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Computation of disease index of root (wilt) disease of coconut

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ABSTRACT

The major foliar symptoms associated with the root (wilt) disease of coconut are flaccidity, yellowing and necrosis. Data available from a previous study on the diagnostic symptoms of the disease on 7,168 palms (both adult and young), growing under varying ecological conditions formed the basis for fixing up the importance of the different symptoms. On the basis of their frequency of occurrence and intensity, due weightage and grade points were assigned to each symptom. A formula was evolved to index the disease intensity, by adding the weighted average grade points of the different symptoms on all the leaves of a palm, thereby reducing the disease-intensity complex to a single numerical expression.

Accurate measurements on the intensity, extent and destructiveness of plant sickness find a wide range of uses. Chester (1967) stressed the importance of expressing the intensity of a disease in quantitative terms as a fundamental requirement for the advancement of plant pathology and control of diseases. The root (wilt) disease of coconut is a major problem in Kerala, affecting the crop in nearly one-third of the area, resulting in a heavy loss in yield. As a result of the lack of standard methods for measuring the disease intensity, even basic information on the resultant crop losses is fragmentary and inaccurate. This paper presents a standard method for measuring the intensity of the root (wilt) disease in quantitative terms, based on foliar symptoms.

MATERIALS AND METHODS

A quantitative evaluation of different symptoms based on the frequency of occurrence in 7,168 palms growing under varying ecological conditions revealed that flaccidity or ribbing of leaflets is the diagnostic and common symptom, whereas yellowing and marginal necrosis of leaves are of secondary importance (Radha and Lal, 1972). There is also considerable variation in the symptoms between young and adult palms.

Foliar conditions of 5,960 adult and 1,208 young palms, in groups of 900 to 2,000 palms from 3 soil types, viz. laterite in the interior hilly areas in Kottayam district, reclaimed clayey soil (waterlogged) of Kuttanad, and sandy-loam soil in the coastal tract at Kayangulam and at Vypeen Islands (where the water-table is high), were recorded during January to April, to avoid the possible effect of seasonal factors. As many as 5,121 adult palms and 812 young ones were found to be diseased. The occurrence of the foliar symptoms, viz. flaccidity, yellowing and marginal necrosis, singly and in combination with each other, were recorded. The percentage of palms under each category was worked out and the percentage contribution of each symptom was assessed. The percentage of palms showing various symptoms (Table 1), rounded to 50, 30 and 20 for adult palms and 75, 15 and 10 for young palms, were taken as the weights for the respective symptoms.

The grade points assigned to the different symptoms vary from 0 to 5 for flaccidity, 0 to 3 for yellowing and 0 to 2 for necrosis, according to the intensity and number of leaflets showing the symptoms.

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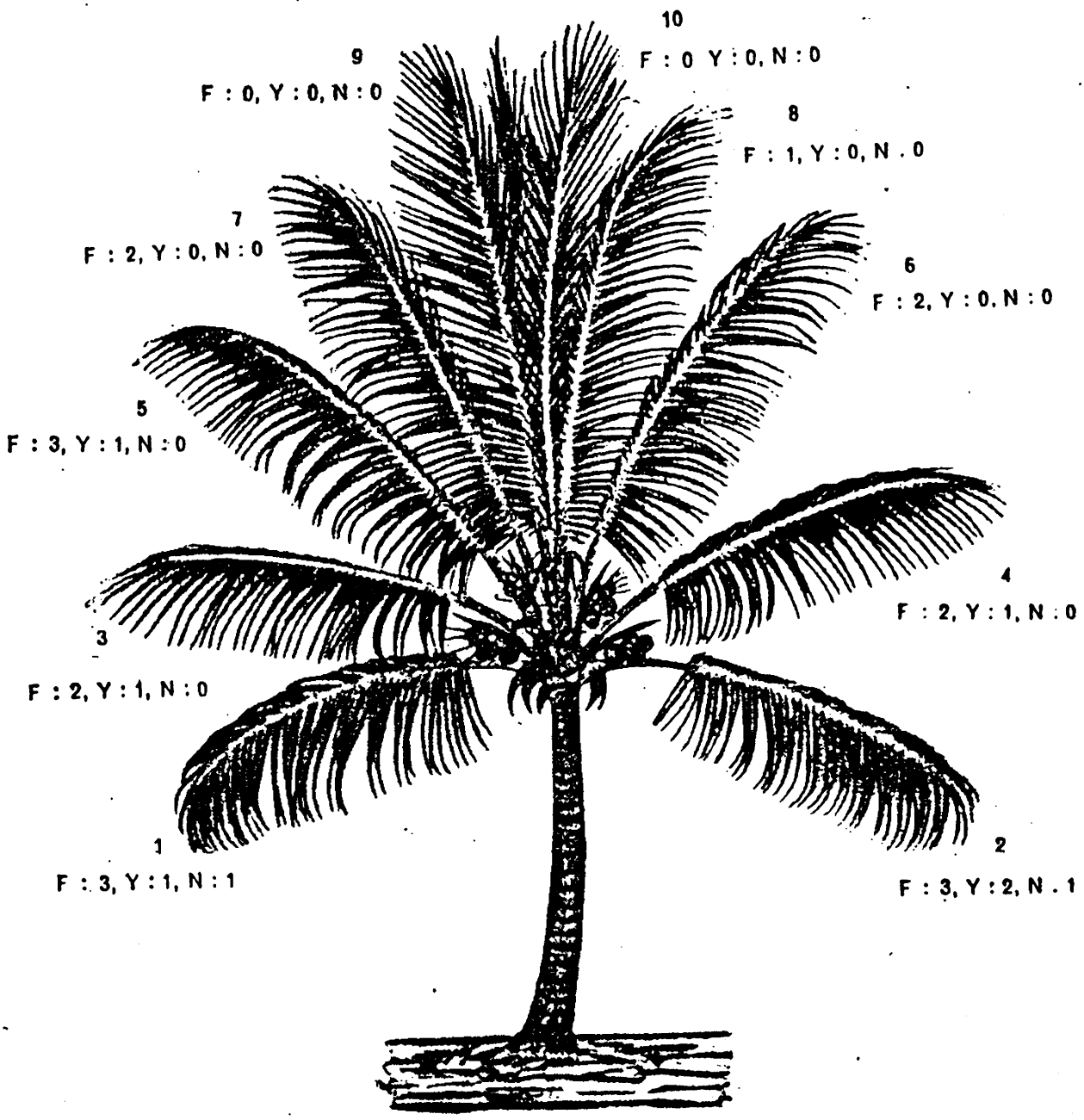

Total score = F : 18, Y : 6, N : 2

$$I = \frac{15F + 5Y + 5N}{L} = \frac{(15 \times 18) + (5 \times 6) + (5 \times 2)}{10} = \frac{310}{10} = 31\%$$

Fig. 1. Computation of the index of root (wilt) disease of young palm. The grade points are: flaccidity (F) = 5, yellowing (Y) = 3, and necrosis (N) = 1.

For working out the disease index of a palm (Figs 1, 2) each leaf was graded separately for flaccidity, yellowing and necrosis.

The disease index for the palm 'I' was worked out according to the following formula:

$$I = \Sigma \frac{(a.F + b.Y + c.N)}{L}$$

where F, Y and N are the grade points assigned to a leaf for flaccidity, yellowing and necrosis; L is the total number of leaves in the palm; Σ is the sum of all the grade points over all the (L) leaves; and a, b and c are the weights given to flaccidity, yellowing and necrosis, so that 'I' is the expression in 100. By dividing the respective weights by the maximum

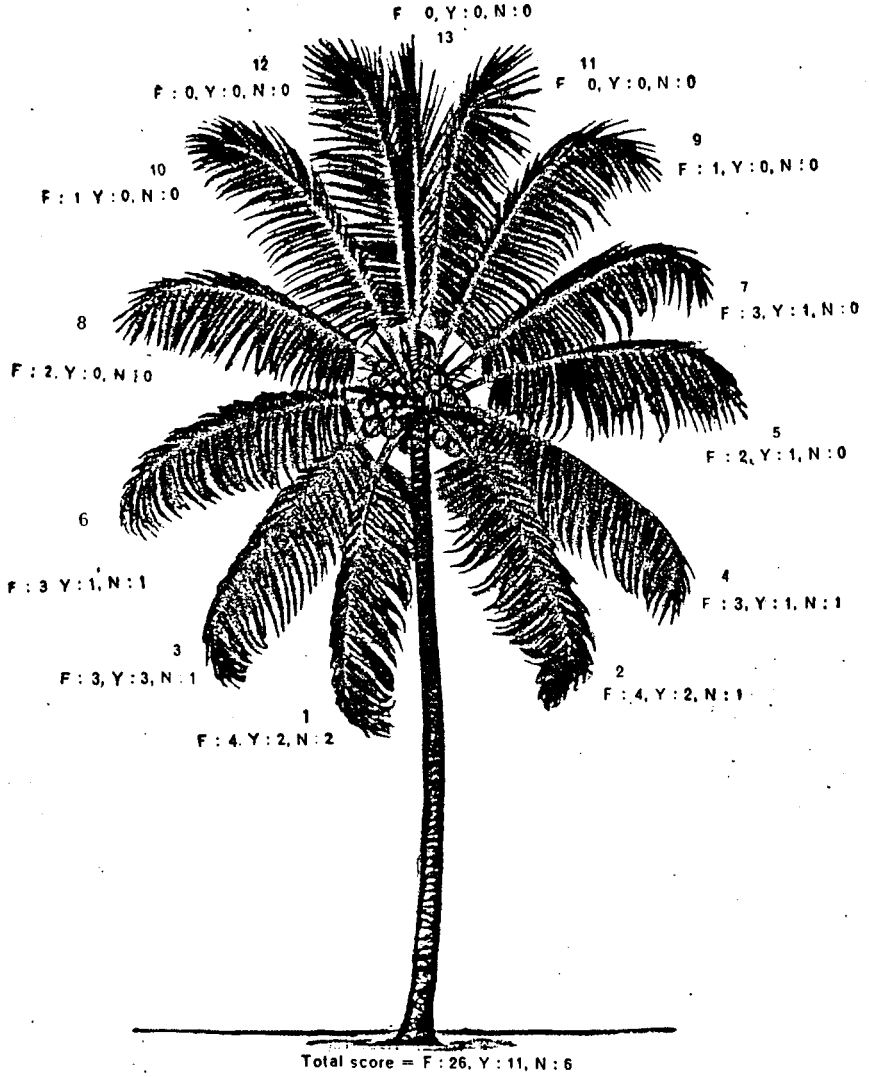

Fig. 2. Computation of the index of root (wilt) disease of adult palm. The grade points are: flaccidity (F)=5, yellowing (Y)=3, and necrosis (N)=1.

Table I. Partitioning of the percentage of diseased palms under the 3 symptoms singly and in combination

Source	Flaccidity		Yellowing		Necrosis	
	Adult	Young	Adult	Young	Adult	Young
Single	14·7	57·1	3·6	3·8	1·7	2·0
Contributions from						
Flaccidity + yellowing	17·3	8·1	17·2	8·0		
Flaccidity + necrosis	5·6	2·1			5·7	2·1
Yellowing + necrosis			0·4	0·2	0·4	0·3
Flaccidity + yellowing + necrosis	11·2	5·5	11·1	5·4	11·1	5·4
Total	48·8	72·8	32·3	17·4	18·9	9·8

score given to each symptom, a, b and c were obtained.

For adult palms, a=50/5=10; b=30/3=10; c=20/2=10; i.e. a=b=c=10; and for young palms, a=75/5=15; b=15/3=5; and c=10/2=5.

Substituting the respective weights, the above formula was reduced to

For adult palms

$$I=\frac{\text{Sum }(F+Y+N)}{L}\times 10 \quad \ldots\ldots\ldots (1)$$

which is the sum of all the grade points assigned to each symptom for all the leaves (L) multiplied by 10 and divided by the number of leaves.

For young palms below 10 years

$$I=\frac{\text{Sum }(15\,F+5\,Y+5\,N)}{L} \quad \ldots\ldots\ldots (2)$$

which is the sum of all grade points for flaccidity, yellowing and necrosis multiplied by 15, 5, and 5 respectively, added for all the leaves (L) and divided by the number of leaves.

RESULTS AND DISCUSSION

The intensity of disease expressed as disease index varies from 0 to 100, where 0 represents the total absence of all the symptoms, indicating that the palm is in perfect health, and 100 means the presence of all the symptoms in the acute stage on all the leaves. If 'I' lies below 20, the palm may be classified diseased at the early stage; between 20 and 50, diseased at the moderate stage; and above 50, diseased at the advanced stage.

Thus the disease index of an adult palm that has 22 leaves and has scored 56 grade points for flaccidity, 15 for yellowing and 22 for necrosis, works out to I=42·3, when it is classified moderately disased. Similarly, for young palm (below 10 years) with 15 leaves, the grade points for flaccidity, yellowing and necrosis being 42, 13 and 8 respectively, the disease index works out to I=49, when the young palm is classified moderately diseased.

The present formula has the advantage to measure the complex disease syndrome of root (wilt) disease of coconut, giving due emphasis on each of the 3 symptoms associated with the disease, accommodating the simultaneous variation in the intensity of these symptoms. This formula helps in judging the intensity of the disease in precise degrees of magnitude and does away with the possible errors of human judgement in the arbitrary rating of the disease. It also reduces a disease-intensity complex to a single numerical expression that is open to statistical analysis.

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