Journal of Plantation Crops 17 (2): 80–84 December, 1989

Research Articles

STEM BLEEDING DISEASE OF COCONUT—A METHOD FOR INDEXING THE DISEASE SEVERITY *

JACOB MATHEW, K. K. N. NAMBIAR, C. T. JOSE and ANIL KUMAR
Central Plantation Crops Research Institute, Kasaragod 670 124, Kerala, India

ABSTRACT

A method for indexing the disease severity in stem bleeding affected coconut palms, based on lesion size and the score for tapering has been developed. The index can be worked out using the formula $I=1.8\,l + 4.3\,t$, where l is the lesion size expressed in 1000 cm^2 and t is the score for tapering. This will be useful in comparing the disease severity in different locations/cultivars as well as for a meaningful comparison of the efficacy of treatments.

INTRODUCTION

Stem bleeding disease of coconut, caused by *Thielaviopsis paradoxa* (Nambiar et al. 1986) is widely prevalent in all coconut growing states in India, irrespective of the soil type. The characteristic symptom of the disease is the exudation of a dark brown gummy fluid from the growth cracks in the trunk, mostly at the base. The lesions traverse upwards and sometimes many lesions coalesce together forming larger patches. The tissues lying beneath the affected bark also show decay. In later stages, symptoms are also seen on the crown of the affected palm. The outer whorl of leaves turn yellow which gradually spreads to the inner whorl. The leaves droop one by one and fall prematurely. The stem apex gradually tapers and crown size is reduced as a result.

The necessity for quantifying the severity of the disease was felt, especially when field control trials are laid out which may in turn involve evaluation of different treatments. Such indexing methods are known in other diseases of palms like root (wilt) disease of coconut (George and Radha, 1973, Nambiar and Pillai, 1985), yellow leaf disease of arecanut(George,Mathew and Nagaraj,1980), tatipaka disease of coconut (Rama Pandu and Rajamannar, 1983) and Thanjavur wilt disease of coconut (Vijayan and Natarajan, 1975). Though in stem bleeding and Thanjavur wilt disease, exudation of the fluid is the common symptom there is great deal of difference between these diseases, as far as the etiology, symptomatology and epidemiology are concerned (Nambiar and Rethinam, 1986). Hence the indexing

* *Contribution No. 720, Central Plantation Crops Research Institute, Kasaragod*

method used in the case of Thanjavur wilt cannot be straight away used in stem bleeding disease and hence this attempt.

MATERIALS AND METHODS

Observations on the severity of the disease and other associated characters were recorded for 860 stem bleeding affected palms, belonging to the age group 15–50 years, distributed over 15 plots, comprising laterite, sandy/sandy loam and red loamy soils, in Kasaragod district in North Kerala. The observations recorded were :

1. Height of the lesion (in M), 2. Lesion size (in cm^2), 3. No. of leaves, 4. No. of drooping leaves, 5. No. of leaves with yellowing, 6. Score for tapering (ranging from 0 to 4), 7. No. of bunches, 8. Yield of nuts and 9. Management practices.

The lesion size was worked out, from the actual measurements of length and breadth of the lesions, when they occur individually and quite apart from one another. When lesions occur in group, the total length and breadth were taken. In severe cases when the entire girth of the trunk is involved in the expression of the symptoms, the mean girth multiplied by the height of the lesion was taken as the lesion size. Tapering of the stem generally appear when the palms are in the middle stage of the disease. A visual score of 4 was given to those plants where the girth of the trunk apex was almost half that of the base portion of the trunk, at breast height and girths in between them were given proportionate scores of 1 to 3.

Taking lesion size as an appropriate measure for the intensity of disease infection, its linear correlation coefficients with other characters were worked out (Table I). The characters which are more closely related with lesion size were then considered as independent variables in a multiple regression model to find out the relative contribution of each of these characters in estimating the lesion size (Table II). In view of the possible inter-relationship between some of those characters, step-down regression method was also attempted, in order to bring down the number of variables, without any substantial loss of information. Taking these partial regression coefficients as weights, with suitable changes in the scale of measurement, an index was developed, to measure the severity of the disease, with a range of 0 to 100. The index so calculated was

Table I. *Linear correlation coefficients between lesion size and other characters in coconut palms affected by stem bleeding disease (n = 860)*

Height of lesion	:	0.8574	Number of bunches	:	—0.3163
Tapering	:	0.6171	No. of drooping leaves	:	0.3090
Number of leaves	:	—0.3867	Leaves with yellowing	:	0.1422
Yield of nuts	:	—0.3616			

Table II. *Multiple regression equations for estimating the lesion size*

Equation	Constant term	Partial regression coefficients corresponding to				
		Height of lesion	Tapering	No. of leaves	Yield of nuts	R^2
1	—1722.08	5284.16 (148.59)	1539.02 (224.97)	—38.10 (52.12)	—14.88 (9.90)	0.76
2	—1678.955	5302.86 (148.17)	1593.51 (222.20)	—68.50 (48.07)	—	0.76
3	—3228.98	5326.27 (147.35)	1711.55 (206.30)	—	—	0.75

Note: Figures in parenthesis denote the standard errors of regression coefficients

evaluated under field conditions and compared with the visual index scores given by workers (Table III).

RESULTS AND DISCUSSION

Correlation studies showed that lesion size was highly correlated with the height of the lesion and tapering (Table I). Number of leaves, yield of nuts, number of bunches and number of drooping leaves were also having significant correlation with lesion size. More or less similar results were obtained when the data for individual plots were analysed. About 76% of the variations in lesion size can be explained by the four characters with maximum correlations with lesion size, *viz.*, height of the lesion, score for tapering, number of leaves and yield of nuts, when used in a multiple regression model. Step-down regression methods showed that characters like number of leaves and yield of nuts can be avoided, without any appreciable loss in information (Table II). The lesion size estimated on the basis of height of lesion and tapering may go upto 40,000 cm^2 depending on the severity of the disease, assuming that lesions seldom appear above 7 m height. With this regression equation as the basis and with suitable changes in

Table III. *Evaluation of the indexing method*

	Plot–1 (n=46)	Plot–2 (n=48)
Visual index score (Mean)	17.7	26.1
Index based on height of lesion and tapering (Mean)	18.7	25.2
Rank correlation with visual score	0.788	0.933
Index based on lesion size and tapering:		
Mean	17.5	25.7
Rank correlation with visual score	0.874	0.938

the scale of measurement, an index of the form 13.3 h + 4.3 t – 8.0 was obtained to measure the lesion size, with a maximum score of 100. In this index, h is the height (in M) at which lesion appear and t is the score for tapering, ranging from 0 to 4. The highest value that the factor relating to tapering can contribute towards the index for lesion size is 17 only and therefore, in severe cases of disease, the remaining 83% is the contributes of height of the lesion. This Index for lesion size can be taken as a numerical score for the severity of the disease. But in this method, when height alone is considered mildly affected palms with lesions occurring in isolation are not clearly distinguished from the severely affected ones, where the lesions coalesce together and appear in large patches, covering all sides of the trunk. Therefore, a more sensitive index for quantifying the severity of stem bleeding disease was obtained, by replacing the component for height of the lesion with the estimated lesion size. Keeping the maximum lesion size at 45000 cm^2, the coefficient was suitably modified to account for nearly 83% of the contribution to the Index score. The modified formula is of the form 1.8 l + 4.3 t where l is the lesion size, expressed in 1000 cm^2 and t is the score for tapering. This formula can be used to quantify the severity of the stem bleeding in coconut palms.

Evaluation of the indexing method carried out in two gardens showed that they are very much in agreement with the visual scores (Table III). The formula based on lesion size is found superior to the other based on height, in view of the fact that the values are more close to the visual scores, with a slightly higher rank correlation coefficient.

An index score of 10 and below can be considered as mild, with 11 to 25 as moderate and above 25 as severe. In the case of moderate score, the trunk apex will normally give a score of one only. This might however vary according to the management practices. In well managed gardens, tapering can be observed only when the palms are in the advanced stage of disease.

This formula can be effectively used in palms of ages above 15 years. Young palms are highly susceptible and even a few lesions may have deleterious effect on the growth activity.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. M. K. Nair, Director, CPCRI, Kasaragod for encouragement during the study and to Dr. P. Rethinam, Assistant Director General (Plantation Crops), ICAR for going through the manuscript. The help rendered by Mr. Joseph Sebastian, Junior Technical Assistant in collecting field data is gratefully acknowledged.

REFERENCES

GEORGE, M. V. and RADHA, K. 1973. Computation of disease index of root (wilt) disease of coconut. *Indian J. Agric. Sci.* **43** : 366–370

GEORGE, M.V., JACOB MATHEW and NAGARAJ, B. 1980. Indexing the yellow leaf disease of arecanut. *J. Plant. Crops.* **8** : 82–85

NAMBIAR, K. K. N. and RETHINAM, P. 1986. Thanjavur wilt / Ganoderma disease of coconut. *CPCRI Pamphlet No. 30*, pp. 10

NAMBIAR, K.K.N., JOSHI, Y., VENUGOPAL, M.N. and MOHAN, R. C. 1986. Stem bleeding disease of coconut. Reproduction of symptoms by inoculation with *Thielaviopsis paradoxa*. *J. Plant. Crops.* **14 (1)** : 130–133

NAMBIAR, P. T. N. and PILLAI, N. G. 1985. A simplified method of indexing root (wilt) affected coconut palms. *J. Plant. Crops.* **13** (1) : 35–37

RAMA PANDU, S. and RAJAMANNAR, M. 1983. Symptomatology and indexing of Tatipaka disease of coconut. *Indian Phytopath.* **36**: 608–612.

VIJAYAN, K. M. and NATARAJAN, S. 1975. Influence of fertilizer and manuring on the incidence and progress of coconut wilt disease of Tamil Nadu. *Cocon. Bull.* **5** : 1–5.