Butterfly Diversity in Manasagangothri campus of Mysore University

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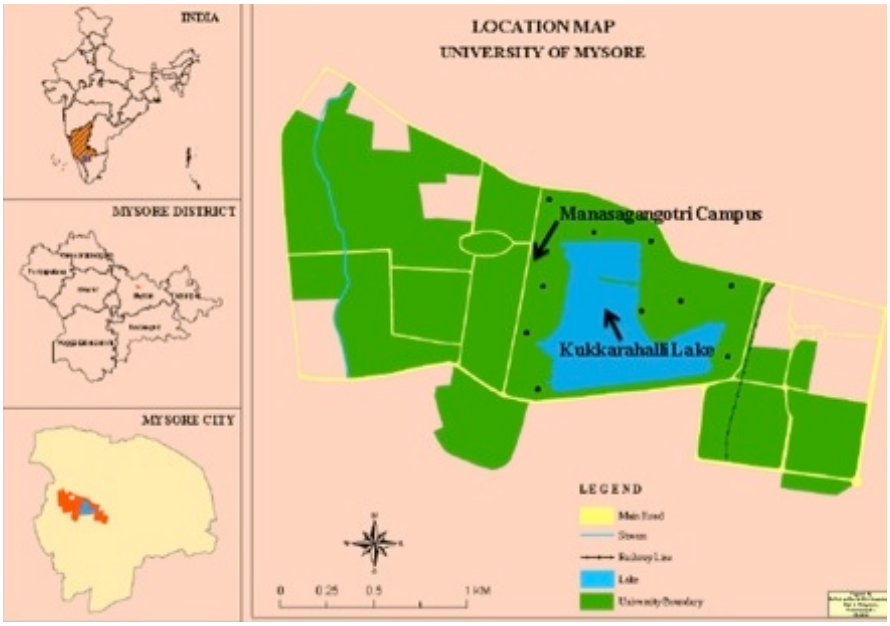
Abstract

The present study was aimed to explore the existing diversity of butterflies from Manasagangothri Campus of Mysore University, Mysore, Karnataka. Manasagangothri Campus harbours 86 species of what belonging to 55 genera. Nymphalidae was the most dominant family and Lemon pansy (*Junonia lemonias*) was the most dominant species in the study site. Species richness was 3.71 in the study area and species were less uniformly distributed. Simpson's Diversity Index shows greater sample diversity. Blue mormon, Crimson rose and Common jezebel were the three endemic species observed in the study area. Twelve species listed under the Wildlife (Protection) Act 1972 were recorded. Congregations of *Catopsilia* sp. *Euploea core, Prosotas dubiosa* and *Tirumala limniace* were observed during the study period.



Location of Manasagangothri Campus of Mysore University
● Locations of transects in the study area

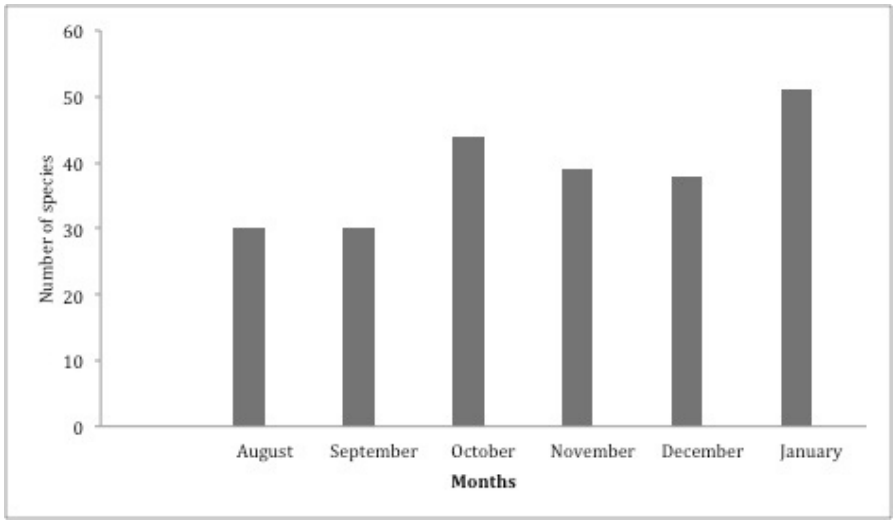


Fig 1. Number of butterfly species recorded in different months at

Introduction

Among insects, butterflies are the most studied group (Ramesh *et al.* 2010). They are essential part of any natural ecosystem as pollinators and energy transferors from herbivore to the next trophic level (Shreekumar and Balakrishnan, 2001). Many species of butterflies are strictly seasonal, preferring only particular habitats (Kunte, 1997). Because of their diversity, wide distribution, specificity to vegetation type, rapid response to perturbation, taxonomic tractability, significant abundance and ease of sampling, they are considered useful organisms to monitor environmental changes (Gowda *et al*. 2011). Hence, they are designated as indicator species (Kocher and Williams, 2000; Sharma and Joshi, 2009; Choudhary *et al.* 2010; Amala *et al.* 2011). The diversity and distribution of a particular species is dependent not only on the geography of the area and ability of the species to move around within it, but also on the ecological demands of the species (Khan *et al*. 2011).

There are about 18,000 species of butterflies in the world (Kehimkar, 2011); their diversity is high in the tropics compared to temperate regions of the world (Gowda *et al.* 2011). The number of Indian butterflies amount to one fifth of the world total butterfly species (Arun, 2003). The total number of butterfly species recorded from the Indian region is about 1,501 (Gaonkar, 1996); majority of them are in the North-eastern region (Kunte, 1997). Peninsular India hosts 350 species of butterflies; 331 species from Western Ghats and 313 species are from South India, of which 42 species are

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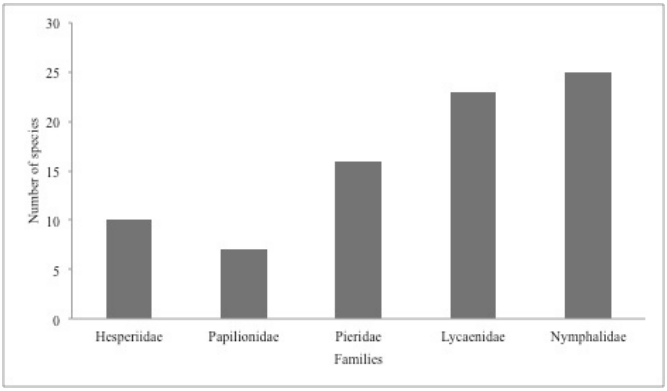

Fig 2. Number of species encountered in different families at Manasagangothri Campus of Mysore University

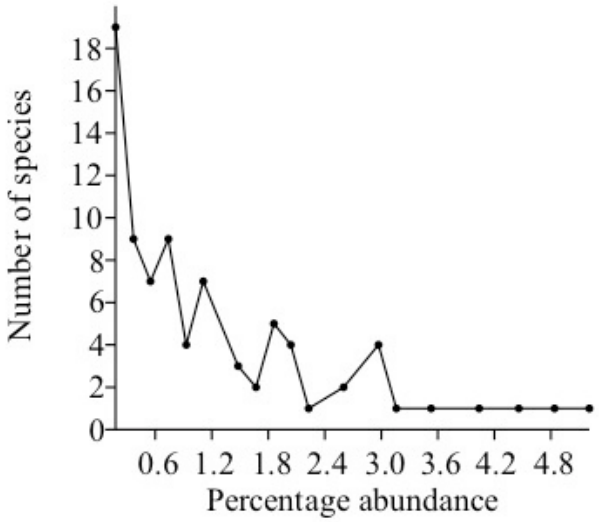

Fig 3. Percentage abundance of different butterfly species at Manasagangothri Campus of Mysore University

endemic to South India (Gaonkar, 1996). The butterfly fauna of the Southern part of the Indian Peninsular is very rich and diverse compared to the other parts of the peninsular region due to the availability of diverse habitat, a wide range of altitudinal gradients and associated microclimatic regimes (Rajagopal *et al.* 2011). No literature is available on the butterfly diversity of Manasagangothri Campus except that of Basavarajappa (2012). His study is confined to only listing of butterfly species of the Campus.
The present work was undertaken as a part of a major project of M.Sc. CBCS System. The objectives of the present investigation were to study the butterfly diversity, their abundance and diversity index in Manasagangothri Campus of Mysore University.

Study sites
Study was carried out in Manasagangothri Campus of Mysore University. Manasagangothri Campus spreads over 350 acres (12^0 18' N and 18^0 83' E) and has a serene atmosphere. The well groomed trees that surround the buildings provide a good habitat for the butterflies. Vegetation is scrubby with 305 plant species belonging to 93 families (Jayaramaiah, 2012).

Methodology
Butterfly survey was made in Manasagangothri Campus during daytimes 8.30 AM to 11.30 AM and 2.00 PM to 5 PM when they were most active. The method adopted for sampling the butterflies was Transect Count popularly known as 'Pollard Walk' (Pollard *et al.* 1975). All the butterflies observed on either side of the transect path up to 5m wide were recorded. 10 separate transect paths (500 m) were laid in different natural vegetation of the study area and were surveyed twice in a month for a period of 6 months (August 2012 to January 2013).

Population numbers were estimated by using area census method (Douwes, 1976). Identification was done in the field; more emphasize was given on direct sighting or photographic evidence. Some rare and small butterflies which were difficult to identify were caught by using insect net, closely observed and released immediately to the same habitat. Identification was carried out using references such as Kunte (2000), Kehimkar (2011), and website www.ifoundbutterflies.org.

Statistical Analysis
Dominance index: Patterns of relative abundance of species that determine the dominance of insect order Lepidoptera in a locality was determined by calculating the dominance index after Shamsudeen and Mathew (2010).

Species richness index: The index of species richness (D_{mn}) was calculated as per the formula published by Menhinick (1964).
Shannon's evenness index: The evenness of species abundance indicates how the individuals of various species are distributed in the community. It was calculated as per Shannon's evenness index (Pielou, 1975).

Alpha diversity: Alpha diversity is the measurement of number of taxa within the ecosystem. It was calculated using Simpson's index (Heip *et al.* 1998).

Results
Table 1 shows the checklist of butterfly species of Manasagangothri Campus of Mysore University. Butterflies recorded from study sites belong to five families; Hesperiidae, Papilionidae, Pieridae, Lycaenidae and Nymphalidae. During the study period a total of 86 species were recorded. Out of 86 species indentified, 13 belong to the family Hesperiidae, 7 to Papilionidae, 17 to Pieridae, 23 to Lycaenidae and 26 species to the family

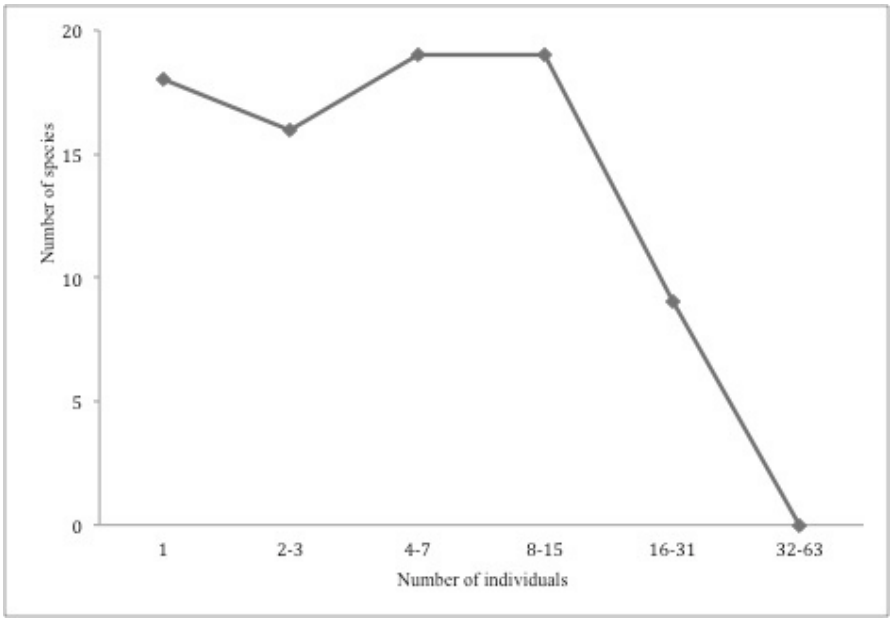

Fig 4. Species abundance curve at Manasagangothri Campus showing log series distribution

Nymphalidae. Table 2 shows the relative abundance (RA) of butterfly species at Manasagangothri Campus. Among the 5 families, Nymphalidae was the most dominant family with high number of species and Papilionidae was the least dominant family with less number of species. Total of 55 genera were recorded from the study area. High numbers of genera were found in family Lycaenidae (RA-35.18%).

Family Nymphalidae had the highest Dominance Index, while Hesperidae and Papilionidae showed least values (Table: 3). Species richness, Shannon-Wiener diversity index and Evenness or Equitability Index in the study site were 3.71, 3.702 and 0.84 respectively. Simpson's Diversity Index was high in the study area (Table: 4). Relative Abundance of each species was determined; Lemon Pansy (*Junonia lemonias)* was the most dominant species encountered in the study area with RA of 5.21 followed by Tawny coster (*Acraea violae)* with RA of 4.84. *Acraea issoria, Acytolepis puspa, Ampittia dioscorides, Appias albina, Azanus ubaldus, Curetis thetis, Eurema brigitta, Eurema laeta, Jamides alecto, Junonia almana, Junonia atlites, Matapa aria, Megisba Malaya, Pareronia ceylanica, Polyura althamus, Prosotas nora, Telicota bambusae* and *Telicota colon* were rare in the study site. The study area harbours 3 endemic species; endemism level varies from Southern India to the Indian Subcontinent. Three species under Schedule I, 8 species under Schedule II and 1 species under Schedule IV of Wildlife Protection Act 1972 were recorded from the study site (Table: 1) Figure 1 depicts the number of butterfly species observed during the study period, where fluctuation was observed in the number of species. From figure 2 it was clear that, families like Lycaenidae and Nymphalidae had high number of species compared to Pieridae, Papilionidae and Hesperiidae. Figure 3 depicts percentage abundance of different butterfly species; maximum number of species showing lower abundance and few species has high abundance. Figure 4 represent species abundance curve representing log series distribution. No species have more than 32 individual, maximum numbers of species been rare with only 1-3 individuals. The butterfly species recorded in Manasagangothri Campus (86 species) formed 25% of butterfly species recorded from the Western Ghats (331 Species) with better representation for Pieridae (51%) and Papilionidae (36%) compared the other families (Table: 5). During the study period, Congregation of *Catopsilia* sp.*, Euploea core, Prosotas dubiosa,* and *Tirumala limniace* were observed from study site. Congregation of *Tirumala limniace* and *Euploea core* were observed on the tree *Pongamia pinnata* (Caesalpiniaceae).

Discussion

Species richness was high in the study site. The abundance of butterfly population in the study area may be due to the availability of ample food, optimum climate and serene atmosphere (Ravindra *et al.* 1996). Evenness or Equitability index shows that, species distribution in the study area was less uniform and Alpha diversity indicates greater sample diversity. High numbers of species were observed during October 2012, November 2012, December 2012 and January 2013; related to better availability and access to the larval host plants and nectar plants (Das *et al.* 2012). In the present study abundance curve shows uneven distribution of butterfly species with few species being abundant and many species being rare. This was supported by low evenness index (0.84)

Nymphalidae was the most diverse family; due to the presence of flowers belonging to the families such as Euphorbiaceae, Compositae, Rubiaceae and Verbinaceae (Gunathilagaraj *et al.* 1998). Congregation is the phenomenon occurs during population outbreak; for flower nectar (Smetacek, 2002). Congregation of male butterflies at mud paddles and sand banks is for getting minerals and salts required for the formation of spermatophores (Smetacek, 2002). Manasagangothri Campus not only possesses high number butterfly species, but it also supports few rare and legally

Table 1. Checklist of Butterfly species in Manasagangothri Campus of Mysore University

Sl. No.	Common Name	Scientific Name
	Hesperiidae	
1	Bush hopper	*Ampittia dioscorides* Fabricius
2	Chestnut bob	*Iambrix salsala* Moore
3	Common banded awl	*Hasora chromus* Cramer
4	Common grass dart	*Taractrocera maevius* Fabricius
5	Common Red eye	*Matapa aria* Moore
6	Conjoined swift	*Pelopidas conjuncta* Herrich-Schaffer
7	Dark palm dart	*Telicota ancilla* Herrich-Schaffer
8	Indian Skipper	*Spialia galba* Fabricius
9	Large branded swift	*Pelopidas subochracea* Moore
10	Oriental dark-palm dart	*Telicota bambusae bambusae*
11	Pale palm dart	*Telicota colon* Fabricius
12	Rice swift	*Borbo cinnara* Wallace
13	Small branded swift	*Pelopidas mathias* Fabricius
	Papilionidae	
1	Blue mormon	*Papilio polymnester* Cramer[#2&3]
2	Common jay	*Graphium doson* C. and R. Felder
3	Common mormon	*Papilio polytes* Linnaeus
4	Common rose	*Atrophaneura aristolochiae* Fabricius
5	Crimson rose	*Atrophaneura hector* Linnaeus[#1&2, *1]
6	Lime butterfly	*Papilio demoleus* Linnaeus
7	Tailed jay	*Graphium agamemnon* Linnaeus
	Pieridae	
1	Common albatross	*Appias albina* Boisduval[*2]
2	Common emigrant	*Catopsilia pomona* Fabricius
3	Common grass yellow	*Eurema hecabe* Linnaeus
4	Common gull	*Cepora nerissa* Fabricius[*2]
5	Common jezebel	*Delias eucharis* Drury[#3&2]
6	Common wanderer	*Pareronia valeria* Cramer[*2]
7	Dark wanderer	*Pareronia ceylanica* C and R. Felder
8	Mottled emigrant	*Catopsilia pyranthe* Linnaeus
9	One spot grass yellow	*Eurema andersoni* Moore[*2]
10	Pioneer	*Belenois aurota* Fabricius
11	Plain orange tip	*Colotis eucharis* Fabricius
12	Psyche	*Leptosia nina* Fabricius
13	Small grass yellow	*Eurema brigitta* Cramer
14	Small orange tip	*Colotis etrida* Boisduval
15	Small salmon arab	*Colotis amata* Fabricius
16	Spotless Grass yellow	*Eurema laeta* Boisuval
17	Three spot grass yellow	*Eurema blanda* Boisduval
	Lycaenidae	
1	Bright babul blue	*Azanus ubaldus* Stoll
2	Common cerulean	*Jamides celeno* Cramer[*2]
3	Common hedge blue	*Acytolepis puspa* Horsfield
4	Common pierrot	*Castralius rosimon* Fabricius[*1]
5	Dark cerulean	*Jamides bochus* Stoll
6	Forget-Me-Not	*Catochrysops strabo* Fabricius
7	Grass jewel	*Freyeria trochylus* Freyer
8	Indian common line blue	*Prosotas nora ardates* C. Felder
9	Indian sunbean	*Curetis thetis* Drury
10	Lesser grass blue	*Zizina otis* Fabricius

protected species (Eswaran and Pramod 2005, Tiple and Khurad 2009, Tiple 2011 and Kunte *et al.* 2012).

Conclusion

Present study shows the occurrence of high number of butterfly species in Manasagangothri Campus of Mysore University. Species distribution was not completely even in the study site. On the whole the butterfly fauna of Manasagangothri Campus was rich and varied containing few rare, endemic and protected species. It was observed that, the occurrence and distribution of butterflies were closely associated with the availability of its larval and adult host plants.

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Sl. No.	Common Name	Scientific Name
11	Lime blue	*Chilades lajus* Stoll
12	Malayan	*Megisba malaya* Horsfield
13	Metallic cerulean	*Jamides alecto* C. and R. Felder[*2]
14	Opaque 6-line blue	*Nacaduba beroe* C. and R. Felder
15	Pale grass blue	*Pseudozizeeria maha* Kollar
16	Pea blue	*Lampides boeticus* Linnaeus[*2]
17	Red pierrot	*Talicada nyseus* Guerin-Meneville
18	Red spot	*Zesius chrysomallus* Hubner
19	Slate flash	*Rapala manea* Hewitson
20	Small cupid	*Chilades parrhassius*
21	Tailless lineblue	*Prosotas dubiosa indica* Evans
22	Tiny grass blue	*Zizula hylax* Fabricius
23	Zebra blue	*Leptotes plinius* Fabricus
	Nymphalidae	
1	Blue pansy	*Junonia orithiya* Linnaeus
2	Blue tiger	*Tirumala limniace* Cramer
3	Chocolate pansy	*Junonia iphita* Cramer
4	Common caster	*Ariadne merione* Cramer
5	Common crow	*Euploea core* Cramer[*3]
6	Common evening brown	*Melanitis leda* Linnaeus
7	Common fourring	*Ypthima huebneri* Kirby
8	Common leopard	*Phalanta Phalanta* Drury
9	Common nawab	*Polyura athamus* Drury
10	Common palmfly	*Elymnias hypermnestra Caudata* Linnaeus
11	Common sailer	*Neptis hylas* Linnaeus
12	Common threering	*Ypthima asterope* Klug
13	Danaid eggfly	*Hypolimnas misippus* Linnaeus[*1&2]
14	Dark blue tiger	*Tirumala septentrionis* Butler
15	Glasy Tiger	*Parantica aglea* Stoll
16	Great eggfly	*Hypolimnas bolina* Linnaeus
17	Grey pansy	*Junonia atlites* Linnaeus
18	Lemon pansy	*Junonia lemonias* Linnaeus
19	Long-brand bush brown	*Mycalesis visala* Moore
20	Peacock pansy	*Junonia almana* Linnaeus
21	Plain tiger	*Danaus chrysippus* Linnaeus
22	Striped tiger	*Danaus genutia* Cramer
23	Tawny coster	*Acraea violae* Fabricius
24	White fourring	*Ypthima ceylonica* Hewitson
25	Yellow coster	*Acraea issoria* Hubner
26	Yellow pansy	*Junonia hierta* Fabricius

[#1]SI = South India, [#2]SL = Sri Lanka, [#3]PI = Peninsular India, [*1]Schedule I, [*2]Schedule II and [*3]Schedule IV

Table 2. Relative abundance of butterflies at Manasagangothri Campus of Mysore University

Sl. No.	Family	Number of Genera	Relative abundance (%)	Number of species	Relative abundance (%)
1	Hesperiidae	9	16.36	13	15.11
2	Papilionidae	3	5.45	7	8.3
3	Pieridae	9	16.36	17	19.76
4	Lycaenidae	19	34.54	23	26.74
5	Nymphalidae	15	27.27	26	30.23
	Total	**55**		**86**	

Table 3. Dominance index worked out for various families of butterflies

Sl. No.	Family	I	D
1	Hesperiidae	34	6.33
2	Papilionidae	36	6.7
3	Pieridae	84	15.64
4	Lycaenidae	148	27.56
5	Nymphalidae	235	43.76
	Total	**537**	

I = Number of individuals, D = Dominance index

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Table 4. Data on Butterflies at Manasagangothri Campus of Mysore University

Locations	No. of species	No. of individuals	D_{mn}	H	E	D
Manasagangothri	86	537	3.71	3.702	0.84	0.978

Table 5. Butterfly diversity in Manasagangothri Campus of Mysore University vs. Western Ghats

Sl No.	Family	No. of species in Manasagangothri Campus	No. of butterflies in Western Ghats	Percentage of Species in Mysore University Campus
1	Hesperiidae	13	81	16%
2	Papilionidae	7	19	36%
3	Pieridae	17	33	51%
4	Lycaenidae	23	102	22%
5	Nymphalidae	26	96	27%

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