33. Chemical studies on the leaf and root (wilt) diseases of coconuts in Travancore-Cochin

VII. Cadmium content of coconut soils and coconut leaves

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INTRODUCTION

WRITING on the 'unknown disease' of coconuts in the West Indies, Hansen (1952) reported that a similar disease could be produced by poisoning the palms with small quantities of certain substances eg. cadmium chloride. It was therefore felt worthwhile, during the course of an investigation on the factors responsible for the Leaf and Root (Wilt) diseases of coconuts in Travancore and Cochin to study the cadmium status of coconut soils and coconut leaves from healthy and diseased areas and the effect of application of cadmium chloride on healthy palms. The results of this study are presented in this paper.

The leaf and Root (wilt) diseases of coconut palms :—

The nature of the leaf and Root (Wilt) diseases has been described in detail by Menon and Nair (1948, 1949) and by Menon and Pandalai (1958). Briefly the symptom of the Leaf disease is a shrivelling and drying up of the distal ends of leaflets, and that of Root (Wilt) disease a yellowing and drooping of the leaves of the infected tree. The two diseases are generally found to occur together.

MATERIALS AND METHODS

The soil and leaf samples were collected and prepared for analysis, according to the methods previously reported - vide Verghese *et al.*, (1957).

Two healthy trees were treated with cadmium chloride to see if symptoms of the diseases could be induced thereby. A solution of 10 g. of the salt in 500 cc of distilled water was kept in a bottle and the solution injected through the cut end of a root, according to the root injection technique evolved at the Central Coconut Research Station, Kayangulam – vide Nagaraj *et al.*, (1954) and Davis *et al.*, (1954).

The procedure for extraction and estimation of cadmium in soil samples was that of Stankomitholic (1950). The samples were extracted with a mixture of hydrochloric acid and nitric acid, heavy metals precipitated with hydrogen sulphide and the precipitate after removal of tin as thiostannate was dissolved in nitric acid and cadmium determined polarographically. The leaf samples were ashed at 500°c, the ash dissolved in hydrochloric acid and cadmium separated as dithizone complex and estimated polarographically, according to the method of Kolthoffand Lingane (1940). A cambridge pen recording polarograph was used in these estimations. The ash samples were also examined for cadmium spectrographically in an automatic large quartz spectrograph by the cathode layer arc technique used for quantitative analysis of micro elements in soils and plants, with copper electrodes and D.C. current, the ash being filled into the cavity of the anode without admixture with the usual internal standard.

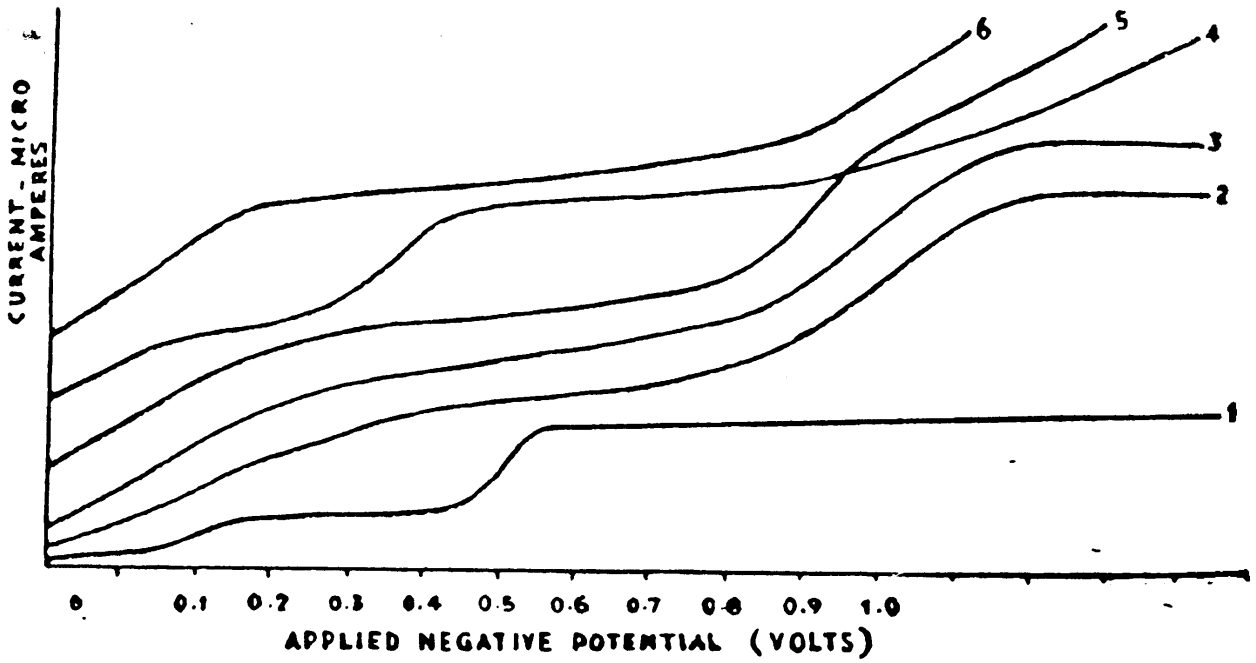
The extracts of typical soils and leaves collected from healthy and diseased areas and the plant materials from the tree treated with cadmium chloride were also tested for cadmium chromatographically by the circular paper chromotography technique of Giri and Rao (1952) using n-butanol saturated with 3 N.HCl as solvent and ammonium sulphide for spraying.

Results and Discussion

The results obtained in these studies showed that the soil and leaf samples did not contain cadmium. The type of polarogram obtained is illustrated in Plate 1. Spectrographic study of the ash did not show the presence of cadmium in any of the leaf samples analysed. The study, however, revealed incidentally that there is no difference between healthy and diseased leaves in respect of boron, manganese, magnesium, iron and calcium contents. This finding has, however, to be confirmed by analysing more samples.

PLATE 1

Polaro, rams of extracts of leaf and soil-samples from healthy and diseased coconut regions, recorded on a cambridge Pen-recording Polarograph



1. Standard cadmium solution. 2. Healthy coconut leaf. 3. Diseased coc nut leaf. 4. Diseased coconut leaf. 5. Soil-Healthy area. 6. Soil-Diseased area.

Note:— To avoid overlapping of curves the zero on the X-axis has been shifted.

The trees treated with cadmium chloride were found to have wilted in a fortnight's time. But none of the symptoms characterestic of the Leaf and Root (Wilt) diseases were obtained. The ash of plant materials such as husk, kernel and nut water collected from the wilted trees did not reveal the presence of cadmium when tested for, chromatographically. The toxic effect of chloride is also ruled out by the fact that two healthy trees similarly treated with strontium chloride were not affected in the least. These trees continue to be healthy and yield well. Incidentally this observation confirms the finding of Verghese *et al.*, (1957) that strontium toxicity is not responsible for the diseases. Since characterestic symptoms of the Leaf and Root (Wilt) diseases were not observed in the treated palms, it may be inferred that cadmium toxicity is not also responsible for the diseases.

Leaf samples collected from the trees prior to and subsequent to injection with cadmium chloride were analysed for potash, lime, magnesia, iron, aluminium and phosphoric acid. The results are presented below.

Heads of analysis	Tree No. 150		Tree No. 370	
	Before Injection	After Injection	Before Injection	After Injection
Ash %	3.71	4.07	4.97	4.57
Potash (K_2O) %	0.57	0.63	0.87	1.42
Lime (CaO) %	0.40	0.41	0.35	0.18
Magnesia (Mgo) %	0.22	0.20	0.23	0.19
Iron (Fe_2O_3) %	Trace	Trace	Trace	Trace
Aluminium (Al_2O_3) %	0.69	0.60	0.61	0.60
Phosphoric acid (P_2O_5) %	0.28	0.28	0.28	0.30

It may be seen from the above that except for an increase in potash content and decrease in lime status in one of the trees treatment with cadmium has not affected the other nutrients appreciably. The reason for the change in potash and lime status is not understood.

Summary

Determination of the cadmium content of coconut soils and leaves collected from healthy and diseased coconut areas in Travancore and Cochin showed that the soils and leaves did not contain cadmium and that cadmium toxicity is not the factor responsible for the Leaf and Root (Wilt) diseases of coconuts. Healthy trees treated with small quantities of cadmium chloride wilted, but no characteristic disease symptoms were observed to develop. Trees treated with strontium chloride were unaffected and continued to be healthy.

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