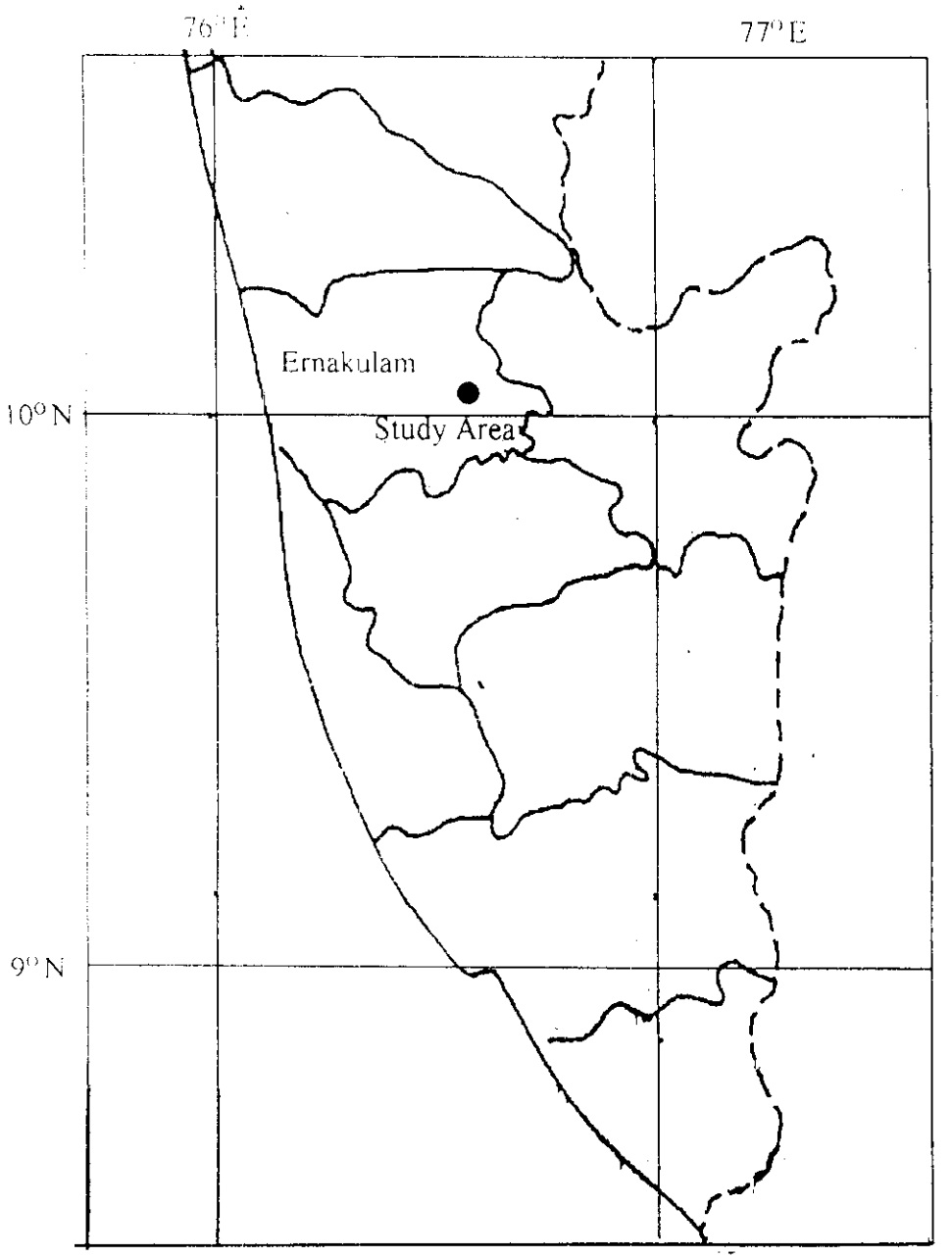
Chapter 2

STUDY AREA

Introduction

The area selected for present study is confined to included the forests of Ernakulam and Idukki districts of Kerala. However, intensive studies were carried out in and around the Thattakad bird sanctuary. This chapter describes the major features of the biotic and abiotic elements of the area. The area is a part of Idamala- Pooyamkutty valley. This valley represent the only large contiguous forest belt extends all along the northern end of the high ranges and the southern end of the Anamalais and continues west across the Pooyamkutty and Pichiyar valleys and north up to Idamalayar. Forests of the Munnar Division, Malayattor Division and part of the Kothamangalam Division are included this tract. The valley falls within the latitude 10° N and longitude 76° to 77° E with the elevation ranging from about 60 m to 1300 m above MSL. The eastern part of the tract is the high elevation shola grasslands. The forest area in this segment covers approximately 1000 sq. km of which less than 200 sq.km forms the closed climax forests and 100 to 125 sq.km area is relatively undisturbed shola grasslands (Nair, 1991).

The accounts of Aby *et al.* (2001), Ali (1936,1987), Shaju *et al.* (1998), Sugathan (1995,1996), Sugathan and Aby (1996), clearly indicates the floral



Map 1 The study area in Ernakulam district of Kerala

Bhoothathankettu forest

Chelamala, an emerging forest

Plate No. 2

and faunal diversity of the area. According to them this diversity is characterized by low altitude (60 m above MSL) evergreen forests, shallow wetlands, and vicinity of high altitude shola- grass lands (Anamala, 2695 m). Ali (1987) states: "Thattakad on the Periyar river in northern Travancore which linger in my memory as the richest bird habitat in peninsular India...comparable only with the Eastern Himalayas".

Studies on foraging ecology, population, habitat preference and breeding biology were conducted in the localities namely Marottichal, Urulanthanny, Bhoothathankettu, and Chelamala forests. The Marottichal area is in the Thattakad bird sanctuary where monoculture teak and mahogany is interspersed with small patches of semi-evergreen forest. Urulanthanny is in the eastern boundary of the sanctuary where intact evergreen forest tract occurs. Chelamala is on the left bank of the river Periyar, where the vegetation is an emerging evergreen (Shaju, 1998). Bhoothathankettu is a disturbed moist deciduous forest type. These areas are on the foot of Anamalais and the altitude ranges from 60 m-530 m above MSL. The terrain is undulating with two peaks namely Thoppimudi (488 m) and Njayappillymudi (523 m). Most of the area is under monoculture plantations of Teak (*Tectona grandis*) replacing the riparian and superb natural forests.

The river Periyar traverses the area. According to Ward and Conner (1827), Periyar is the finest river in the Travancore, most probably the principal

one throughout the whole of the western coast. Sixty miles were navigable and small crafts ascending its stream as far as Neriyamangalam.

According to Ali (1936) the forest at Thattakad was principally confined to the right banks of the river and consists in patches of both deciduous and tropical evergreen. He noted that, along the banks of the river, and those of many small streams that flow in it harbours dense clumps of eeta, *Ochlandra travancorica* and they are often lined with *ome* trees (*Trema orientalis*).

Climate and Rainfall

The area is hot and humid. The rainfall, number of rainy days, monthly mean temperature recorded from the study area in 1998 is described in Table 2 and Fig 1. Rainfall received during the southwest and northeast monsoon season. The monsoon season in the study area begins in June and ends in mid December, with the most persistent rainfall occurring between June to July, and August to September. During this heavy monsoon season rainfall occurred intermittently over a period of about 20 days in each month. January and February are generally dry months. However, rainfall occurred over a period of about 3 days in each month and the minimum number of rainy days recorded were 2 in January over the year. For convenience the climate in this area is categorized into three seasons namely monsoon, post monsoon and summer.

Table 2

Rainfall, number of rainy days and monthly mean temperature recorded from the study area during 1998

Month	Rainfall (mm)	Rainy days	Monthly mean temperature (^{0}C)
January	161	2	20.4
February	37	3	20.8
March	22	3	21.9
April	311	13	24.4
May	56	4	27.1
June	562.8	17	23.4
July	842.5	25	23.9
August	538.5	26	23.1
September	720.8	24	23.1
October	259	14	22.7
November	74	8	21.7
December	195	5	20.9

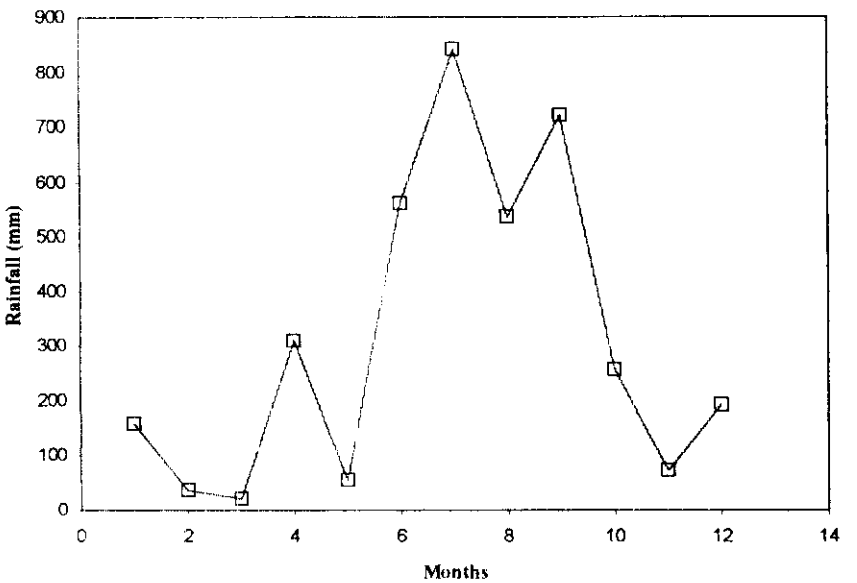


Fig.1: Showing the monthly rainfall (mm) recorded from the study area during 1998

General Vegetation

Mainly three types of forests were met with in the study area. They are tropical evergreen, tropical semi evergreen and tropical moist deciduous. Interspersed in these forests reeds, rocky outcrops, grasslands, teak and mahogany plantations, and bamboo thickets are also present in the study area. Most of the semi-evergreen forest belt occupied by the reed, *Ochlandra travancoorica.*

The evergreen vegetation occur in small patches and was already in a degraded state. The first canopy trees were; *Vateria indica, Canarium striatum, Dipterocarpus indicus, Hopea parviflora, Hopea ponga, Dysoxylum malabaricum, Artocarpus hirsutus, Machilus macrantha, Palaquium ellipticum, Diospyros microphylla and Polialthia fragrans.*

The second canopy trees were *Holigarna arnotiana, Myristica beddomei, Cinnamomum zeylanicum, Evodia roxburghiana, Eleocarpus tuberculatus, Eleocarpus serratus, Democarpus longan, Schlichera oleosa, Mallotus philippinensis, Xanthophyllum arnotianum, Polialthia coffeoides.*

Calamus reedi, Smilax zeylanica, Cissampelus perana, Gneetum scandence, Piper nigrum, Piper longum, Leea indica, Ixora pavetta, Unona pannosa, etc. were seen in the lower storey of evergreen vegetation.

The major plants of semi-evergreen vegetation were as follows: Top-storey- *Hopea parviflora, Hopea ponga, Democarpus longan, Meristica beddomei, Memusops elengi, Hydnocarpus pentandra, Mangifera indica, Polyalthia fragrens, Artocarpus hirsuta, Lagerstroemia lanceolata, Terminalia tomentosa, and Pterocarpus marsupium.*

The second storey was constituted by *Grevia tilifolia, Lagerstromea flosrigina, Holigarna arnotiana, Aporosa lindliana, Bridelia retusa, Cannarium strictum, Xanthophyllum arnotianum, Sterculia urens, Artocarpus gomezianus, Pterigota allata, Cinnamomum zeylanicum,* and *Zizygium munroni.*

The moist deciduous forests consisted of trees like *Terminalia bellerica, Terminalia chebula, Terminalia tomentosa, Terminalia paniculata, Tectona grandis, Xylia xylocarpa, Lagerstroemia microcarpa, Bridelia retusa, Pterocarpus marsupium,* and *Dellinia pentagyna.*

Lantana camera, Cassia alata., Vernonia cinerea, Eupatorium odoratum, Noxia sumaterensis, Canthium reedi, Noxia mollis, Mossainta frontosa, Carea arborea, Pithecelobium bigeminum etc constituted under cover of moist deciduous forest.

Fauna

Ali (1987) described the area as the richest bird habitat in Peninsular India. The first Ornithological survey at Thattakad was conducted during 2nd to 13 th February 1933 (Ali, 1936) as a part of Travancore Bird Survey. Sugathan and Aby (1996) published a review of the bird of Thattakad after two years of field study. In this review, 270 species of birds were described with its status and abundance. Apart from these accounts and checklists, no detailed studies were carried out here. About 30% of the total bird species are migratory, while others are resident or local migrants (Sugathan and Aby, 1996). Some species are very rare, with only one or two sight records while others are very common. The bird species recorded by Ali (1936) are listed in the appendix II. A few species recorded as common by Salim Ali during 1933, have now become locally extinct. They were great Indian hornbill and malabar pied hornbill. The Western Ghats endemic species of birds seen in the study area are small green barbet, bluewinged malabar parakeet, yellow browed bulbul, malabar lorikeet, grey headed bulbul, malabar whistling thrush, rufous babbler, small sunbird, rufous bellied munia, nilgiri wood pigeon, malabar grey hornbill, wynaad laughing thrush, white bellied blue flycatcher and southern tree pie. Other important species are black crested baza, rufous bellied eagle, great-eared nightjar, Ceylon frogmouth, broad billed roller, peninsular bay owl, large brown throated spine tail swift, pigmy woodpecker and forest eagle owl. Current trends in forest management, clearing

undergrowth for planting, and assisted afforestation are threatening the bird fauna of the area.

Total 29 species of mammals are recorded from the study area. The reptilian fauna consists of monitor lizard, draco, snakes like king cobra, cobra, russels viper, bamboo pit viper, hump-nosed pit viper, python, cat snakes, lycodon etc. Skinks, geckos and different species of calotes are also recorded. No detailed investigations are carried out for the reptilian fauna.

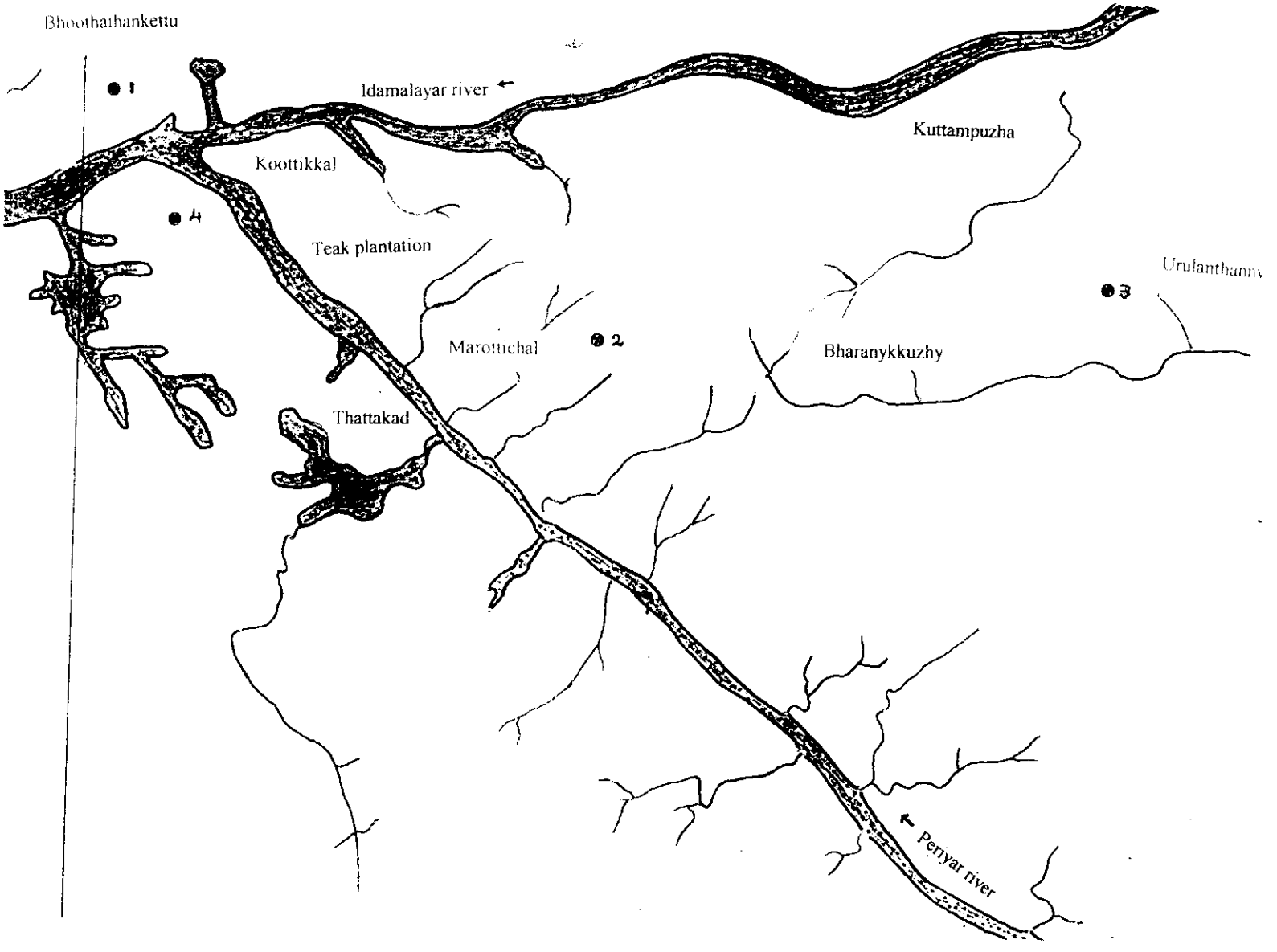
130 species of butterflies are recorded. The biggest one is the southern birdwing, *Troides helena*. Some of the rare species are Travancore Evening Brown, Banded Peacock, Malabar Banded Swallowtail, Spot Swordtail and Blue Oak leaf.

Vegetation characteristics and Insect abundance

Under this title, the vegetation of the four selected study sites are described. Insect abundance, the new leaf and flowering of dominant plants (80 species, 380 individuals) in the study area are also discussed.

Methodology

The point centered quadrate method was used to study the vegetation characteristics. This method involves the choice of random point within the study site and drawing a "X" on the floor. Using a tape, the nearest plant (may



Map: 2 Showing the intensive study areas

be a tree or a woody plant above 30 cm girth at breast height, GBH) from the centre of the cross mark measured in each quarter. Information on the identity, height and girth of the four plants and the extent of the canopy are also recorded at each point.15 such points were sampled in each study site except Chelamala. Total 45 such points is sampled. Quadrates enumerated were laid on both sides of the bird transect intended for the observation of Trogons. The minimum distances between the quadrates were 50 meter. Four transects of 1000 m length were laid in the selected study sites for the observations of Trogons, which are designated as T1 (Bhoothathankettu), T2 (Marottichal, T3 (Urulanthanny) and T4 (Chelamala).

The density is calculated by following the method of Daniels (1991). If the distances of the four woody plants from the center are r1, r2, r3, and r4, the area within which a single woody plant occurs may be given as -

$d = (\pi r1^2 + \pi r2^2 + \pi r3^2 + \pi r4^2)/4$. The average values of 'd' is calculated for each transect, would give the area (m^2) required to find one woody plant.

Plant species diversity was calculated by using the reciprocal of Simpson's Index,

$$\text{ie.} \quad \frac{1}{\sum Pi^2}$$

Where Pi is the proportion of the i^{th} species in the sample.

Fortnightly insect sampling was also done in the study area during 1998. Beating and sweeping sampling techniques were used to sample insects on foliage. Samplings were carried out in eight locations in the study area. During beating (n=5) the branches tapped with a stick and catching dislodged insects in a net (size 50 cm- 50 cm) held beneath. The sweeping method involves passing a sweep net through the vegetation using alternate backhand and forehand strokes. After completing a series of sweeps (n=5); invertebrates caught in the net can be encouraged to move to the closed part of the net by holding this end up towards light. Insects were identified upto the Order. 820 insect samplings were done during the study.

Abundance of insects (order wise) was calculated by the formula

$$\text{Abundance} = \frac{\text{Total count of insect belonging to an order}}{\text{Total number of quadrates in which the order occurred}}$$

Tender young leaves were eaten by many adult insects and/ or their larval stages, and the abundance of such insects related to the seasonality of leaf production. Data on the seasonality of leaf production and flowering were also collected along the transects. For this 380 trees in the study area were selected and marked. Fortnightly observations were conducted to record the abundance of new leaf and flower. Trees without new leaf or flower, with new leaf or

flower less than 50%, and more than 50% were noted and recorded. All the data collected were analyzed using the SPSS software.

Results and discussion

The tree densities calculated from the quadrate data are presented in the Table 3. Along with the mean density, percentage of canopy cover, mean tree girth (GBH), mean tree height, diversity index for trees, number of tree species are also presented in the Table 4 The highest tree density is in the T3 transect and the lowest density is in the T1 transect. It is apparent that the values of tree height, canopy cover, and diversity of trees are higher in T3 than the other three sites. The density, canopy, mean tree height of T2 transect were also higher than the T1.The reciprocal of Simpson index values are also very low in the T1 transect.

The number of trees in different height class in different sites were cross tabulated (Table 5). From this cross tabulation, it was evident that in all the transects selected, most of the trees were below 10 meter in height. However, in the T3 transect 69.6% of trees were in the height class of less than10-meter.

Table 3

Trees densities calculated from 44 point centered quadrates in the study area during the study

Tree density (D)*	Transect		
	T1	T2	T3
d1	121.87	127.8569	179.9623
d2	102.25	126.0906	264.4469
d	48.28	232.1638	110.5378
d4	58.48	154.4488	35.4722
d5	104.85	117.3575	53.4291
d6	115.40	117.8481	175.3003
d7	114.81	151.1125	52.6931
d8	57.60	95.8191	113.4816
d9	88.31	48.2775	124.1772
d10	75.56	66.5288	89.1956
d11	84.98	87.9763	127.2681
d12	75.9 5	96.0153	49.0139
d13	35.9 1	57.6975	170.5059
d14	32.63	100.6763	26.7889
d15	20.02	-------	140.5641

*d= the area within which a single woody plant occurs (m2), from 44 points in the study area. T1=Bhoothathankettu, T2=Marottichal, T3= Urulanthanny, and T4=Chelamala.

Table 4

Vegetation parameters recorded from the selected transects

Name of the site	Tree density	Mean tree GBH (cm)	Mean tree height (meter)	Mean canopy cover (%)	Number of species	Diversity index
T 1	75.7917	148.3750	11.20	26.7857	56	7.64878
T 2	112.6335	114.4833	13.30	59	57	20.56329
T 3	114.1892	125.6833	15.30	59.6667	59	20.12139

Table 5

Area X height class cross tabulation

Transect No.	No. of trees in the height class (m)				Total
	< 5	5- < 10	10 -15	15<	
T1	7	31	12	6	60
T2	7	26	9	8	60
T3	12	27	9	12	56

The abundance of different groups of insects were tabulated and presented in the Table 6. The most abundant insect group is the Order Hymenoptera, and followed by the Orders Phasmida, Coleoptera, and Orthoptera (Fig 2). The seasonal insect abundance was plotted in the Fig 3. The insects were more abundant in the monsoon (SI, June-September) and summer season (SIII, February-May).

The new leaves were abundant in the monsoon season and the flower abundance was recorded in post monsoon and in summer (Fig 4).

Table 6

Monthly abundance of insects during 1997-1998

Month	Name of the insect Order									
	LE	OR	HY	HO	CO	DI	PH	HE	IS	Total
June	0	1.83	13.18	1.63	2.1	1	1.83	1.75	2.5	25.79
July	0	3	17	1.8	2	3	1.2	1.2	0	29.2
August	2	1.88	11.08	1.9	2.28	0	1	1	1	22.14
September	1	2.42	3.25	1.4	2.16	1	1	1	1	14.23
October	1.625	1.83	12.5	2	2.09	2	1.66	0	0	23.705
November	1.33	1.5	6.37	1.12	1.66	0	12.5	0	1	25.48
December	1	1	1.66	0	1	0	1.33	1	0	6.99
January	0	0	0	0	0	0	0	0	0	0
February	1.33	1.44	12.25	1.28	2.66	0	1.4	0	1	21.36
March	1.33	1.5	4.37	2	2.83	1.25	1	1	3.5	18.78
April	1	1.28	5.12	1.33	1.5	2	1	1	1	15.23
May	1	1	4.516	1	3.55	2	0.66	0	1.5	15.24
Total	11.62	18.58	91.30	15.46	23.83	12.25	24.58	7.95	12.5	218.145

LE- Lepidoptera, OR- Orthoptera, HY- Hymenoptera, HO-Homoptera, CO-Coleoptera, DI-Diptera, PH- Phasmida, HE- Hemiptera, IS- Isoptera.

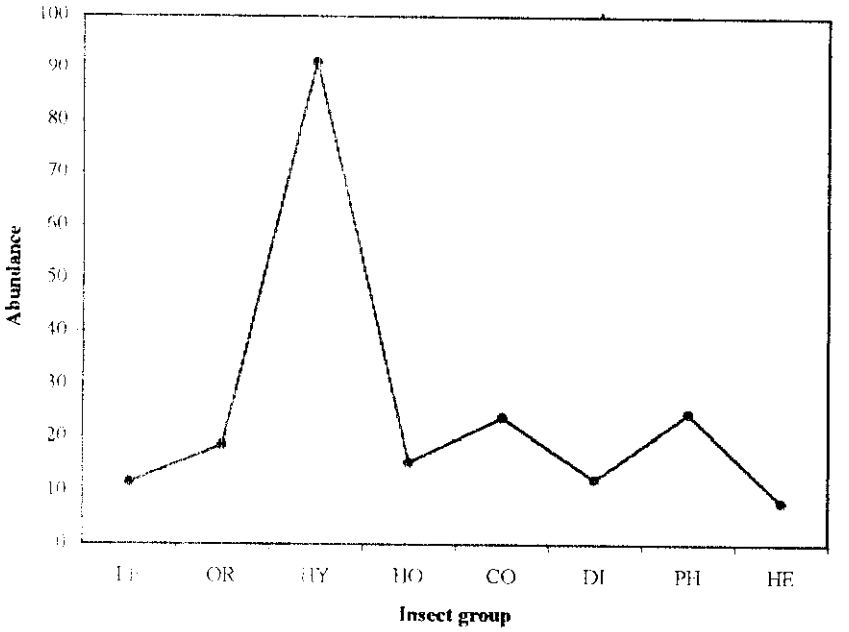


Fig. 2: Showing the abundance of different groups of insects in the study area during 1997-1998

LE- Lepidoptera, OR- Orthoptera, HY- Hymenoptera, HO-Homoptera, CO- Coleoptera, DI- Diptera, PH- Phasmida, HE- Hemiptera, IS- Isoptera.

Table 7

Monthly abundance of insects, new leafs, and flowers during 1997 - 1998

Month	Insects	New leaf**	Flower**
June	4.3246	78.57143	19.04762
July	4.6594	82.92683	14.63415
August	2.9840	90.69767	11.62791
September	3.2088	62.5	40.70122
October	2.7958	59.09091	65.15152
November	3.2237	57.14286	36.50794
December	3.3724	61.29032	8.333333
January	*	60.97561	26.82927
February	3.7542	37.77778	55.55556
March	3.2282	46.2963	37.03704
April	3.6596	63.33333	13.33333
May	3.5798	69.38776	20.40816

* Data not available **Abundance represented in percentage

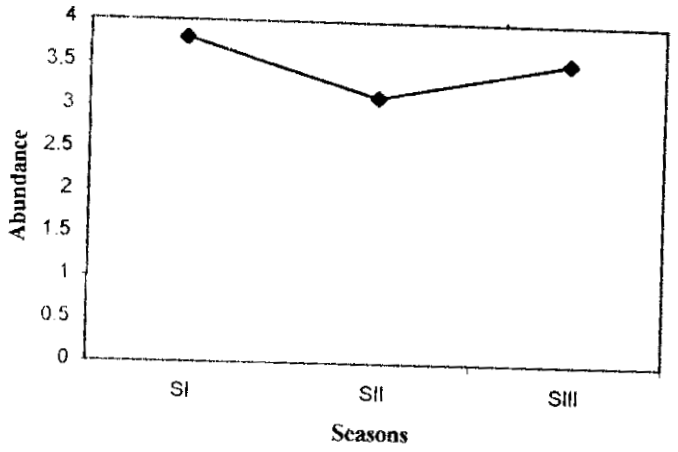


Fig.3: Abundance of insect groups in three different seasons during 1997-1998

SI = monsoon, SII = post monsoon, SIII = summer

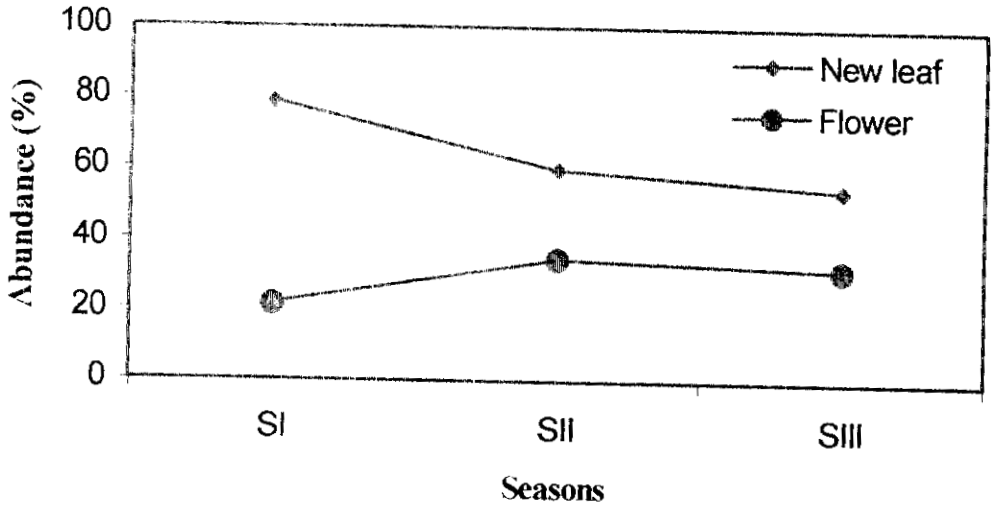


Fig. 4: Showing the abundance of new leaf and flower in the study area during 1997-1998

Table 8

Results of Correlation between new leaf abundance, flower abundance, insect abundance, rain, and months

		New leaf	Flower	Insects	Rain	Month
Pearson Correlation	Flower	-.657*	1.000	-.397	-.312	-.050
	Insects	.291	-.397	1.000	.404	-.302
	Month	.283	-.050	-.302	.273	1.000
	New leaf	1.000	-.657*	.291	.711**	.283
	Rain	.711**	-.312	.404	1.000	.273
Sig.(2-tailed)	Flower	.020	.	.201	.324	.877
	Insects	.359	.201	.	.193	.341
	Month	.373	.877	.341	.390	.
	New leaf	.	.020	.359	.010	.373
	Rain	.010	.324	.193	.	.390
N	Flower	12	12	12	12	12
	Insects	12	12	12	12	12
	Month	12	12	12	12	12
	New leaf	12	12	12	12	12
	Rain	12	12	12	12	12

* Correlation is significant at the 0.05 level (2- tailed)
** Correlation is significant at the 0.01 level (2-tailed)

The results of correlation between abundance of insect, new leaf, flower, rainfall, and months are presented in Table 8. Form the analysis it is evident that the new leaf formation is positively correlated with rainfall significantly at 0.01 level. The abundance of insects and flowers were not significantly correlated with rain fall and months.