

A SAMPLING TECHNIQUE TO ESTIMATE WHITE GRUB POPULATION IN COCONUT GARDEN

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ABSTRACT

A sampling technique was standardised for the population estimation of *Leucopholis coenophora* around the palm basin in irrigated coconut gardens. The total number of white grubs present in the root zone of a palm can be estimated by the regression equation $Y = 3.78 + 1.7938 x$, where Y is the total population of white grubs found around a palm and x is the number of insect stages found upto a depth of 40 cm at a distance of 50 to 100 cm away from the trunk of the palm.

INTRODUCTION

The white grub *Leucopholis coenophora* Burm., is a major pest of coconut in the coastal areas of Kerala and Karnataka. The grub feeds voraciously on the roots of

coconut palm, resulting in substantial yield losses. *L. coenophora* was reported to have an annual life cycle with three larval instars (Nirula 1958; Abraham and Mohandas 1988). White grubs are polyphagous with a variety

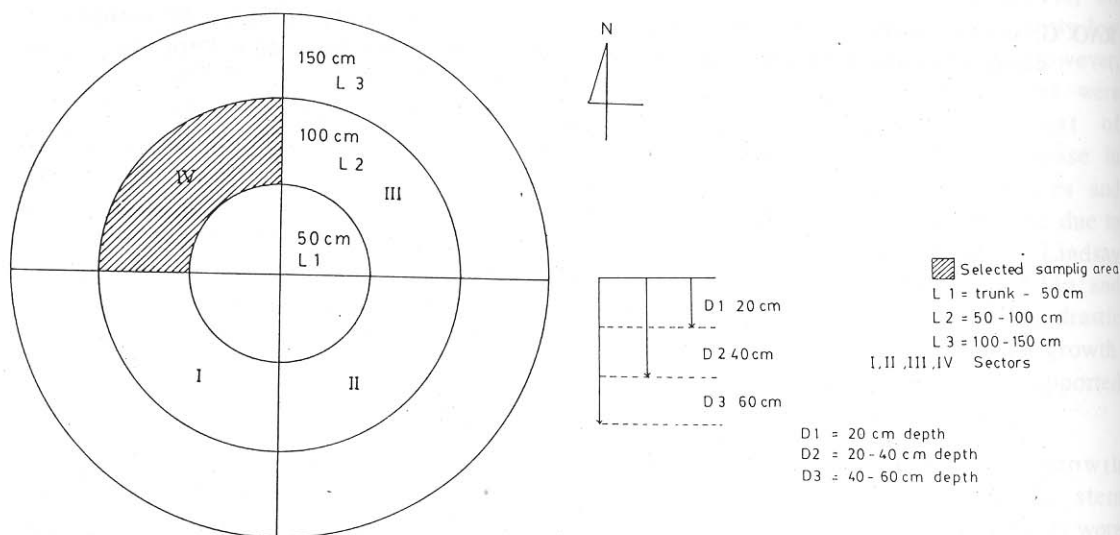


Fig. 1. Diagrammatic view of regions and sectors

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Table 1. Population distribution of *L. Coneophora* in different areas around the Palm. (Mean of 30 palms).

Depth (cm)	Distance from the bole (cm)		
	0-50	50-100	100-150
0-20	2.07 (0-10)	3.60 (0-16)	1.93 (0-13)
20-40	1.40 (0-7)	3.43 (0-14)	1.90 (0-8)
40-60	0.53 (0-2)	0.87 (0-4)	0.67 (0-4)

(The values in parenthesis indicate the range)

of host plants such as arecanut, cocoa, banana, groundnut, sugarcane, vegetables and many tuber crops apart from coconut (Nirula 1958, Veeresh 1977, Abraham and Mohandas 1991). To understand the seasonal phenology of the pest, knowledge of its population distribution is needed for which a valid sampling procedure has to be developed. Though sampling techniques have been formulated for the white grubs attacking cabbage, chickpea (Sharma and Shinde 1973) and groundnut (Yadava *et al.* 1977), there was no uniformity among them with regard to sample size and method. Moreover, in the coconut palm with a well defined root zone and spacing pattern, it was found that none of the methods mentioned above will give an account of the actual population in a coconut garden. Veeresh (1983) adopted random sampling of six 1.5m² areas upto a depth of 30 cm. As no systematic study has been made so far to standardize a sampling technique for white grubs in coconut garden, this study was undertaken to evolve an efficient sampling technique for estimating the population of *L. coneophora*.

MATERIALS AND METHODS

The investigations were carried out at C.P.C.R.I., Kasaragod (12°38'N, 78°E), Kerala in an irrigated coconut monocrop with a spacing of 7m x 7m for the palms. The soil type is sandy loam. Thirty palms selected at random in different age groups (6 to 20

Table 2. Correlation between Population in different positions and the total population (Y)

Sl. No.	Depth	Distance	correlation coefficient(r)
1.	0-20 cm	0-50 cm	0.7409**
2.		50-100 cm	0.7089**
3.		100-150 cm	0.4108*
4.	20-40 cm	0-50 cm	0.5425**
5.		50-100 cm	0.5438**
6.		100-150 cm	0.3857*
7.	40-60 cm	0-50 cm	0.2439**
8.		50-100 cm	0.0699*
9.		100-150 cm	0.5226**
10.	0-20cm	upto 100 cm	0.7741**
11.		upto 150 cm	0.8451**
12.	0-40cm	50-150 cm	0.7938**
13.		0-50 cm	0.7891**
14.		50-100 cm	0.8613**
15.		100-150 cm	0.6591**

* Significant at 5%; **Significant at 1%: (n=30)

years) were sampled for population counts. All stages of the pest viz., egg, larvae, pupae and adults were counted by visually examining the extracted soil in the field. The experiment was done in two stages. In the first stage, the total root zone of the palm was divided into nine categories involving three lateral distances from the bole of the palm (L1: bole to 50cm, L2: 50-100 cm and L3: 100-150 cm) and at three depths (D1: 0-20 cm, D2: 20-40cm and D3: 40-60 cm) (fig-1). Thus, from those 9 positions (3x3), population counts were made. The total population for the palm is the sum total of all these positions. In the second stage of study observations were recorded on 33 palms, only in one particular position viz., upto 40 cm depth and 50-100 cm lateral distance from the bole of the palm. In this study the counts were recorded separately for four equal sectors made around the palm viz., Sector I: South to West, Sector II: South to East, Sector III: North to East and Sector IV: North to West. Correlations were worked out between the counts for each position or a few combination of positions with the

Table 3. *Some promising regression equations for estimating total population*

Regression equation		R ²	Quantity of soil to be excavated
Y = 6.79 + 1.96	D1L1 + 1.00 D1(L2+L3)	(0.75)	1.4143 M ³
Y = 6.94 + 1.25	D1(L1 + L2 +L3)	(0.73)	1.4143 M ³
Y = 3.90 + 1.94	D1L2 + 1.62 D2L2	(0.75)	0.9429 M ³
*Y = 3.78 + 1.79	(D1 + D2) L2	(0.75)	0.9429 M ³
* Selected equation; Y = Total number of grubs per palm L1, L2, L3, D1 and D2 see Materials and method for details.			

total count for the palm, to identify the most suitable position which gives good correlation with the total count.

RESULTS AND DISCUSSION

Maximum population counts were observed in the area between 50-100 cm lateral distance upto 40 cm depth (Table 1). Studies on the correlation between counts for each position and few combination of positions with the total counts indicated that all the positions, except those at the last depths (40-60 cm depth and upto 100cm lateral distance) gave significant positive correlation with total count of palm (Table 2).

Ideal variable to predict the total population should have a high correlation with total count. At the same time it should be a physically convenient position to record observation without much disturbance to the root system of the palm. The data in table 3 give some of the prediction equations with their coefficient of determinations (R²). It

was found that the populations of grubs present in the soil upto 40 cm depth around the palm at 50-100 cm lateral distance gave high correlation. The amount of soil to be excavated for counting also was found to be the minimum (0.94m³) in this position. Hence this variable was found to be the suitable to predict the total count of the grubs affecting a palm. This variable (x) used for prediction explains about 75% of the variation existing in the total count of a palm.

Analysis of variance for the counts in the second stage of study in different sectors did not reveal significant differences (Table 4). Thus, four times the count of any sector could be used as an estimate for the count of white grubs present upto 40 cm depth (D1 + D2) at 50-100 cm (L2) distance from the bole of the palm. Out of the four sectors, the sector IV appeared to be better as it gave the least CV%. When the counts in sector IV were multiplied by four and used as a variable(x) in the prediction equation, the average of 33 palms agreed with the average obtained by using the count of all sectors. It is thus clear that to estimate the total count of white grubs present in a coconut palm, it is enough to count the grubs present in the North-West sector of the palm between 50-100 cm away from the bole and upto 40 cm deep and use it in the regression equation $Y = 3.78 + 1.79X$, where Y is the total count for the palm and X is four times the count in the IVth sector at 50-100 cm away from

Table 4. *Table of sector means*

Sector	Mean(x)	$\sqrt{(x+0.5)}$	SE	correlation between total
I	7.76	2.69	0.15	0.876
II	5.90	2.40	0.15	0.774
III	6.00	2.42	0.15	0.893
IV	6.67	2.56	0.15	0.866
Gen. mean	6.59	2.52	0.08	
F. value		0.77		

the trunk upto 40 cm depth. For the population estimation of *Holotrichia consanguinea*, 1m³ pits were sampled at random in the fields of cabbage and chickpea (Sharma and Shinde 1973) and groundnut (Nigam and Awasthi 1978) and pits of 30 cm³ in groundnut (Prasad 1975) and 1m² upto 30cm depth in groundnut and chillies (Yadava et al. 1977). But in the case of coconut since the active root zone is restricted to the basin of 1.8 m around the bole, general field pits will not yield a true population estimation. In arecanut for the population estimation of *Leucopholis burmeisteri*, 50 cm³ volume of soil was drawn 30 cm away from the base of the palm (Premkumar 1974). Veeresh (1983) reported that 1.5 m² area upto 30 cm depth was sampled for white grub population in coconut.

In sugarcane, groundnut and wheat, Nath and Janardhan Singh (1987) sampled 1m x 1m x 30 cm volume of soil for all species of white grubs. The present sampling method evolved involves only 0.24m³ of soil with least disturbance to root system and minimum of labour requirement.

Accurate monitoring of population levels of any pest is essential for an effective pest management system. With the present method developed, the distribution of different stages of *L. coneophora* in soil can be described. The seasonal phenology of the pest can be studied by this technique and based on the information an Integrated Pest Management strategy for *L. coneophora* can be formulated.

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