

Changes in Foliar Pigments in Yellow Leaf Disease of Arecanut

N. Srinivasan*

Abstract

Yellow leaf disease remains as a serious disease of arecanut in Kerala and Karnataka. The precise etiology of the disease is unknown. Serious alterations in foliar pigments were noticed and the content of chlorophyll declined significantly depending upon severity of the disease. Pigments, carotene and xanthophyll seem to superimpose the yellowing of foliage in affected palms. The significance of changes in major plant pigments has been discussed.

Introduction

Arecanut (*Areca catechu* L.) popularly known as betel nut is an important plantation crop of India. Yellow leaf disease (YLD) threatens the arecanut cultivation in Kerala and Karnataka where the crop is cultivated extensively. The yield of arecanut palm is affected drastically due to YLD. The precise cause of disease is yet unknown.

Foliar yellowing is the most conspicuous symptom of YLD. As the etiology of the disease is not known conclusively it is believed that an understanding of pathophysiology of the foliar yellowing would be helpful in the diagnosis of YLD. In many plant diseases, the degree of pigment changes has been correlated with intensity of tissue damage and expression of disease syndromes (Takahashi, 1971; Haspel-Horvatovic and Horickova, 1975; Farkas, 1978). Therefore, an attempt has been

made to relate the changes in major plant pigments with expression of YLD and its early diagnosis.

Materials and Methods

Healthy and YLD affected palms in early, middle, and advanced stages of foliar syndromes were selected for the study. Leaves at lower, middle and upper positions of the crown from selected palms were subjected to analysis of total chlorophyll, carotene and xanthophyll pigments. The total chlorophyll was estimated by the modified method of Smith and Benitez (1955) and the other pigments by following the method of Snell and Snell (1937). Three palms were analysed independently under each category and the contents of the pigments were calculated (mg/g of leaf sample).

Results and Discussion

The contents of foliar pigments in healthy and YLD affected areca palms are presented in Table 1. In healthy palms,

* Central Plantation Crops Research Institute, Regional Station, Kayangulam, Krishnapuram 690 533, Kerala

chlorophyll, carotene and xanthophyll contents were maximum in lower leaves. The quantity of chlorophyll was several fold higher than other pigments. In YLD affected palms, deviations in contents of these pigments were observed depending upon severity of yellow leaf syndromes.

Changes in early stage of foliar symptom

In lower leaves of affected palms, chlorophyll was significantly reduced. But in younger leaves the pigment content generally remained unchanged. Contents of carotene and xanthophyll increased in lower (older) leaves of the diseased palm as compared to younger ones and also the corresponding healthy leaves in control palms. It reveals that in early phase of foliar syndromes the pigment changes occur particularly in lower fronds and the palm loses an average of 12 per cent chlorophyll with an increase in carotene (9 per cent) and xanthophyll (27.50 per cent) levels.

Changes in advanced stage of foliar symptom

Chlorophyll was found to be reduced drastically in leaves at all positions of the affected palm. The change was maximum in lower fronds followed by younger ones. Contents of carotene and xanthophyll enhanced, on the other hand, in all leaves of the YLD palm. However, these pigments were generally higher in other fronds. Palms expressing severe foliar syndromes retained 16.48 per cent of chlorophyll only revealing a major derangement in chlorophyll system of affected palms.

The results showed that changes occurred in foliar pigments in arecanut, from early to advanced stages of the disease. Decreased level of chlorophyll has been observed as a distinct feature of the disease. In YLD affected palms chlorophyll derangement may be due to direct pathological causes.

Table 1. Contents of pigments in leaves of healthy and yellow leaf disease affected arecanut palms*

Nature of palm	Leaf position in crown	Pigments (mg / g)			Diseased / Healthy (%)		
		Total chlorophyll	Carotene	Xanthophyll	Total chlorophyll	Carotene	Xanthophyll
Healthy	Lower	2.85	0.23	0.10			
	Middle	2.70	0.19	0.08			
	Upper	1.67	0.22	0.04			
	Mean	2.41	0.21	0.07			
Early YLD syndrome	Lower	1.92	0.28	0.17	67.37	121.74	170.00
	Middle	2.68	0.20	0.09	99.26	105.26	112.50
	Upper	1.65	0.22	0.04	98.80	100.00	100.00
	Mean	2.09	0.23	0.10	88.48	109.00	127.50
Middle YLD syndrome	Lower	1.02	0.33	0.22	35.79	143.48	220.00
	Middle	1.80	0.24	0.15	66.67	126.32	187.50
	Upper	1.62	0.23	0.06	97.01	104.55	150.00
	Mean	1.48	0.27	0.14	66.49	124.78	185.83
Advanced YLD syndrome	Lower	0.33	0.39	0.28	11.58	169.57	200.00
	Middle	0.44	0.31	0.21	16.30	163.16	262.50
	Upper	0.36	0.23	0.11	21.56	104.55	275.00
	Mean	0.38	0.31	0.20	16.48	145.76	245.83

*Average of 3 samples / treatment.

Enhanced levels of carotene and xanthophyll in diseased palm is believed to be a result rather than a cause for foliar syndromes. In healthy leaf, chlorophyll level outweighed carotene and xanthophyll levels. Under diseased state the chlorophyll level was outweighed by yellow pigments resulting in foliar yellowing. The degree of alteration in pigments is dependent on the disease intensity or the stages of the

disease in affected palms. This is supported by the fact that early chlorosis appears in affected palm at its older leaves and symptom spreads to younger leaves systematically (George et al., 1980; Seliskar and Wilson, 1981). The observation of early changes in pigments in older leaves may be considered as a criterion for early diagnosis of YLD.

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Discussions

Abi Cheeran:

It is not necessary for root disease that the pathogen should be a parasite. Therefore the role of population dynamics of the microbes in rhizosphere and rhizoplane should be studied well.

N Srinivasan:

YLD is considered as a complex disease. The bacteriological studies require intensive approach. Of course, the population in rhizoplane and rhizosphere of the roots would supplement additional information.