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INDEXING THE YELLOW LEAF DISEASE OF ARECANUT*

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ABSTRACT

A technique for quantifying the severity of yellow leaf disease of arecanut (betelnut palm, *Areca catechu* L.: Arecaceae) was evolved based on three easily recognisable foliar symptoms, yellowing, necrosis, and reduction in crown size. Due weights were assigned to the symptoms based on the frequency of occurrence of these symptoms in the natural population of arecanut palms growing under various ecological conditions in Kerala and Karnataka (South India).

The disease index I for a palm was worked out using the formula, $I = \left(\frac{Y+N}{L} + R\right) \times 10$, where Y and N are the sum of grade points for yellowing and necrosis, L is 50% number of leaves in the crown, and R is the grade point for the reduction in crown size for the palm as a whole.

INTRODUCTION

Yellow leaf disease of arecanut (also known a as betel nut palm, *Areca catechu* L.: Arecaceae) is the most serious problem facing the arecanut growers of Kerala and Karnataka, South India. Its aetiology is uncertain. This malady is prevalent in different intensities in almost all the districts of Kerala and 3-4 pockets of Karnataka (Nayar, 1976). The symptoms generally associated with this disease are foliar yellowing, necrosis, reduction of crown size, shedding of mature and immature nuts, discolouration of kernel, and blackening of root tips (Rawther, 1976). Qualitative and arbitary assessment of the intensity as mild, medium, and heavy are often subjective and is not amenable for statistical computation. The severity of several plant diseases has been indexed on the basis of one symptom alone (Chirappa, 1971). However, it is better and more accurate to index a disease on the basis of multiple symptoms.

This paper presents a method for indexing the severity of yellow leaf disease of arecanut based on three easily recognisable foliar symptoms, yellowing, necrosis and reduction in crown size.

MATERIALS AND METHODS

The frequency of occurrence of the major foliar symptoms was recorded during October-November in a representative sample of 2316 diseased palms growing under various agroclimatic conditions in Kerala and Karnataka. The three major foliar symptoms, yellowing, necrosis, and reduction in crown size, which are distinct and easily visible were considered. The percentage contribution of each symptom was assessed.

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The percentage of palms showing various symptoms (Table I) rounded to 70, 20 and 10, were taken as the weights for the respective symptoms. As the foliar symptoms of yellowing and necrosis are not generally reflected in the younger leaves even in the advanced stages, the leaves in the lower half of the crown only were scored for yellowing and necrosis. However, for computing the reduction in crown size, the crown was scored as a whole. The grade points assigned to the symptoms varied from 0-7 for yellowing, 0-2 for necrosis according to the intensity and number of leaflets showing the symptoms, and 0-1 for reduction in crown size.

For working out the disease index of a palm, only 50% of the leaves (i.e., lower one-half, or $\frac{N+1}{2}$ leaves if N, the total number of leaves on the crown, is odd) was graded separately for yellowing and necrosis. The disease index I for a palm was worked out using the formula

$$I = \Sigma \frac{(ay + bn)}{L} + CR \ldots\ldots (1)$$

where y and n are the grade points assigned to a leaf for yellowing and necrosis respectively. R is the grade point of the palm for reduction is crown size; L is the number of leaves in the lower half of the crown, ie., $L = \frac{N}{2}$ or $\frac{N+1}{2}$; N, being the number of leaves in the corwn; Σ is the sum of all the grade points over L leaves; and a, b, and c are the weightages given to yellowing, necrosis, and reduction in crown size, so that I is expressed in 100. By dividing the respective weightages by the maximum score given to each symptom, we get the values for a, b, and c

$$a = \frac{70}{7} = 10;\ b = \frac{20}{2} = 10;\ \text{and}\ c = \frac{10}{1} = 10$$

ie., a=b=c=10. Substituting the respective weights and denoting sum y=Y and sum n=N the above formula was reduced to:

$$I = \frac{(Y + N)}{L} \times 10 \ldots\ldots (2)$$

which is the sum of average grade points for yellowing and necrosis over the L leaves and the grade point for reduction in crown size and multiplied by 10.

To varify the adaptability of this technique by different workers, 200 palms from a severely diseased area in the Institute's Research Centre, Palode were indexed independently by four investigators and the agreement of their Classification was tested (Table II).

Table I. *Frequency of occurrence of the major foliar symptoms associated with arecanut yellow leaf disease*

Symptoms	No. of palms observed	Percentage	Weightage given
Yellowing	2316	73.0	70
Necrosis	595	18.7	20
Reduction in crown size	263	8.3	10
Total	3174*	100.0	100

*The symptoms are not mutually exclusive, that is, the same palm will show more than one symptom, hence the total number of observations is more than the number of palms observed.

Table II. *Classification of 200 arecanut palms into various stages of disease by four investigators*

Category of the palm	No. of palms grouped by various investigators.				Expected
	I	II	III	IV	
H	27	32	28	30	29.3
DE	41	40	37	44	40.5
DM	84	86	86	82	84.5
DA	48	42	49	44	45.7
Total	200	200	200	200	200

$X^2 = 1.97$ not significant.

Results and Discussion

The formula (Eqn. 2) measures the intensity of yellow leaf disease giving due weights to each of the three major foliar symptoms which are distnct and easily visible, accommodating simultaneous variation in the intensity of these symptoms. The other symptoms like shedding of mature and immature nuts, discolouration of kernel, blackening of root tips, etc. were excluded, since they were less important and scoring them would involve destructive and cumbersome procedures. Arecanut palm generally have 6-8 leaves, and hence, scoring of 3-4 lower leaves will be sufficient for working out the disease index of the palm. The value of I varies from 0 to 100, where 0 represents the absence of all the symptoms indicating that the palm is apparently healthy, and 100 means the presence of all the symptoms in the most acute stage. For convenience, the score for the symptoms can be given as follows:

For Yellowing

Healthy .. 0
Tip yellowing (TY)in upto 25% of leaflets 1
TY in upto 50% 2
TY in more than 50% +Marginal yellowing (MY) in upto 25% .. 3
TY in full+MY in upto 50%+complete yellowing (CY) in upto 25% .. 4
TY in full+MY in more than 50% +CY in upto 50% 5
TY in full+MY in more than 50%+ CY in (mild)full 6
CY in full (severe) 7

For Necrosis

Healthy 0
Necrosis upto 50% of the leaflets .. 1
Necrosis in more than 50% of the leaflets 2

Reduction in Crown Size

Normal size of the crown and leaves .. 0
Reduction in the size of younger leaves 0.5
Reduction in the size of younger leaves and tampering of the stem .. 1

Thus, the disease index of a palm, having 7 leaves the scores for yellowing 7, 6, 6 and 5, those for necrosis 2, 1, 1 and 0, respectively for the lower four leaves, and 0.5 score for reduction in crown size works to

$I = (\frac{24+4}{4} + 0.5) \times 10 = 75$ and this palm is classified diseased at the advanced stage (DA).

If the value of I lies below 20, the palms may be classified Diseased at the Early stage (DE), if the value lies between 20 and 50, as Diseased at the Moderate stage (DM), and at values above 50, as Diseased at the Advanced (DA) stage.

Table II shows that the four investigators did not differ significantly in thier evaluation of the intensity of yellow leaf disease. Hence, we propose that the procedure can be used by any investigator who has an adequate knowledge on the symptoms of this disease.

The above index reduces the disease intensity complex to a single numerical value, and it can be used for statistical analysis.

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