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## Diversity and abundance of butterflies of Kerala University Campus, Kariavattom Thiruvananthapuram

**Anupa K Antony, G Prasad and Kalesh S**

### Abstract

The present study reflects the richness and diversity of butterflies at Kariavattom Campus. This study reported 105 species of butterflies from four study sites. The highest number of butterflies was recorded belonging to the Nymphalidae (40 species), followed by Lycaenidae (23 species), Hesperidae (18 species), Pieridae (13 species) and Papilionidae (11 species). This study revealed that Nymphalidae was most dominating family with a highest number of species and individuals. The highest number of butterfly species (83) was recorded at site 3 (Botany garden) followed by 65 at site-1 (Medicinal Garden), 32 at site 2 (Mixed Vegetation) and 9 species at site 4 (Grass land). Most butterfly species were observed during June and May and least in April and March. Among the 105 butterflies recorded, 21 species come under the protection category as per the Indian Wild Life protection Act 1972 among 8 belong to various Schedules and 9 are endemic to Western Ghats.

**Keywords:** Butterflies, Kariavattom, Nymphalidae, species diversity

### Introduction

Butterflies are good biological indicators of habitat quality as well as general environmental health [16, 13, 27], as many species are strictly seasonal and prefer only particular set of habitats [15]. Butterflies may react to disturbance and change in habitat and act as an ecological indicator [17, 7]. Because of their dependence on the plants, butterfly diversity may reflect overall plant diversity in the given area [20]. Thus, change in land use pattern may lead to landscape changes that can reflect into change in butterfly diversity and distribution. As a result, butterflies can also be used as umbrella species (the species whose protection serves to protect many co-occurring species) for conservation planning and management [7, 2].

Kerala has rich and diverse butterfly fauna because of the availability of wide range of habitats. Among the 1501 species so far recorded from India, 327 species are found in Kerala region [22]. In our state detailed studies have been done only in some specific habitats. Butterflies were systematically studied and 220 butterfly species were recorded from Travancore area in 1891[6]. Recent studies on butterflies of Kerala were from Silent valley national park [19], the sacred groves of north Malabar [21], Parambikulam wildlife sanctuary [29], and Mahatma Gandhi University campus, Kottayam [30]. The present study was carried out in order to assess the species richness and diversity of butterflies of Kerala University, Kariavattom.

### Materials and Methods

The present study of butterfly diversity was carried out in the selected habitats of Kerala University Campus, Kariavattom (8°32', 8° 34'N and 76° 52', 76° 54'E) with a total geographic area of about 300 hectares. The area is about 16km north of Thiruvananthapuram city. The study area is distributed on either side of the NH 47 connecting Thiruvananthapuram and Kollam. The elevation of the study area is about 57m from the mean sea level. The area has been shown as Fig. 1.

### Monitoring of butterflies

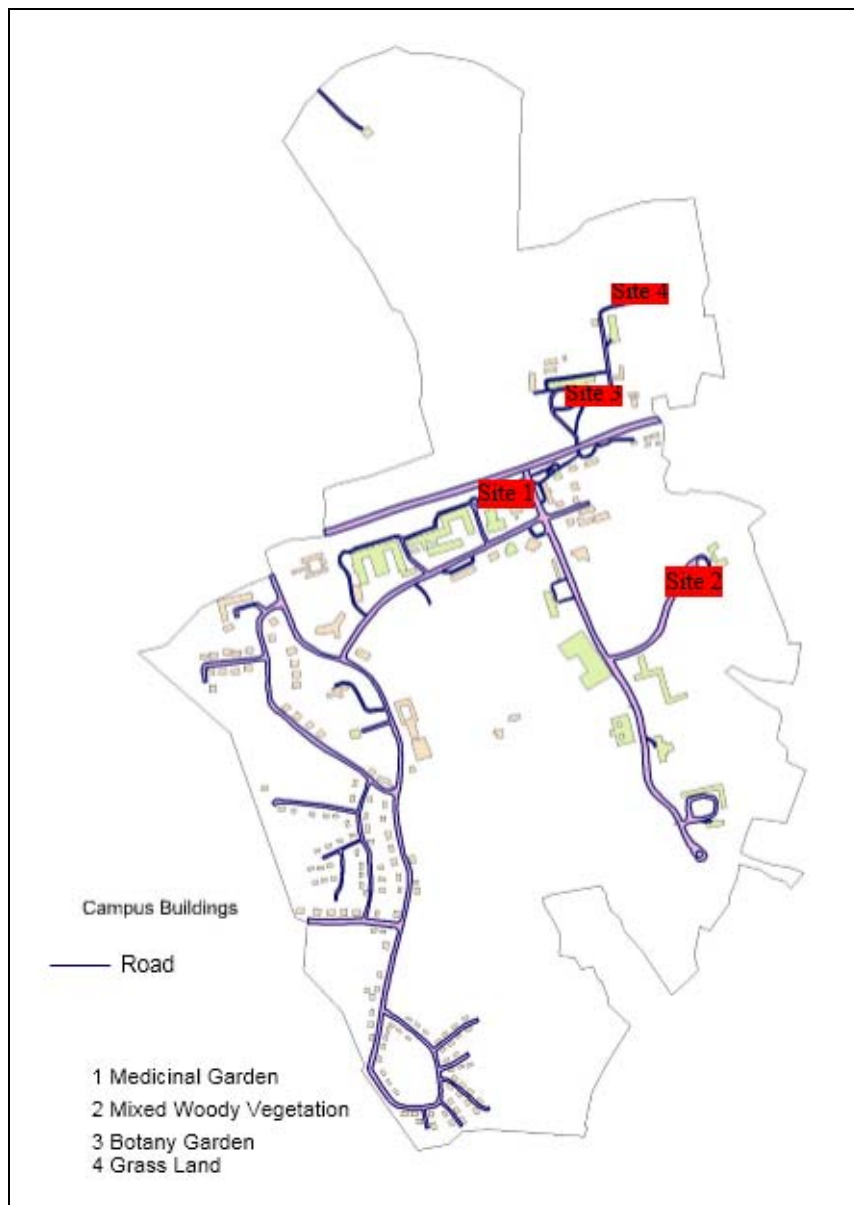
In order to assess the diversity and distribution of butterflies, the standard transect counting method [10, 23] was used. Four transects each of 50m x 50m were identified in different habitats and monitored the butterfly fauna.

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The butterflies observed in each transect were recorded regularly at an interval of 7 days for a period of four months (March 2014- June 2014). Observations were taken twice in a day (8.00-11.00 am and 3.00-5.00 pm) when the butterflies were most active. All the butterflies observed were recorded and identification of butterflies was done on the site itself and was confirmed with the help of field guides [31, 22, 12] Some rare and small butterflies which are difficult to identify were

caught by using insect net (Nylon net with long handle was used for sweeping free flying butterflies) and closely observed after placing them in clear glass bottle. Then they were released to the same habitat from where they were caught. Enough precautions were taken, so that, by no means the entire procedure can cause any damage to the collected specimens. All sighted species are photo- documented.



**Fig 1:** Site map

The four different transects selected for monitoring butterflies were:

**SITE 1 (Medicinal garden):** Medicinal garden is an area with cultivated medicinal plants. It's a herbal park with plants having high medicinal values, some have anticancerous properties, some are dye yielding and many are used in hair and skin care etc. A part of medicinal garden is called 'Nakshathravanam' in which plants connected to each malayalam horoscope stars are grown. A group of plants in the garden are known as grandma's remedies.

**SITE 2 (Mixed vegetation):** This area supports a variety of vegetation types mainly dominated by acacia plants. The other vegetation includes trees, shrubs, climbers, creepers etc.

**SITE 3 (Botany garden):** Botany garden comprises of many flowering plants (*Ixora coccinea*, *Saraca asoca*), palm varieties (*Oreodoxa regia*, *Cycas* sp.), citrus plants (*Citrus limon*, *Citrus grandis*) and all are beautifully maintained.

**SITE 4 (Grassland):** This area is comparatively an open place dominated by *Cymbopogon citratus*. Many Acacia trees and few cashew plants are also present.

### Statistical Analysis

Based on the number of sightings, butterfly species were categorized into Very rare (>2 sightings), Rare (2-14 sightings), Occasional (15-49 sightings), Common (50-100 sightings) and Very common (<100 sightings) and ranked from 1 (Very rare) to 5 (Very common) [32, 33, 34]. The checklists of the specimens were prepared. The percentage compositions of the different families at different sites calculated were graphically plotted. The diversity indices (Shannon-Wiener diversity index, Shannon Evenness Index, Simpson dominance index, Margalef index and Berger-Parker index) of the butterflies from four different habitats were

calculated using software (PAST, 2005)

### Results and Discussion

The present butterfly survey has been conducted in the Kerala University Campus at Kariavattom and reported 1343 individuals of butterflies comprising 105 species belonging to 5 families. The highest number of butterflies was recorded from the family Nymphalidae (537 individuals), followed by Pieridae (386 individuals), Papilionidae (232 individuals), Lycaenidae (160 individuals) and Hesperidae (28 individuals). The sighted butterflies are listed with their Occurrence status and Host plants in Table.1

**Table 1:** List of Butterflies with host plants and Occurrence status.

S.I.no	Name of the Butterfly	Host Plant	Number of Individuals	Occurance Status
1	<i>Triodes minos</i>	<i>Aristolochia indica</i>	14	R
2	<i>Pachliopta aristolochiae</i>	<i>Aristolochia indica</i>	10	R
3	<i>Pachliopta hector</i>	<i>Aristolochia indica</i>	2	R
4	<i>Graphium sarpedon</i>	<i>Polyalthia longifolia</i>	37	O
5	<i>Graphium doson</i>	<i>Polyalthia longifolia</i>	39	O
6	<i>Graphium agamemnon</i>	<i>Michelia champaca</i>	54	C
7	<i>Papilio clytia</i>	<i>Cinnamomum iners</i>	8	R
8	<i>Papilio demoleus</i>	<i>Murraya koenigii, Citrus sp.</i>	7	R
9	<i>Papilio polytes</i>	<i>Murraya koenigii, Citrus sp.</i>	50	C
10	<i>Papilio polymnestor</i>	<i>Citrus sp.</i>	9	R
11	<i>Papilio helenus</i>	<i>Citrus limon</i>	2	R
12	<i>Captopsilia pomona</i>	<i>Cassia fistula</i>	249	VC
13	<i>Captopsilia pyranthe</i>	<i>Cassia fistula</i>	9	R
14	<i>Eurema andersonii</i>	<i>Acacia sp., Mimosa sp.</i>	2	R
15	<i>Eurema brigitta</i>	<i>Acacia sp., Mimosa sp.</i>	8	R
16	<i>Eurema blanda</i>	<i>Acacia sp., Mimosa sp.</i>	4	R
17	<i>Eurema hecabe</i>	<i>Acacia sp., Mimosa sp.</i>	28	O
18	<i>Delias eucharis</i>	<i>Dendrophthoe falcate</i>	2	R
19	<i>Leptosia nina</i>	<i>Capparis spinosa</i>	40	O
20	<i>Appias lyncida</i>	<i>Capparis sp.</i>	15	O
21	<i>Appias albina</i>	<i>Capparis sp.</i>	6	R
22	<i>Appias libythea</i>	<i>Capparis sp.</i>	1	VR
23	<i>Hebomoia glaucippe</i>	<i>Capparis spinosa</i>	6	R
24	<i>Pareronia valeria</i>	<i>Capparis sp.</i>	17	O
25	<i>Mycalesis subdita</i>	Grasses	1	VR
26	<i>Melanitis leda</i>	<i>Panicum sp., Oryza sativa</i>	9	R
27	<i>Elymnias hypermnestra</i>	<i>Oreodoxa regia</i>	15	O
28	<i>Lethe europa</i>	Bamboos	5	R
29	<i>Mycalesis mineus</i>	Grasses	2	R
30	<i>Mycalesis visala</i>	Grasses	1	VR
31	<i>Mycalesis perseus</i>	Grasses	11	R
32	<i>Orsotriaena medus</i>	Grasses	4	R
33	<i>Ypthima huebneri</i>	Grasses	102	VC
34	<i>Ypthima baldus</i>	Grasses	14	R
35	<i>Ypthima ceylonica</i>	Grasses	1	VR
36	<i>Acraea violae</i>	<i>Adenia hondala</i>	114	VC
37	<i>Cupha erymanthis</i>	<i>Flacourtia sp.</i>	30	O
38	<i>Phalanta phalantha</i>	<i>Flacourtia sp.</i>	3	R
39	<i>Cirrochroa thais</i>	<i>Hydocarpus pentandra</i>	6	R
40	<i>Neptis jumbah</i>	<i>Canavalia gladiate</i>	6	R
41	<i>Neptis hylas</i>	<i>Canavalia gladiate</i>	10	R
42	<i>Pantoporia hordonia</i>	<i>Albizia odoratissima</i>	1	VR
43	<i>Moduza procris</i>	<i>Mussaenda frondosa</i>	2	R
44	<i>Euthalia aconthea</i>	<i>Mangifera indica</i>	2	R
45	<i>Euthalia lubentina</i>	<i>Mangifera indica</i>	1	VR
46	<i>Tanaecia lepidea</i>	<i>Careya arborea</i>	3	R
47	<i>Ariadne ariadne</i>	<i>Ricinus communis</i>	4	R
48	<i>Ariadne merione</i>	<i>Ricinus communis</i>	3	R
49	<i>Junonia orithya</i>	<i>Sida rhombifolia</i>	1	VR
50	<i>Junonia lemonias</i>	<i>Sida rhombifolia</i>	10	R
51	<i>Junonia hierta</i>	<i>Sida rhombifolia</i>	1	VR
52	<i>Junonia almanac</i>	<i>Sida rhombifolia</i>	1	VR
53	<i>Junonia atlites</i>	<i>Sida rhombifolia</i>	5	R

54	<i>Junonia iphita</i>	<i>Sida rhombifolia</i>	72	C
55	<i>Hypolimnas bolina</i>	<i>Portulaca oleracea</i>	35	O
56	<i>Hypolimnas misippus</i>	<i>Portulaca oleracea</i>	9	R
57	<i>Euploea core</i>	<i>Nerium odorum</i>	18	O
58	<i>Euploea klugii</i>	<i>Nerium odorum</i>	1	VR
59	<i>Parantica aglea</i>	<i>Calotropis gigantean</i>	4	R
60	<i>Tirumala limniace</i>	<i>Asclepias curassavica</i>	12	R
61	<i>Tirumala septentrionis</i>	<i>Asclepias curassavica</i>	3	R
62	<i>Danaus chrysippus</i>	<i>Calotropis gigantean</i>	10	R
63	<i>Danaus genutia</i>	<i>Asclepias curassavica</i>	1	VR
64	<i>Euploea Sylvester</i>	<i>Asclepias curassavica</i>	2	R
65	<i>Arhopala amantes</i>	<i>Terminalia catappa</i>	2	R
66	<i>Arhopala centaurus</i>	<i>Terminalia catappa</i>	5	R
67	<i>Spalgis epius</i>	<i>Lantana camara</i>	2	R
68	<i>Castalius rosimon</i>	<i>Ziziphus rugosa</i>	16	O
69	<i>Caleta caleta</i>	<i>Ziziphus rugosa</i>	8	R
70	<i>Talicauda nyseus</i>	<i>Kalanchoe pinnata</i>	1	VR
71	<i>Discolampa ethion</i>	<i>Ziziphus rugosa</i>	2	R
72	<i>Leptotes plinius</i>	<i>Albizia lebbek</i>	3	R
73	<i>Acytolepis puspa</i>	<i>Xylia xylocarpa</i>	12	R
74	<i>Megisba malaya</i>	<i>Scheichera oleosa</i>	1	VR
75	<i>Zizula hylax</i>	<i>Lantana camara</i>	26	O
76	<i>Zizina otis</i>	<i>Lantana camara</i>	8	R
77	<i>Euchrysops cnejus</i>	<i>Acacia sp.</i>	17	O
78	<i>Jamides bochus</i>	<i>Abrus precatorius</i>	3	R
79	<i>Jamides celeno</i>	<i>Saraca asoca</i>	35	O
80	<i>Chilades lajus</i>	<i>Citrus limon</i>	1	VR
81	<i>Chilades pandava</i>	<i>Cycas sp.</i>	6	R
82	<i>Everes lacturnus</i>	<i>Cycas sp.</i>	1	VR
83	<i>Tajuria cippus</i>	<i>Dendrophthoe falcate</i>	1	VR
84	<i>Zesuis chrysomallus</i>	<i>Anacardium occidentale</i>	1	VR
85	<i>Loxura atymnus</i>	<i>Dendrophthoe falcate</i>	2	R
86	<i>Rapala manea</i>	<i>Antidesma acidum</i>	1	VR
87	<i>Rathinda amor</i>	<i>Ixora coccinea</i>	7	R
88	<i>Erionota torus</i>	<i>Musa sapientium</i>	3	R
89	<i>Iambrix salsala</i>	<i>Bambusa arundinaceae</i>	5	R
90	<i>Matapa aria</i>	<i>Bambusa arundinaceae</i>	2	R
91	<i>Udaspes folus</i>	<i>Curcuma aromatic</i>	2	R
92	<i>Gangara thyrsis</i>	<i>Calamus rotang</i>	1	VR
93	<i>Telicota ancilla</i>	<i>Oryza sp.</i>	1	VR
94	<i>Cephrenes acalle</i>	<i>Oryza sp.</i>	1	VR
95	<i>Pelopidas mathias</i>	<i>Oryza sp.</i>	1	VR
96	<i>Polytremis lubricans</i>	<i>Impertat sp.</i>	1	VR
97	<i>Caltoris kumara</i>	<i>Pseuderanthemum reticulatum</i>	1	VR
98	<i>Baoris farii</i>	Palm plants	1	VR
99	<i>Pelopidas conjuncta</i>	<i>Bambusa arundinaceae</i>	2	R
100	<i>Parnara bada</i>	<i>Oryza sp.</i>	1	VR
101	<i>Borbo cinnara</i>	<i>Oryza sp.</i>	1	VR
102	<i>Spialia galba</i>	<i>Sida rhombifolia</i>	1	VR
103	<i>Badamia exclamationis</i>	<i>Terminalia bellirica</i>	2	R
104	<i>Hasora chromus</i>	<i>Ricinus communis</i>	1	VR
105	<i>Tagiades litigiosa</i>	<i>Dioscorea oppositifolia</i>	1	VR

Occurrence Status: VR (Very Rare >2 sightings), R (Rare 2-14sightings), O (Occasional 15-49 sightings), C (Common 50-100 sightings) and VC (Very Common <100).

Nymphalidae was the most dominant family comprising 40 species, and it constituted 38.1% of the total butterfly species of Campus. Nymphalidae was followed by Lycaenidae with 23 species which constituted 21.9% of total butterfly species. Hesperidae was the third dominant family with 18 species that constituted 17.14% of total butterfly species. Family Pieridae was represented by 13 species which constituted 12.38% of total butterfly species of the Campus. The family with least number of species was found to be Papilionidae, with 11 species that constituted 10.48% total butterfly species. Most number of individuals sighted was also from the family Nymphalidae with 537 individuals, which constituted 40% of total number of butterflies. *Acraea violae* was the most dominant species of Nymphalidae which constituted 21.22%

of total individuals of this family, followed by *Ypthima huebneri* (18.99%). Pieridae was the second dominant family with 386 individuals, which constituted 28.7% of the total sighted butterflies. *Catopsilia pomona* was the most dominant member which constituted 64.50% of total individuals of this family, followed by *Leptosia nina* (10.40%). Family Papilionidae was the third dominant family with 232 individuals and it constituted 17.3% of total sighted butterflies. *Graphium agamemnon* was the most dominant species of this family, which constituted 39.65% of total individuals, followed by *Papilio polites* (21.55%). Family Papilionidae was followed by Lycaenidae with 160 individuals and it constituted 11.9% of total sighted butterflies. *Jamides celeno* was the dominant species of this

family, which constituted 21.87% of total individuals and was followed by *Zizula hylax* (16.25%). Family Hesperidae was rarely seen, only 28 individuals were sighted from this family during the study period and it constituted 2.1% of the total butterflies sighted. *Iambrix salsala* was the most commonly seen species of this family.

The total number of butterflies was recorded highest in the month of June (490 individuals) and lowest in the month of April (126 individuals). The monthly abundance of each butterfly families also showed higher values in the month of May and June when compared to March and April (Table 2).

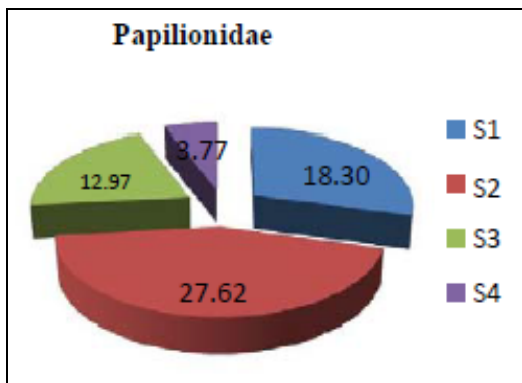
**Table 2:** Monthly distribution of families.

Families	March	April	May	June
Papilionidae	17	3	96	116
Pieridae	81	40	133	132
Nymphalidae	158	66	136	177
Lycaenidae	30	12	63	55
Hesperidae	4	5	9	10
Total	290	126	437	490

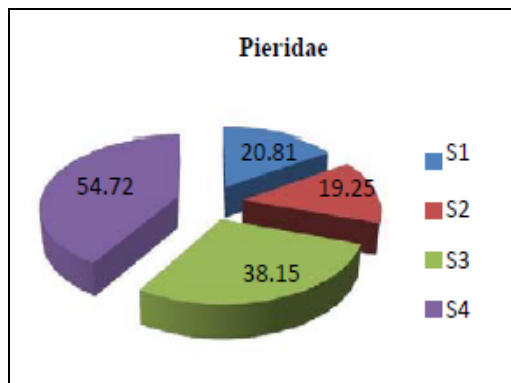
The highest number of individuals of family Papilionidae was reported in June (116 individuals) and least in April (3 individuals). The highest number of individuals of family Pieridae was reported in May (133 individuals) and least in April (40 individuals). The highest number of individuals of family Nymphalidae was reported in June (177 individuals) and least in April (66 individuals). The number of individuals of family Lycaenidae was highest in May (63 individuals) and lowest in April (12 individuals). It was reported that the number of individuals of family Hesperidae was highest in June (10 individuals) and lowest in March (4 individuals).

In the present study, Site 3 supported maximum number of butterflies (532 individuals) belonging to 83 species with *Catopsilia pomona* (120 individuals) being dominant. While 65 species of butterflies were recorded from Site 1 (519 individuals) with *Acraea violae* (80 individuals) being dominant, 32 species were reported from Site 2 (239 individuals) with *Ypthima huebneri* (44 individuals) being dominant and the Site 4 comprised only 9 species (53 individuals) with *Catopsilia Pomona* (29 individuals) being the most sighted species. *Catopsilia pomona*, spotted in the four sites was the most abundant species in the Campus (249 individuals). The greatest number of individuals of *Catopsilia pomona* occurred in Site 3.

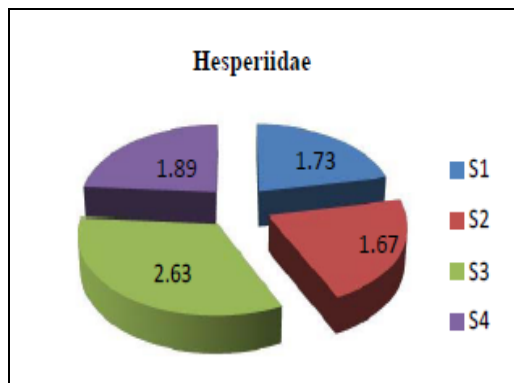
Site wise comparison of different families of butterflies was done and was graphically plotted (Fig. 2 to Fig.6).



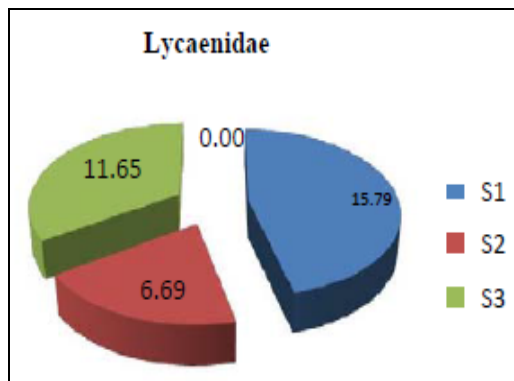
**Fig 2:** Distribution of Papilionidae in four sites



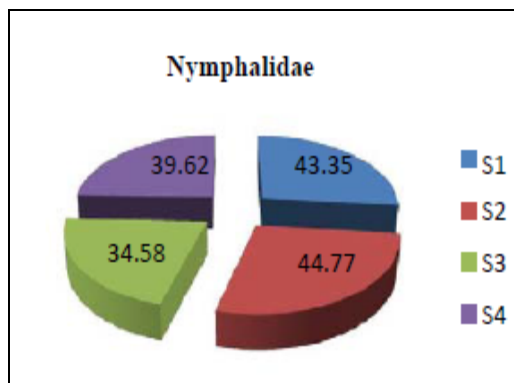
**Fig 3:** Distribution of Pieridae in four sites



**Fig 4:** Distribution of Hesperidae in four sites



**Fig 5:** Distribution of Lycaenidae in four sites



**Fig 6:** Distribution of Nymphalidae in four sites

During the study it was found that, butterfly species belonging to the families Papilionidae and Nymphalidae were highest at

Site 2 and Pieridae was abundant at Site 4. Hesperidae and Lycaenidae was reported maximum at Site 3 and Site 1 respectively. The least number of individuals in all families were reported from Site 4.

As per the frequency status adopted, 30 species were included in the Very Rare category, 55 species in Rare category and 14 species are Occasionally sighted. Out of the remaining 6 species, 3 species each belongs to Common (*Graphium agamemnon*, *Papilio polytes* and *Junonia iphita*) and Very Common (*Acraea violae*, *Ypthima huebneri* and *Catopsilia pomona*) category sighted.

Out of 105 species of butterflies recorded from the Campus 9 species are endemic to Western Ghats. They are *Mycalesis subdita*, *Elymnias caudate*, *Mycalesis mineus*, *Mycalesia visala*, *Mycalesis perseus*, *Ypthima ceylonica*, *Cirrochora thais*, *Caleta caleta*, *Discolampa ethion*.

Several butterfly species reported from our study comes under Wild life Protection Act of 1972. *Actolepis puspa*, *Neptis jumbah*, *Castalius rosimon*, *Hypolimnas misippus*, *Lethe europa* and *Pachliopta hector*, came under schedule I of the Wild Life Protection Act 1972. The species which came under the schedule II of the Wild Life Protection Act 1972 were *Hypolimnas misippus*, *Eurema andersonii*, *Appias albino*, *Appias lycnida*, *Pareronia valeria*, *Jamides celeno*, *Melanitis leda*, *Tanaecia lepidea*, *Euthalia aconthea*, *Euchrysops cnejus* and *Tajuria cippus*. The species recorded in the Campus which included in the schedule IV of the Wild Life Protection Act 1972 were *Appias libythea*, *Euploea core*, *Baoris farri*, *Euploea klugii* and *Euthalia lubentina*.

**Diversity indices**

The diversity indices of the different transect and the total diversity of the Campus were calculated and presented as Table 4 and Table 3 respectively.

**Table 4:** Diversity indices of Butterflies from Selected Habitats

Indices	Medicinal garden	Mixed vegetation	Botany garden	Grass land
Taxa	65	32	83	10
Individuals	519	239	532	53
Shannon- Wiener index	3.32	2.58	3.41	1.53
Evenness Index	0.43	0.41	0.36	0.46
Simpson's Index	0.94	0.89	0.93	0.66
Margalef Index	10.24	5.66	13.06	2.27
Berger-Parker Index	0.15	0.18	0.23	0.55

The present study reflects the richness and diversity of butterflies at Kariavattom Campus. From the already reported butterfly species, a total of 105 species of butterflies belonging to 5 families were reported from Kerala University Campus.

Family Nymphalidae, represented the highest number of butterfly species, followed by Lycaenidae, Pieridae, Papilionidae and Hesperidae. The family Nymphalidae outnumbered with a maximum of 40 species. This is because of their speciation and high dispersal ability [1], ecological adaptation [11] and polyphagous nature [28] which probably help these Lepidopterans to survive in a variety of habitats. Moreover, members of this species can forage in distant areas as they are active fliers that might help them in searching for resources in large areas [5, 14, 25, 20] The least abundance of family Hesperidae may be either due to lesser availability of habitat or limited monitoring time (8.00am to 10.00am and 3.00pm to 5pm), since Hesperids are crepuscular habit, i.e., they are active early morning and to a lesser extent, in the

**Shannon - Wiener diversity index**

Shannon - Wiener diversity index showed that the total butterfly diversity of the Kerala University Campus is 3.55. The species diversity of the four different habitats ranged from 1.53 to 3.41. The maximum diversity was reported in Site 3 (3.41) and minimum diversity was found in Site 4 (1.53).

**Shannon Evenness Index**

The Shannon evenness index ranged from 0.36 to 0.46. The index disclosed maximum at Site 4 (0.46) and minimum at Site 3 (0.36).

**Simpson Dominance Index**

The Simpson index ranged from 0.66 to 0.94. The index value was highest at Site 1 (0.94) and lowest in Site 4 (0.66).

**Margalef Diversity Index**

Species richness was measured by using Margalef index and it ranged from 2.27 to 13.06. Species richness marked maximum at Site 3 (13.06) and minimum at Site 4 (2.27).

**Berger-Parker Index**

Berger-Parker index varied from 0.15 to 0.55 and it recorded maximum at Site 4 (0.55) and minimum at Site 1 (0.15)

**Table 3:** Biodiversity indices of Butterflies of Kerala University Campus

Taxa S	105
Individuals	1343
Simpson 1-D Index	0.94
Shannon H Index	3.55
Evenness e <sup>H/S</sup> Index	0.33
Margalef Index	14.44
Berger-Parker Index	0.19

evening.

In the present study, *Catopsilia pomona* of family Pieridae, *Ypthima huebneri* and *Acraea violae* (Nymphalidae) were found to be in the Very Common category. The availability of host plants, *Cassia fistula* (*Catopsilia pomona*), grasses (*Ypthima huebneri*) and *Tridax procumbens* (*Acraea violae*) in the Kerala University Campus could be the reason for their abundance. There are 30 species including *Appias libythea*, *Mycalesis subditi*, *Ypthima ceylonica* and many species of hesperiidae came under Very Rare category. A positive relationship between abundance of butterflies and their preferred host plants was noted during the study period. According to Balakrishnan and Palot, (2004) the butterflies and plants are inter dependent and the diversity of butterflies found in an area is a clear indication of its floral diversity.

The different diversity indices calculated give information about the distribution of butterflies in the four study sites. The Shannon-Wiener diversity indices ranged from 1.53 (Site 4) to 3.41 (Site 3) indicating that the man made habitats showed

higher species diversity compared to the natural areas. Simpson's dominance index (D) ranged from 0.66 (Site 4) to 0.94 (Site 1). The index value showed lowest abundance in Site 4 and highest abundance in Site 1. In Site 1 (0.94) and in Site 3 (0.93), the Simpson index values obtained were nearer to 1, indicating the dominance of certain butterfly species like *Ypthima baldus* in Site 1 and *Catopsilia pomona* in Site 3. The availability of host plants may be the reason for their dominance. The calculated values of Margalef's index ranged from 2.27 (Site 4) to 13.06 (Site 3) indicating less abundance in Site 4 and more abundance in Site 3. Berger-Parker index ranged from 0.15 (Site 1) to 0.55 (Site 4). It is often reported in its reciprocal form, so that an increase in the value of index accompanies an increase in diversity and reduction in dominance [18].

Diversity pattern and faunal composition differ significantly between four habitats. Among the selected sites taken during the study period, two came under the natural habitat and the remaining two sites were artificially made and maintained. Butterflies belonging to the five families showed high population in the artificial habitats compared to the natural ones. The artificial sites mainly contain cultivated plants especially nectar rich flowering plants which host several butterfly species and hence reported high diversity compared to the natural areas.

The least diversity was observed in *Cymbopogon citratus* dominated grasslands which is not a host plant for many butterfly species. Another reason for the low abundance of butterfly species in grassland could be the absence of shade in these areas. In the present study, the maximum number of species and individuals were observed at garden area, where availability of diverse plants and access to host plants viz., *Tridax procumbens*, *Nerium odorum*, *Mussaenda frondosa*, *Oreodoxa regia*, *Albizia odoratissima*, *Polyalthia longifolia*, *Cassia fistula*, *Lantana camara*, *Citrus limon*, *Murraya koenigii*, *Ixora coccinea* and different species of ornamental flowering plants which are also promoted the butterfly richness and density.

When the distribution of families on four months was compared, we noted an increase in number of butterflies towards monsoon period. Highest number of butterflies was seen in the month of June followed by May and least in dry seasons (March and April). Reddi *et al.*, (2003) reported that the rainfall conditions greatly influence the butterfly numbers and species distributions. The butterflies tend to avoid dry habitat and prefer moist places [24]. Chandekar *et al.*, (2013) reported a similar trend in which species abundance increase from the beginning of monsoon.

Butterflies engaged in mud puddling were also observed in the Campus. Mud puddling behaviour is common in some tropical butterflies. Mud puddling was common during the sunny hours. Single species assemblages were formed at wet soil patches. Mostly *Graphium sarpedon* were found in mud puddling.

Among the 105 species sighted in Kerala University Campus, 21 species (*Actolepis puspa*, *Neptis jumbah*, *Castalius rosimon*, *Hypolimnas misippus*, *Lethe europa*, *Pachliopta Hector*, *Eurema anderssonii*, *Appias albino*, *Appias lyncida*, *Pareronia valeria*, *Jamides celeno*, *Melanitis leda*, *Tanaecia lepidea*, *Euthalia aconthea*, *Euchrysops cnejus*, *Tajuria cippus*, *Appias libythea*, *Euploea core*, *Baoris farii*, *Euploea klugii* and *Euthalia lubentina*) come under the schedule 1, 2 and 4 of Wild life protection Act, 1972 [9]. Nine (*Mycalesis subdita*, *Elymnias caudate*, *Mycalesis mineus*, *Mycalesis visala*, *Mycalesis perseus*, *Ypthima ceylonica*, *Cirrochora*

*thais*, *Caleta caleta*, *Discolampa ethion*) among the 105 species are endemic to Western Ghats. This shows that Kerala University Campus is a good abode to many butterfly species and there is an urgent need to adapt conservation policies.

During the study period, we noted high predation pressure on butterflies especially from spider, wasps, ants, praying mantis etc. which check the butterfly population. From the conservation aspect, this information about predators is highly valuable for protection of butterflies and to maintain good butterfly diversity in the campus.

The present study showed that the Kerala University Campus at Kariavattom, due to its high floral diversity is a flourishing habitat for butterflies. The environmental conditions in the campus are highly favourable for butterflies to complete its life cycle. Even though its an Urban area, presence of 105 species of butterflies, indicates the ecological importance of this area and calls for a greater conservation strategies like creating butterfly parks, gardens and by preserving the existing vegetation as such. This study is quite significant and it emphasizes the importance of Campuses in the conservation of biological diversity of a region. By conserving butterflies, we are indirectly maintaining the ecological balance.

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