Table 1. Effectof inoculation of *A. diazotrophicus* with different levels of nitrogen on the yield and brix percentage of sugarcane variety CoC-92061

Treatments	Yield (t/ha)	Percentage increase over control	Brix percentage	Percentage increase over control
T_1	63.33	-	13.6	-
T_2	86.97	37.32	13.9	2.20
T_3	99.63	57.31	14.4	5.82
T_4	116.27	83.59	15.1	11.03
T_5	128.93	103.58	15.8	16.17
T_6	74.23	17.21	14.3	5.14
T_7	104.20	64.53	15.1	11.02
T_8	128.10	102.27	15.8	16.17
T_9	129.10	103.85	15.8	16.17
T_{10}	129.50	104.48	16.0	17.64
C.D. (P=0.05)	1.510			0.324

T_1 - No N+ NO *A. diazotrophicus*
T_2 - 25 % N + - do -
T_3 - 50 % N + - do -
T_4 - 75 % N + - do -
T_5 - 100 % N + - do -
T_6 - No N + *A. diazotrophicus* @ 2kg/ha
T_7 - 25 % N + - do -
T_8 - 50 % N + - do -
T_9 - 75 % N + - do -
T_{10} - 100 % N + - do -

nitrogen fixing organism reduced 50 percent of the recommended fertilizer nitrogen requirement.

It was noted that the cane brix percentage considerably increased when *Acetobacter diazotrophicus* was inoculated. Boddey *et al.*, (1991) reported that some sugarcane varieties could obtain large contributions of plant associated biological nitrogen fixation ranging from 60 percent to 80 percent of total plant nitrogen equivalent to over 200 kg/ha/yr. So it can be concluded that the inoculation of *Acetobacter diazotrophicus* would increase yield of sugarcane besides reducing the application of inorganic nitrogen.

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POPULATION DYNAMICS OF TEAK DEFOLIATOR, *Hyblaea pura* IN COMMERCIAL TEAK PLANTATION*

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ABSTRACT

The population dynamics of teak defoliator, *Hyblaea puera* was studied on three commercial teak plantations in South India. Defoliator, *H. puera* occurred in two distinct epidemic infestations in all the sites, one during April-June and the second during September-December. The correlation between larval population and weather parameters showed that rainfall had highly significant positive influence and wind velocity had negative influence on larval population. Other factors like relative humidity, minimum and maximum temperatures were of no significance.

KEY WORDS : Commercial teak plantation, Defoliator, Population dynamics.

Nowadays teak, *Tectona grandis* cultivation has become an attractive commercial venture in the plains of Tamil Nadu. Many private firms have started investing more money on teak. The major problem these enterpreuneurs often encounter is the pests, especially the defoliator *Hyblaea puera*

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Cramer (Lepidoptera : Hyblaeidae). Many scientists have worked on the population dynamics and seasonal abundance of this pest in various locations (Beeson, 1941 ; Vaishampayan, 1982 : Nair *et al.*, 1985 ; Bhowmick and Vaishampayan, 1986 ; Vaishampayan *et al.*, 1987 ; Khan *et al.*, 1988; Pawar and Bhatnagar, 1989, 1990 ; Meshram *et al.*, 1990 ; Nair *et al.*, 1995). However, these works are mostly related to forest teak plantation. Very little information is available on the population dynamics of defoliator in commercial plantations. This study was undertaken with the above objective.

MATERIALS AND METHODS

The investigation was made between October 1995 and February 1997, on three different sites viz., Agricultural College and Research Institute at Killikulam, a commercial teak plantation at Veeravanallur, and a farmer's holding at Kasilingapuram, Tamil Nadu. Larval population of defoliator was assessed at weekly interval from 2-3 year old trees. Sampling was made from 25 trees. The number of larvae present throughout the tree was noted with the help of Alluminium ladder. The population data collected from Killikulam and Kasilingapuram were correlated with the weather data recorded at Killikulam whereas data on population samples made at Veeravanallur were analysed against the meteorological data from the same site. Standard week means of maximum temperature, minimum temperature, relative humidity (RH), rainfall and wind velocity were included for the analysis.

RESULTS AND DISCUSSION

Data on the seasonal abundance of teak defoliator larvae collected from the three sites are presented in Figure 1. In Veeravanallur plantation, the larval population on 2-3 year old trees was nil in January and March. A very stray incidence (0.05 larva/tree) occurred in February. A summer shower in the second fortnight of March facilitated the larval population to build up. The infestation was so widespread that almost all saplings in different age groups were defoliated during April-May. The average larval population density increased to 7.54 per tree in May from 4.55 per tree in April. There were two generations during this first epidemic. The population declined to a very low residual level (0.06/tree) in June-July and was absent in August. When a light pre-monsoon precipitation occurred in September, defoliator larvae were very few in number (0.11/tree). Later a heavy downpour in October caused the trees to produce new flushes, triggering the outbreak. This time larval population exploded to greatest levels in November when each tree supported 13.06 larvae on an average and as

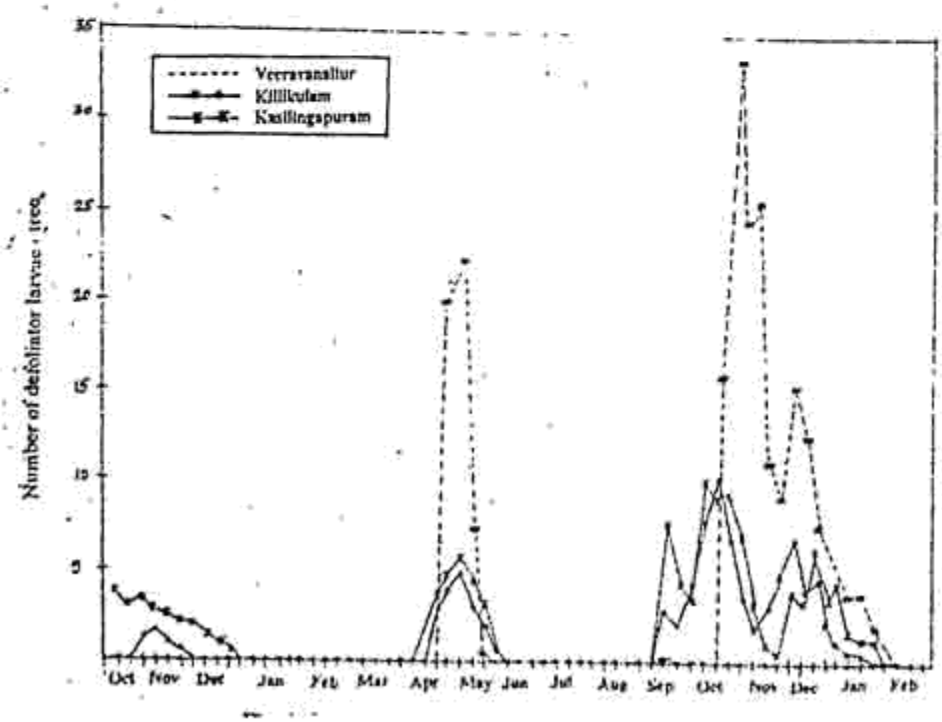

Fig. 1. Seasonal abundance of defoliator in three locations

many as 65-70 larvae per tree at maximum. There were four generations in succession. The infestation declined in December before disappearing by February.

At Killikulam also first epidemic infestation occurred during March-June and the second during September-January. Caterpillars first attacked the one year old teak saplings in April after the summer showers. Larval population was in its peak during May (2.07/tree). Compared to the pest load at Veeravanallur plantation, the incidence was less severe here because of the small size of teak plantation (1.0 acre) coupled with young age (1-year old). There was no defoliator infestation between June and August in 1996. The pest reappeared on receipt of pre-monsoon rainfall in September. This time the attack was much heavier than that after the summer showers with the pest completing four generations. Largest number of larvae defoliated the saplings in early October (7.38/tree) before becoming smaller in November-December (2.10-3.85). A few larvae occurred on teak foliage till January in 1997 (0.88/tree) before disappearing in February.

The five-acre plantation at Kasilingapuram also has the same pattern of defoliator occurrence as that at Killikulam. The pest load on 1-2 year old saplings was 2.90/larvae per tree in october 1995.

Table 1. Correlation coefficients between populations of teak and weather parameters

Weather Parameters	Defoliator	Skeletonizer
Commercial Plantation, Veeravanallur		
Wind Velocity	- 0.3535*	- 0.3582**
Relative Humidity	0.1181^{NS}	0.2202^{NS}
Minimum temp	- 0.0160^{NS}	- 0.2941*
Maximum temp	- 0.0345^{NS}	- 0.0149^{NS}
Rainfall	0.2880*	0.0045^{NS}
AC & RI, Killikulam		
Wind Velocity	- 0.3955**	- 0.1579^{NS}
Relative Humidity	0.1595^{NS}	0.4455**
Minimum temp	- 0.0944^{NS}	- 0.2583^{NS}
Maximum temp	- 0.3282*	- 0.5916**
Rainfall	0.4957**	0.1507^{NS}
Farmer's holding, Kasilingapuram		
Wind Velocity	- 0.4414**	- 0.3109*
Relative Humidity	0.1293^{NS}	0.3750**
Minimum temp	- 0.0241^{NS}	- 0.3874**
Maximum temp	- 0.0318^{NS}	- 0.4914**
Rainfall	0.4426**	0.2210^{NS}

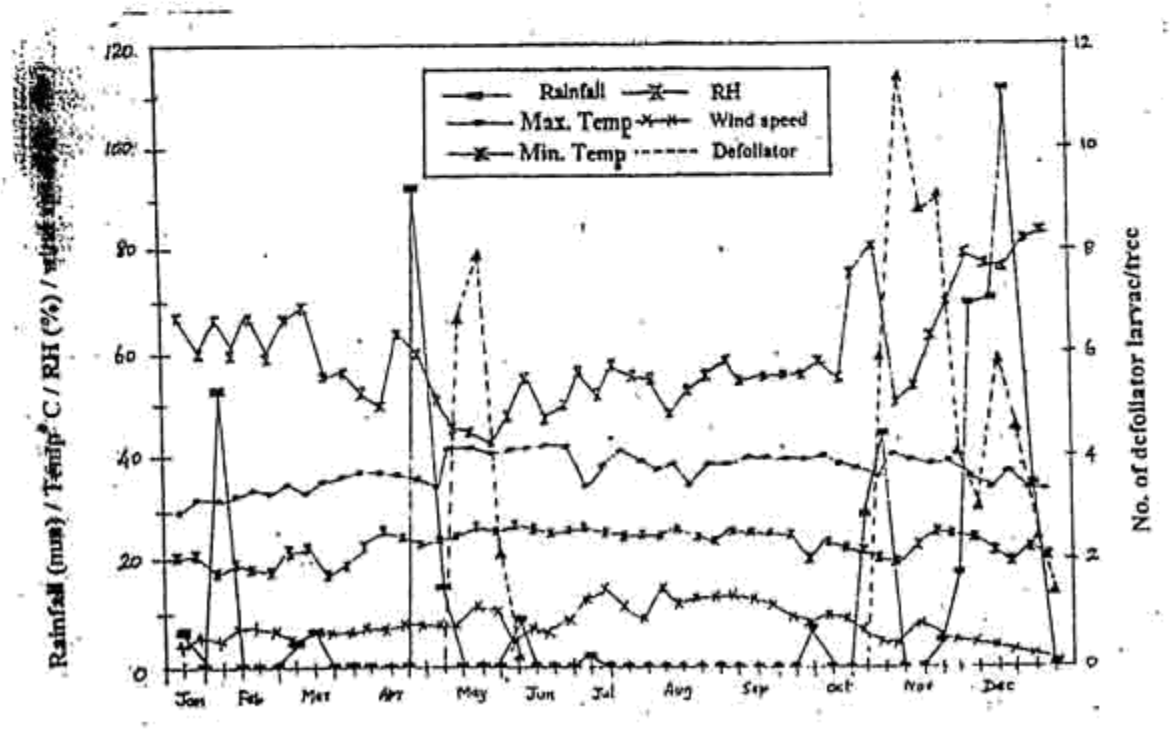

Fig. 2. Population dynamics of defoliator at Veeravanallur in relation to Weather factors

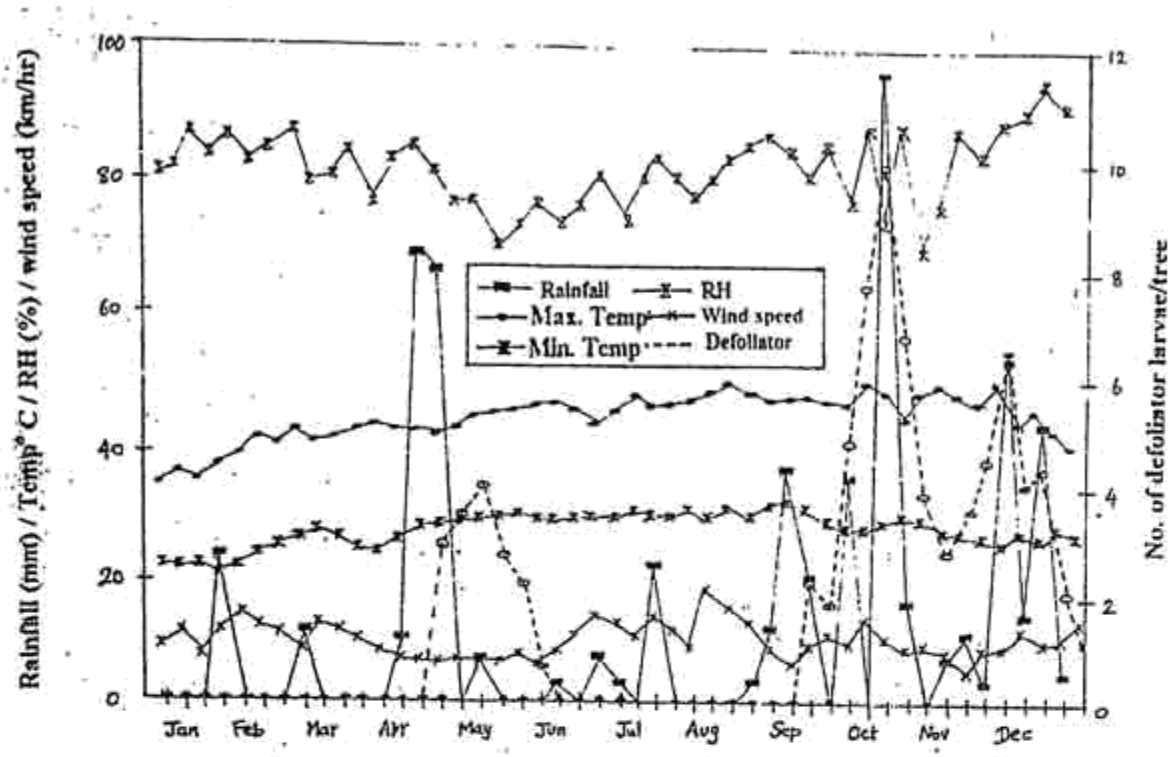

Fig. 3. Population dynamics of defoliator at Killikulam in relation to weather factors

The population density subsided in November-December (0.35-1.46). No larvae could be observed during January-March in 1996. Summer showers in April 1996 (138.40 mm) invited defoliator infestation again. More larvae (2.45/tree) caused defoliation in early May which they disappeared in June - August 1996. The second brood apperared in September after early pre-monsoon rains. This time the population was most numerous (8.10/tree) in October. The infestation decreased in November 1996-January 1997 (0.88-3.60) with moderate levels of ups and downs in larval population.

Usually, *H. puera* undergoes several generations a year (Beeson, 1941 ; Tewari, 1992 ; Nair *et al.*, 1995). Nair *et al.*, (1985) reported that defoliation by *H. puera* was regular annual feature with one or two waves of epidemic infestation between late April and July, followed in between late August and October in Kerala. Nair *et al.*, (1986) also reported two broods of heavy defoliation from Kariem-Muriem, Nedungayam and Aravallikavu forests. In Jabalpur, defoliator population was at its peak in July during the active period from June to August (Khan *et al.*, 1988). Correlation between 3-site larval populations of defoliator and weather factors such as wind velocity, rainfall, minimum temperature, maximum temperature and relative humidity of the corresponding observation week pointed out that rainfall and wind velocity were the two factors which had more impact on defoliator occurrence at all the three places (Table 1). Other factors were either non-significant or inconsistent in their influence. While rainfall had a significant positive influence, wind velocity had the opposite effect on defoliator larval populations. That defoliator population increased with an increase in RH was of no significance on any site. Population tended to decrease with an increase in day and night temperatures. This relationship also had no significance except for maximum temperature at Killikulam. The population dynamics of defoliator at Veeravanallur, Killkulam and Kasilingapuram in relation to the changes in weather is shown in figures 2-4.

Khan *et al.*, (1988) also observed that the defoliator started building up after the rains in coincidence with the sprouting of fresh foliage of teak. Defoliator attack was closely linked with the movement of South West monsoon, which begins in Kerala and moves northwards along the West Coast of India before moving eastwards across

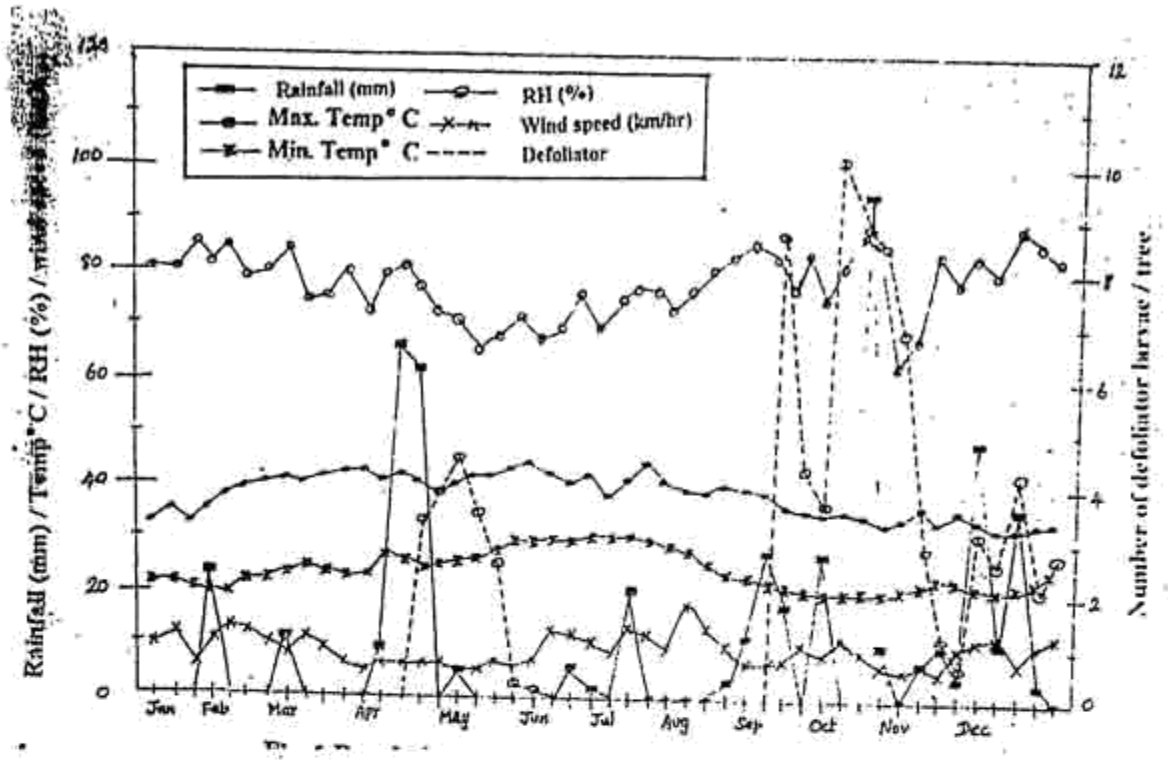

Fig. 4. Population dynamics of defoliator at Kasilingapuram in relation to weather factors

Maharastra and Madhya Pradesh (Bhowmick and Vaishampayan, 1986 ; Vaishampayan *et al.*, 1987).

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