Epidemiology of Bacterial Leaf Stripe Disease of Arecanut Palm (*Areca catechu* L.) caused by *Xanthomonas campestris* pv *arecae*

I. EFFECT OF AGE OF PALM AND AGE OF THE LEAF ON DISEASE MANIFESTATION

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Abstract

Bacterial leaf stripe disease infection on arecanut palms caused by Xanthomonas campestris pv arecae showed variation not only with the age of the palm, but also with age of the leaves. Palms of younger age groups from 3 to 5 years showed a pattern of high degree of susceptibility to the disease indicated by rapid rate of lesion expansion as also the total lesion length recorded. Palms beyond 5 years age showed reduced susceptibility indicated by decreased lesion length. The lesion length decreased gradually with age and comparatively less in higher age groups. The leaf susceptibility character also showed a similar trend. Leaves that are of similar type and physiological age but produced at different periods in the life of the palm behaved differently to infection by the pathogen.

Introduction

Arecanut palms (*Areca catechu* L.) were found to be affected by a bacterial disease in the inland plains of Karnataka State. The pathogen was identified as *Xanthomonas campestris* pv *arecae* (Rao et al., 1970). There is no evidence of the occurrence of this disease on arecanut in the earlier years. Since then it has been reported to occur in epiphytotic form regularly in many plantations of the area. The disease can cause economic loss up to 35 per cent (Sampath Kumar, 1981).

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In this paper the observations on the relative virulence and infection of the pathogen on arecanut palms of different age groups and leaves of different maturity are reported.

Materials and Methods

Bacterial isolation

Fresh isolations were made by subjecting the lesion from the infected leaves to ooze test initially by cutting through the lesions with a sharp razor blade and observing under the microscope the cut ends in a few drops of water on a slide. Pure culture was grown on nutrient

dextrose agar (Bacto peptone 10g; dextrose 5g; agar 20g; distilled water 1000ml; pH adjusted to 7.0).

Field inoculation tests:

The field studies were carried out at the Central Plantation Crops Research Institute, Research Centre, Hirehalli in Tumkur District of Karnataka State. The inoculation tests were carried out on three to ten years old arecanut palms from July to October using fronds of different maturity. The leaves were examined eight to ten days after inoculation when the disease symptoms started appearing. The observations were recorded on their relative susceptibility during active disease season.

Preparation of the inoculum

The inoculum was prepared by suspending the bacteria in sterile distilled water to an absorbance of 1.0 O.D. (about 10^8 colony forming units (CFU) per ml at 600nm as determined by Bausch and Lomb spectronic - 20 colorimeter. The bacterial suspension was rubbed on to the under surface of the selected leaflets after making pinpricks. Symptoms were recorded eight to ten days after inoculation.

Results

When arecanut palms of different age groups were inoculated, palms of younger age groups from three to five years exhibited high degree of susceptibility to the disease, indicated by rapid rate of lesion expansion recorded during the period of study. Palms beyond five years age were less susceptible as shown by decreased rate of lesion length on the final day of observation. The lesion length decreased gradually with the age and was comparatively less in older age groups (Table 1). The correlation coefficient worked out between age and disease development (total lesion length) and between days and disease development is found to be significant.

Table 1. Susceptibility of Arecanut palms of different ages to *Xanthomonas campestris* pv *arecae* (Average of five lesion lengths in cm)

Days	Lesion lengths (cm) in different ages of palms (years)							
	3	4	5	6	7	8	9	10
5	1.2	1.0	2.4	3.0	3.0	2.6	3.2	—
7	2.4	2.0	2.8	3.2	3.2	4.0	3.8	2.0
10	5.9	4.2	6.3	4.4	4.2	7.0	4.4	3.8
15	15.6	8.2	11.2	7.8	5.6	9.8	5.8	6.8
20	21.8	13.5	14.5	12.6	6.2	10.0	6.2	9.8
30	26.0	21.6	18.6	15.0	9.2	11.4	8.8	10.6
50	27.5	22.8	20.2	16.8	11.8	12.2	10.6	10.6
75	30.0	23.0	21.2	17.2	12.6	14.4	11.6	13.0
100	30.5	25.0	23.6	19.2	16.0	16.0	13.2	13.2

Age and total lesion length:

$r = 0.9642$

$y = 35.54 - 2.45 \times$

Days and Av. lesion length:

$r = 0.8209$

$y = 4.51 + 0.2236 \times$

The leaf susceptibility character also showed a similar variation. The tender leaves, particularly the first, second and third leaf (from the spindle) picked up the infection earlier than other older leaves in the whorl. The lesion expansion rate also varied considerably. The first leaf showed rapid rate of lesion expansion with maximum lesion length on the final day of count, whereas the oldest leaf on the crown (seventh) had the lesion length at its minimum. (Table 2). The calculated values for age as well as for leaves does not reveal any significant variation, so also the interaction between them.

Discussion

Plants like animals vary in susceptibility to disease with age. Tissue susceptibility in relation to age decreased with obligate parasites and increased with saprophytes (Yarwood, 1934). In bacterial leaf stripe disease the susceptibility character varied not only with the age of the palm but with the plant part too, particularly in the leaves that were examined for infection studies. Leaves that are of the same type but, produced at different times in the life of the palm behaved differently to infection. Patel and walker (1963) showed that although the bean plant is susceptible at

Table 2. Lesion davelopment in the leaves of different ages

Age & leaf No.	Days							
	10	15	20	30	40	50	75	100
3 yr								
I	1.2	5.5	23.6	25.0	29.5	31.0	32.5	37.5
II	1.0	9.0	17.0	21.0	21.1	21.2	21.2	21.3
5 yr								
I	2.7	10.5	14.5	16.0	16.0	16.0	16.0	16.5
II	0.4	2.0	2.5	2.6	4.4	4.4	4.6	4.8
III	0.6	5.0	5.5	6.5	7.0	7.0	7.0	7.5
6 yr								
I	3.2	5.5	5.8	7.3	7.5	7.5	7.5	7.5
IV	1.2	2.8	4.5	4.5	4.5	4.5	4.7	4.7
VII	0.2	0.5	1.6	1.7	1.7	1.7	3.7	3.7
7 yr								
I	3.0	5.2	12.0	14.0	14.5	14.7	14.8	14.8
IV	4.3	5.2	6.5	7.0	7.1	7.3	7.3	7.5
VII	4.0	5.0	8.4	9.2	11.5	15.0	15.0	15.0
8 yr								
I	9.5	9.7	10.3	10.3	10.3	13.2	15.3	15.3
IV	7.5	7.6	7.7	7.9	8.0	10.0	10.1	10.1
VII	3.2	4.5	4.6	4.7	4.8	4.8	7.5	7.8
9 yr								
I	5.3	5.4	6.4	8.9	10.2	10.2	10.2	10.2
IV	1.2	1.4	1.5	4.3	7.3	9.8	12.7	12.7
VII	3.5	5.5	5.8	6.3	7.9	8.0	8.3	8.3
10 yr								
I	6.2	9.5	10.5	12.5	13.7	13.7	13.7	13.7
IV	13.5	13.5	14.5	15.0	15.7	15.7	15.7	15.7
VII	7.5	9.5	9.9	10.3	10.8	10.8	10.8	10.8

all stages of its growth, the younger leaves are more susceptible than older ones from common and fuscous blight infection. This decrease in susceptibility with plant age called 'adult plant resistance' has been well noticed in rubber affected by species of *Oidium, Helminthosporium, Gloeosporium* and *Dothidella* (Populer, 1972). The need for such studies cannot be over emphasized. For, as the plant becomes older and it produces successive leaves, the lower leaves are affected by different environmental conditions due to shading by their own whorls.

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