations indicate that the disease is prevalent in areas where the soil affords a physical barrier to root penetration and where the soil is badly drained.

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REFERENCES

ABEYGUNAWARDENA, D. V. W. (1963). Disease of coconut in Gonapinuwela area. C.R.I. *Circulation Paper*, 10/63.

BALAKRISHNAMOORTY, T. S. (1968). Annual Report of the Acting Soil Chemist for 1967 (*Ceylon Cocon. Quart.*—in print).

DAVIS, T. A. (1962). Coconut Withering disease of Ceylon. *C.R.I. Bulletin, No. 22.*

DAVIS, T. A. (1966). Coconut Withering Disease of Ceylon and the Indian Root (Wilt) : a comparison of symptoms. FAO Technical Working Party on Coconut Production, Protection and Processing—working papers presented at the second session held in Colombo, Ceylon, 30 November to 8 December 1964. pp. 289-298.

EKANAYAKE, U. B. M. (1964). Annual Report of the Crop Protection Officer, C.R.I. for 1963. *Ceylon Cocon. Quart.* **15,** pp. 50-57.

EKANAYAKE, U. B. M. and C. P. WICKRAMARATNE (1964). *Hemicycliophora longicaudata* Loos 1948 (Criconematidae), a parasitic nematode associated with roots of coconut palms showing symptoms of ' Leaf Scorch '. *Proc. Ceylon Ass. Adv. Scv. 1964.*

KIRTHISINGHE, J. K. F. (1966). Annual Report of the Officer-in-Charge, Crop Protection Division, C.R.I. for 1965. *Ceylon Cocon. Quart.* **17,** pp. 152-161.

KRANZ, J. (1967). Report by J. Kranz, Mycologist, C.R.I., *Circulation Paper 96/67.*

MARAMOROSCH, K. (1964). A survey of coconut diseases of unknown etiology. *F.A.O. Publication 1960.*

NETHSINGHE, D. A. (1965). Annual Report of the Soil Chemist, C.R.I. 1964. *Ceylon Cocon. Quart.* **16,** pp. 9-14.

NETHSINGHE, D. A. (1966). Annual Report of the Soil Chemist, C.R.I. 1965. *Ceylon Cocon. Quar.* **17,** pp. 114-133.

PERERA, K. S. O. (1965). Annual Report of the Soil Survey Unit, C.R.I. for 1964. *Ceylon Cocon. Quart.* **16,** pp. 120-124.

PERERA, K. S. O. (1968). Unpublished data.

ROBERTSON, D. (1965). Report by D. Robertson, Nematologist, C.R.I. *C.R.I. Circulation Paper 34/65.*

SANTHIRASEGARAM, K. (1967). Studies on the nutrient status of some Coconut soils in Ceylon. 8. The lateritic gravel at Gonapinuwela. *Ceylon Cocon. Quart.* **18,** pp. 38-56.