

21. The virus nature of the wilt (root) disease of coconuts - experimental transmission of it into cowpea (*Vigna sinensis* Endl.)

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INTRODUCTION

A critical survey of earlier work on the widely distributed Wilt (Root) disease of coconuts reveals that a combination of factors non-pathogenic as well as pathogenic, brings about the final symptom picture of the disease. Putting together negative evidences such as the absence of any primary parasitic organism or any mineral deficiency, as well as positive indications like the spreading nature of the disease and the systemic symptoms of infected palms, Menon and Nair (1951) suggested a biologic factor, more probably a virus, aided by other environmental factors as responsible for the disease. This hypothesis was supported later by Nagaraj and Menon (1956) and Shanta *et. al.*, (1959) who were able to reproduce the symptoms on artificially inoculated palms in the field. The drawback in this work however, was that the work was carried out in an already infected area and as such, a small percentage of the 'check' palms were also noted to have contracted the disease within the experimental period. It became necessary therefore that the work be done under insect proof conditions, and accordingly this aspect of the work is continued at the Central Coconut Research Station, Kayangulam.

Another aspect of the problem requiring immediate attention is the host range of the virus, if it is one, for amongst the rich flora of the vast infested area with the different types of soils and growing in close proximity to the diseased palms one is naturally bound to come across one or more plants susceptible to it. In the course of work done in this direction, the ordinary cowpea, *Vigna sinensis* Endl., grown as an intercrop in coconut gardens was found to be susceptible, and the results of the preliminary work with this host plant are discussed below.

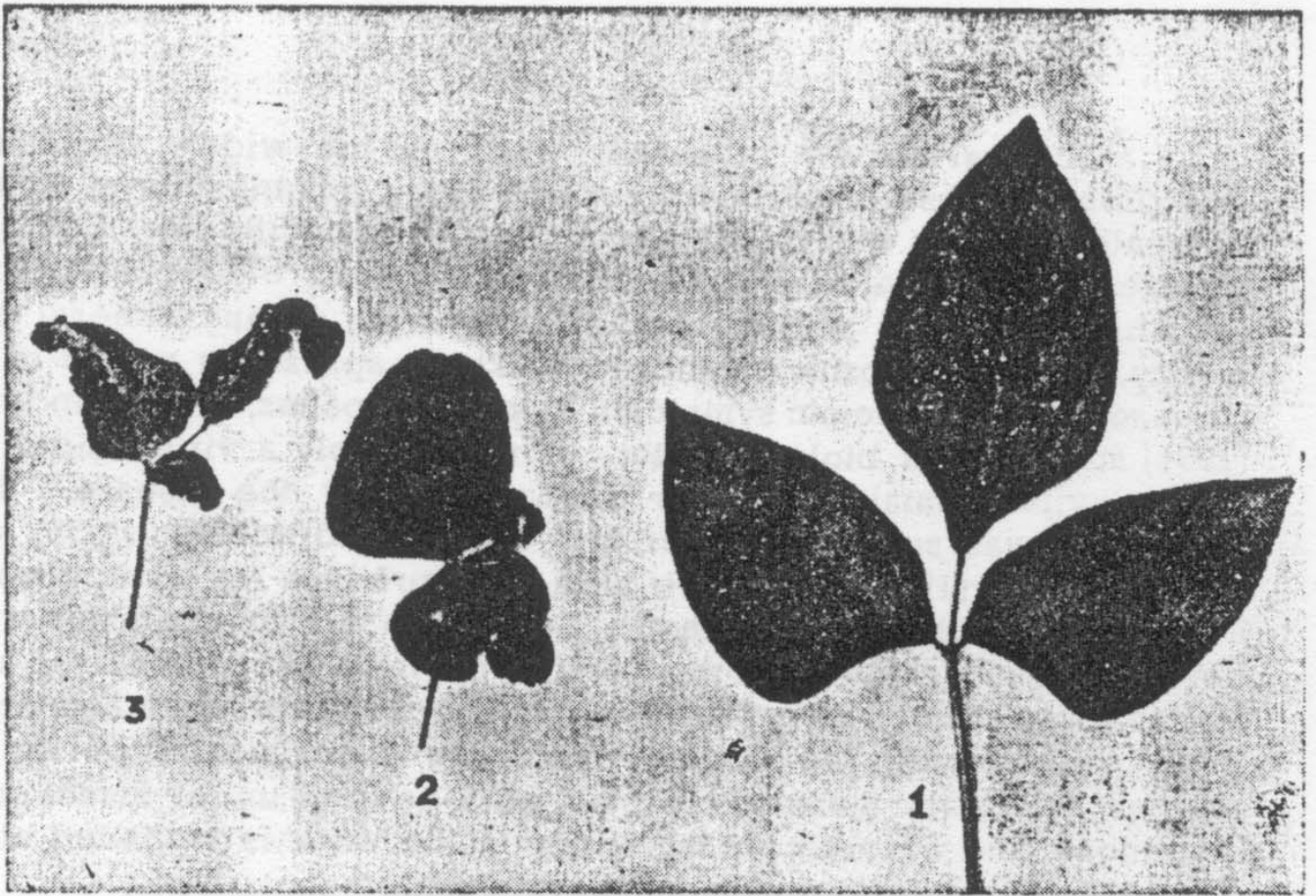


Fig. 1

Showing healthy (1) and artificially injected (2, 3) leaves of cowpea

MATERIALS AND METHODS

The seedlings used in these studies were raised in steam sterilised soil from locally available seeds and from those obtained from the Indian Agricultural Research Institute, New Delhi.

The tender leaves of a 35 - 45 - year - old coconut palm showing advanced disease symptoms formed the source of inoculum.

Mechanical inoculation by the abrasion method with the leaf sap was carried out using 600 mesh carborundum powder as abrasive. The coarse sap used as inoculum was prepared by freezing fresh leaf samples overnight and then extracting the sap in 0.05 M phosphate buffer at pH 7.0.

EXPERIMENTAL

Symptoms

The overall symptoms are malformation, a crinkling and puckering of leaves followed by an irregular yellowing along the margins and a necrosis along the veins (Fig. 1). The plant is most susceptible in the seedling stage, about 80 per cent of the inoculated seedlings getting infected when inoculations are done on the two primary simple leaves of the one-week-old plant. The symptoms make their appearance in about 9 - 12 days after inoculation, slight 'clearing' of the veins and the veinlets, the first evident sign, being visible on the tender, still unfurling first trifoliate leaf. This is followed later and systemically by similar 'vein clearing' of the subsequent leaves, which, in severe cases, results in crinkling, malformation and tearing of the leaves along the veins. Further examination of transverse sections of these leaves under the microscope revealed a necrosis of the parenchymatous tissue immediately round the vein resulting in the 'clearing' of the vein. It is this necrosis in severe cases that results in tearing, unequal growth and consequent crinkling of leaves. In some cases one or more leaflets fail to grow completely whereas leaves free from any symptoms are not uncommon. Many of them in later stages of growth show slight yellowing along the margins, gradually becoming darker towards the centre. The symptoms get more or less masked on plants grown in the insect proof house towards the flowering stage although many of the new axillary shoots, in the flush of their growth, invariably show typical symptoms.

Transmission

Transmission is readily effected mechanically by sap inoculation and the disease has been successfully established in the insect proof house at Kayangulam both by wedge grafting and sap inoculation on successive generations of the plant.

For comparative studies and as a further check, one set of plants were inoculated with sap taken from the tender leaves of a healthy tree of the same age as that of the diseased which generally formed the source of inoculum.

Susceptibility of cowpea

All four varieties of cowpea so far tested were found to be susceptible (Table I).

TABLE I
*Infection trials by sap inoculation by the abrasive method on
7-day-old cowpea seedlings*

Cowpea variety	Source of inoculum	Number of plants		Incubation period in days
		Inoculated	Infected	
Pusa phalguai	Diseased coconut	20	13	9 - 12
	Uninoculated control	20	Nil	
Pusa bursathi	Diseased coconut	90	57	..
	Uninoculated control	90	Nil	
Local black	Diseased coconut	20	16	..
	Uninoculated control	20	Nil	
Local red	Diseased coconut	20	13	..
	Uninoculated control	20	Nil	
Pusa bursathi	Diseased coconut	20	12	..
	Healthy coconut	20	Nil	

DISCUSSION

Although the work herein described does not prove that the Wilt disease is of virus origin, it is of considerable interest in that it establishes beyond doubt that some sap transmissible virus, whether primary or secondary, is involved in it. And, considering the nature of viruses in general, it may safely be assumed that in combination with the soil and other environmental factors, it is responsible for causing the disease. That this may be the case is pointed out by the fact that inoculation with sap from a healthy tree failed to produce any reaction on seedlings of cowpea, while at the same time that from the diseased produced 60 per cent infection.

A mosaic disease on cowpea has been reported earlier (Capoor *et al.*, 1947; Vasudeva, 1942) but the symptoms described vary from that obtained here. It is of some interest to mention here that the cowpea raised at Kayangulam as an inter-crop in the coconut gardens

is found to be attacked by a sap transmissible virus producing symptoms more or less akin to that described here (Shanta and Menon, 1959). It is probable that both are related, and studies on this line are continued with a view to establish the identity of the virus involved.

One feature of particular importance in this work is that cowpea provides at present an essential indicator plant, sensitive to inoculation tests and easy to be handled and work that was much handicapped till now due to the unwieldy size of the experimental palms, enhanced further by the comparatively long incubation time of the virus in the coconut palm (Nagaraj and Menon, 1956; Shanta *et. al.*, 1959), is expected to progress better hereafter.

SUMMARY

It has been shown here that a virus is involved in the Wilt (Root) disease of coconuts which can be experimentally transmitted into cowpea seedlings by sap inoculation, producing necrosis, malformation and crinkling of the leaves of the latter.

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