



Study on Butterfly Diversity in the Campus of Government College Quepem, Goa, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Butterflies belonging to the class Insecta and the order Lepidoptera make the second largest order after Coleopterans. They are one of the best environmental indicators due to their short life cycle and quick response to the changes in the environment. Moreover, they play vital roles in nutrient cycling and food chain in the ecosystems. No published documentary evidences are available on the butterfly diversity of Quepem at the foothills of Western Ghats in Goa. Present study was designed to generate the preliminary checklist of butterflies at the campus of Government College, Quepem. Field survey on butterflies was carried out from September 2021 to January 2022, in the

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selected sites comprising of botanical garden, butterfly garden and specific sites in the college campus rich in vegetation. 40 butterfly species belonging to five families spread over 30 genera were recorded during the study period. Family Nymphalidae dominated the college campus with 18 species followed by Lycaenidae (9 species), Papilionidae (5 species), and Hesperidae and Pieridae with 4 species each. The dominance exhibited by family Nymphalidae was mainly due to the rich landscape and the availability of larval host and nectar plants in the campus.

Keywords: *Butterfly; diversity; Lepidoptera; Quepem; Western Ghats; vegetation.*

1. INTRODUCTION

Order Lepidoptera, consisting broadly of two groups of Butterflies and Moths, is the second largest order of Arthropods after Coleopterans [1]. Butterflies are diurnal and distinguished from moths by the presence of knobbed antennae, wings held vertical at rest with head and thorax well demarcated. As compared to other insects butterflies have wings covered with scales and hold an unique position on account of their bright and striking colouration and varied pattern on wing surfaces enhancing their beauty. They are holometabolus insects with complete metamorphosis involving four distinct stages. They are also a well-studied group throughout the world because of their ecological significance [2] as they play a crucial role in ecosystem services including pollination [3] and are good biological indicators of habitat quality [4]. Butterflies are considered useful organisms to monitor environmental changes because of their diversity, wide distribution, specificity to vegetation type, rapid response to disturbance, taxonomic tractability, significant abundance, and ease of sampling [5].

2. MATERIALS AND METHODS

2.1 Study Area

Goa, is a small state on the southwestern coast of India within the Konkan region, geographically separated from the Deccan highlands by the Western Ghats.

Government College of Arts, Science and Commerce, Quepem (GCQ), Goa, is situated 2 Kms from Quepem town with coordinates 15.228185°N, 74.064698°E, lying far away from hustle and bustle of city life at the foothills of Western Ghats. There is no published data on butterflies of this area till date, thus making it an important reason for conducting this exploration which will in-turn generate primary data with the help of this documentation. Field

surveys on butterflies were carried out from September 2021 to January 2022, in the selected sites comprising of 1) Botanical Garden, 2) Butterfly Garden, 3) vegetation near the Multipurpose Hall, 4) Library and 5) the College entrance.

2.2 Methodology

Visual encounter method and opportunistic sightings were employed to assess butterflies in the morning hours from 7:00am - 9:00 am on every alternate day. Photographs of the butterflies were taken, without disturbing them in their natural habitat. Various identification guides were used for identifying the butterflies [6-11].

3. RESULTS

A preliminary study on diversity of butterflies at the campus of Government College Quepem, Goa, India yielded a total of 40 species of butterflies belonging to five families spread over 30 genera (Table 1, Fig. 9). Recorded over a period of four months i.e., from third week of September 2021 till last week of January 2022, the butterflies in the campus constitute about 15.7% of the state's known butterflies [11] and 2.66 % butterflies of Indian subcontinent [12]. The checklist of the species of butterflies observed in the study area is presented in (Table 1). Nymphalidae was the richest family that dominated the study area with 18 species (45%) followed by Lycaenidae with 9 species (22.5%), Papilionidae with 5 species (12.5%) and least of 4 species (10%) each were recorded under Hesperidae and Pieridae families (Fig. 1). *Junonia* and *Papilio* were the two largest genera with 3 species each followed by *Danaus*, *Tirumala* and *Ypthima* genera with persistent 2 species each.

Among Nymphalidae, 18 species spread over 13 genera were observed followed by Lycaenidae, 9 species spread over 9 genera. In

the family Papilionidae, 5 species spread over 3 genera were recorded and in Pieridae, 5 species spread over 5 genera were noted down whereas among the Hesperidae, 4 species spread over 4 genera were observed (Table 1).

Table 1. Preliminary checklist of butterfly diversity in college campus

Sr. No.	Family	Scientific name	Common name	Relative Frequency status
1	Hesperidae	<i>Aeromachus pygmaeus</i> Fabricius, 1775	Pygmy Scrub Hopper	C
2		<i>Ampittia dioscorides</i> Fabricius, 1793	Bush Hopper	R
3		<i>Potanthus omaha</i> H. Edwards, 1863	Lesser Dart	NR
4		<i>Tagiades litigiosa</i> Moschler, 1878	Water Snow Flat	VR
5	Lycaenidae	<i>Acytolepis puspa</i> Horsfield, 1828	Common Hedge Blue	NR
6		<i>Castalius rosimon</i> Fabricius, 1775	Common Pierrot	C
7		<i>Cigaritis vulcanus</i> Fabricius, 1775	Common Silverline	R
8		<i>Euchrysops cnejus</i> Fabricius, 1798	Gram Blue	NR
9		<i>Jamides celeno</i> Cramer, 1775	Common Cerulean	R
10		<i>Lampidus boeticus</i> Linnaeus, 1767	Pea Blue	R
11		<i>Luthrodes pandava</i> Horsfield, 1829	Plains Cupid	NR
12		<i>Talica niseus</i> Guerin, 1843	Red Pierrot	VR
13		<i>Zizeeria karsandra</i> Moore, 1865	Dark Grass Blue	VC
14	Nymphalidae	<i>Acraea terpsicore</i> Linnaeus, 1758	Tawny Coaster	C
15		<i>Danaus chrysippus</i> Linnaeus, 1758	Plain Tiger	C
16		<i>Danaus genutia</i> Cramer, 1779	Striped Tiger	VC
17		<i>Euploea core</i> Cramer, 1780	Common Crow	VC
18		<i>Junonia almana</i> Linnaeus, 1758	Peacock Pansy	VR
19		<i>Junonia atlites</i> Linnaeus, 1763	Grey Pansy	C
20		<i>Junonia iphita</i> Cramer, 1779	Chocolate Pansy	R
21		<i>Melantia leda</i> Drury, 1758	Common Evening Brown	NR
22		<i>Mycalesis perseus</i> Fabricius, 1775	Common Bushbrown	R

Sr. No.	Family	Scientific name	Common name	Relative Frequency status
23	Papilionidae	<i>Neptis hylas</i> Moore, 1758	Common Sailor	C
24		<i>Orsotriaena medus</i> Fabricius, 1775	Medus Brown	NR
25		<i>Pantoporia hordonia</i> Stoll, 1790	Common Lascar	VR
26		<i>Parantica aglea</i> Stoll, 1782	Glassy Tiger	NR
27		<i>Tirumala limniace</i> Cramer, 1775	Blue Tiger	VC
28		<i>Tirumala septentionsis</i> Butler, 1874	Dark Blue Tiger	R
29		<i>Ypthima baldus</i> Fabricius, 1775	Common Five-ring	R
30		<i>Ypthima huebneri</i> Kirby, 1871	Common Four-ring	C
31		<i>Tanaecia lepidea</i> Butler, 1868	Grey Count	VR
32		<i>Graphium agamemnon</i> Linnaeus, 1758	Tailed Jay	R
33		<i>Pachliopta aristolochiae</i> Fabricius, 1775	Common Rose	NR
34	Papilionidae	<i>Papilio buddha</i> Westwood, 1872	Malabar Banded Peacock	R
35		<i>Papilio demoleus</i> Linnaeus, 1758	Lime Butterfly	VR
36		<i>Papilio polytes</i> Linnaeus, 1758	Common Mormon	NR
37		<i>Catopsilia pyranthe</i> Linnaeus, 1758	Mottled Emigrant	NR
38	Pieridae	<i>Delias eucharis</i> Drury, 1773	Common Jezebel	NR
39		<i>Eurema hecabe</i> Linnaeus, 1758	Common Grass Yellow	VC
40		<i>Leptosia nina</i> Fabricius, 1793	Psyche	NR

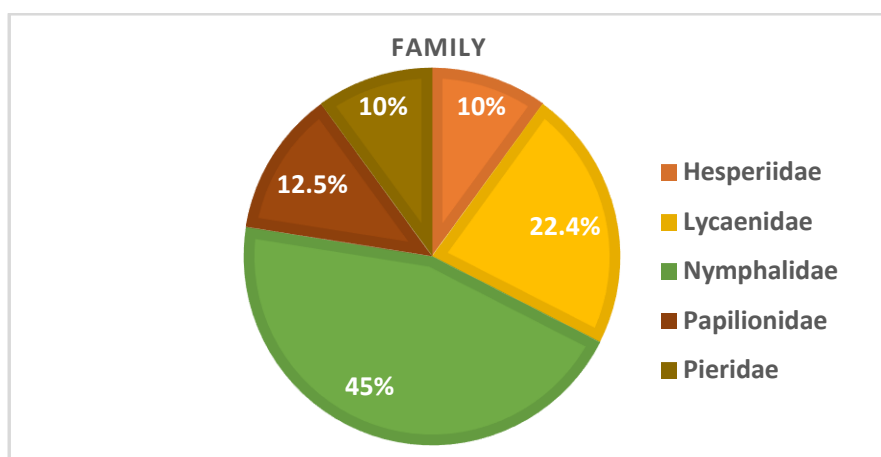


Fig. 1. Family wise percentile distribution of butterfly species

According to the scheme followed [13] VC: >100, C: 50-100, NR: 15-20, R :2-15 and VR: 1-2), butterfly sightings in the study area revealed that 5 species (12%) were Very Common (VC), 7 species (18%) were Common (C), 12 (30%) were Not Rare (NR), 10 species (25%) were Rare (R) and 6 species (15%) were Very Rare (VR) (Table 1 and Fig. 2).

Maximum sightings were noted in the Butterfly Garden as compared to other sites. In grasslands near Library and Multipurpose hall, the occurrence of Lycaenids was more frequent as compared to any other butterfly families. Abundance of butterflies was maximum when the

area was undisturbed with any sought of human activities.

The apex of hierarchy was exhibited by Common Crow (*Euploea core*) from the Nymphalidae family with 128 sightings (Fig. 3) followed by Dark Grass Blue (*Zizeeria karsandra*) from Lycaenidae family with 103 sightings (Fig. 4). Next was Common Mormon (*Papilio polytes*) from the Papilionidae family with 37 sightings (Fig. 5). Pygmy Scrub Hopper (*Aeromachus pygmaeus*) from the Hesperidae family followed next with 59 sightings (Fig. 6). The least was the Common Grass Yellow (*Eurema hecabe*) from Pieridae with 118 sightings (Fig. 7).

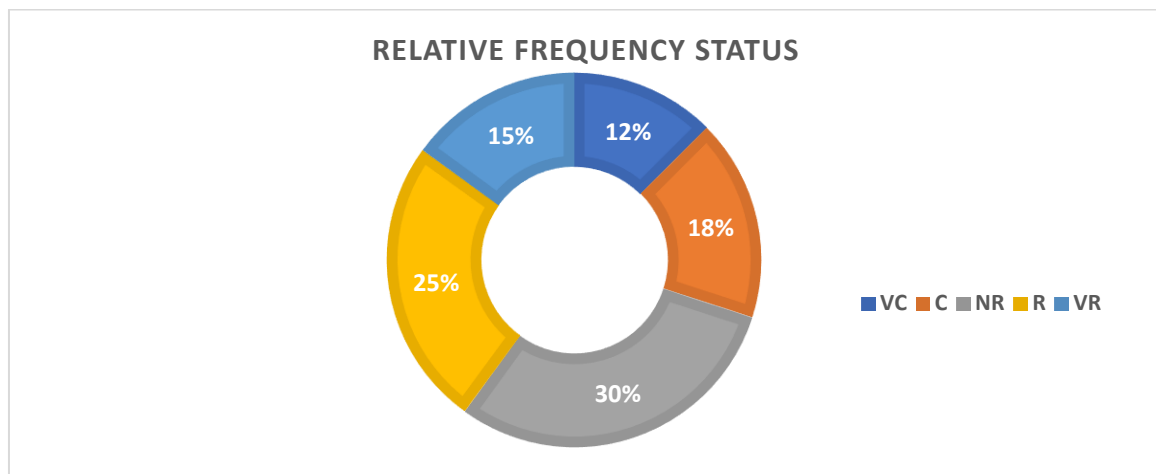


Fig. 2. Family wise percentile distribution of Relative Frequency Status

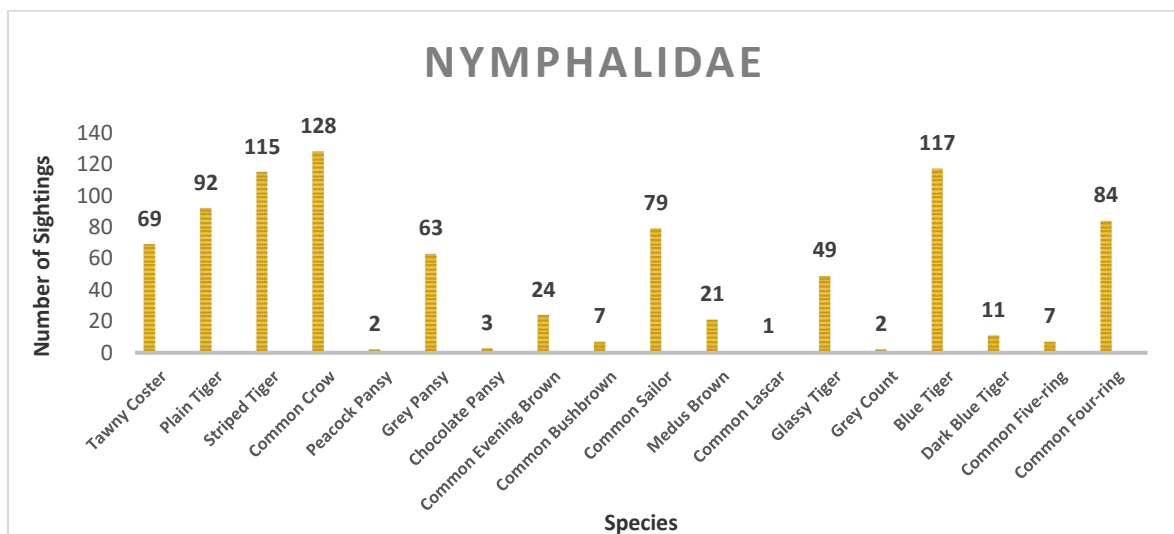


Fig. 3. Graphical representation of Relative frequency of butterfly species of family Nymphalidae

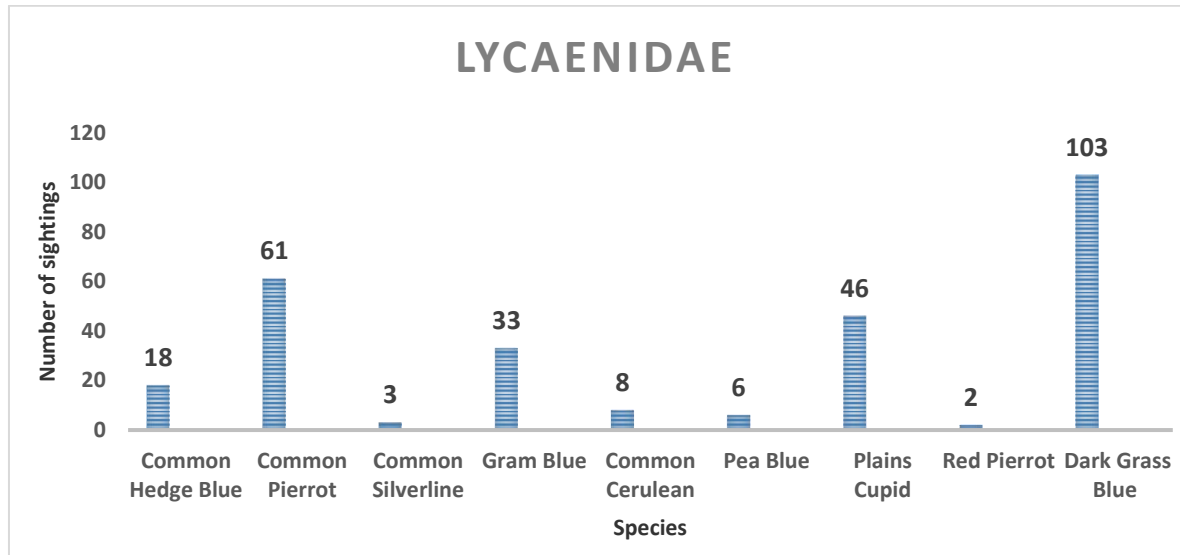


Fig. 4. Graphical representation of Relative Frequency of butterfly species of family Lycaenidae

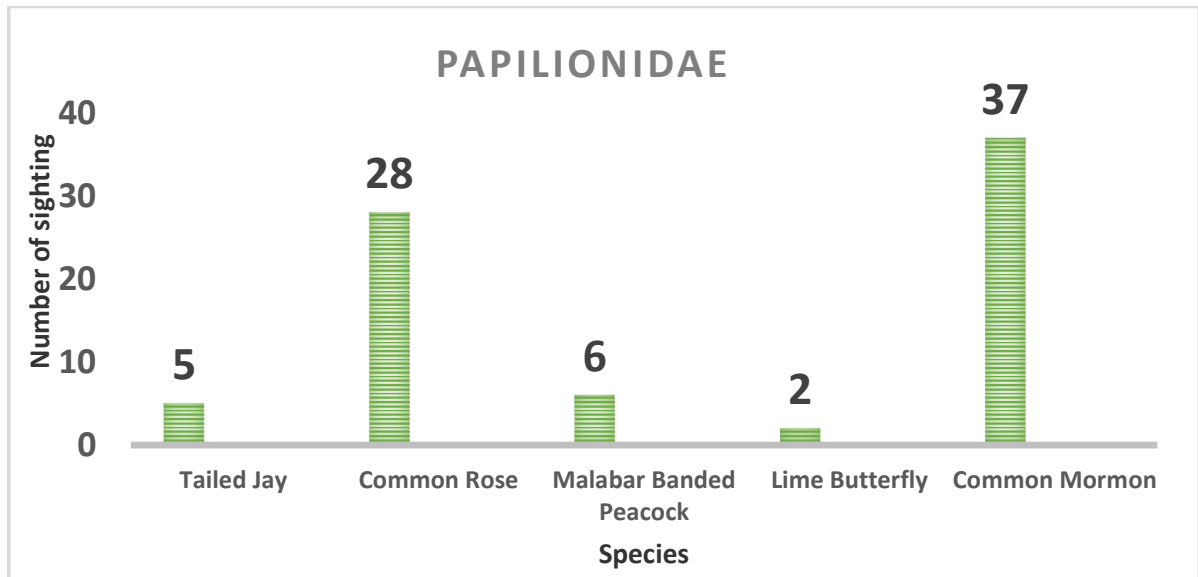


Fig 5. Graphical representation of relative frequency of butterfly species of family papilionidae

Table 2. Family wise Relative Abundance of Butterfly Species

Sr. No.	Families	Number Of Individual Species	Relative Abundance %
1	Hesperiidae	111	7.16%
2	Lycaenidae	280	18.06%
3	Nymphalidae	874	56.39%
4	Papilionidae	78	5.03%
5	Pieridae	207	13.35%
Total		1550	

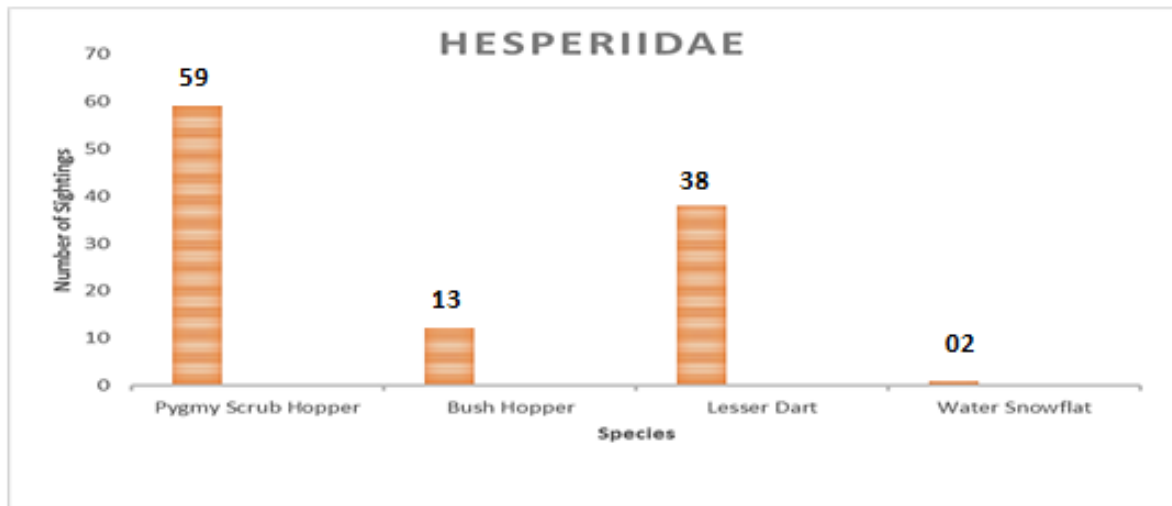


Fig. 6. Graphical representation of Relative frequency of butterfly species of family HesperIIDae

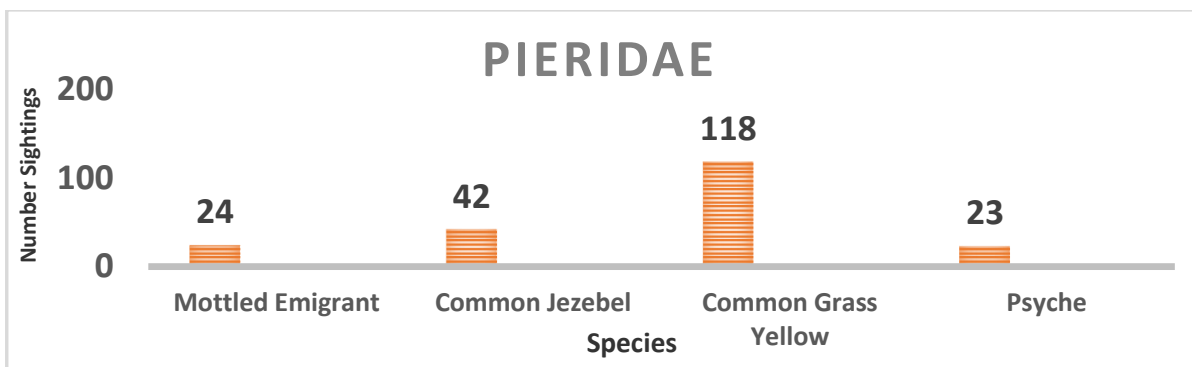


Fig. 7. Graphical representation of relative frequency of butterfly species of family Pieridae

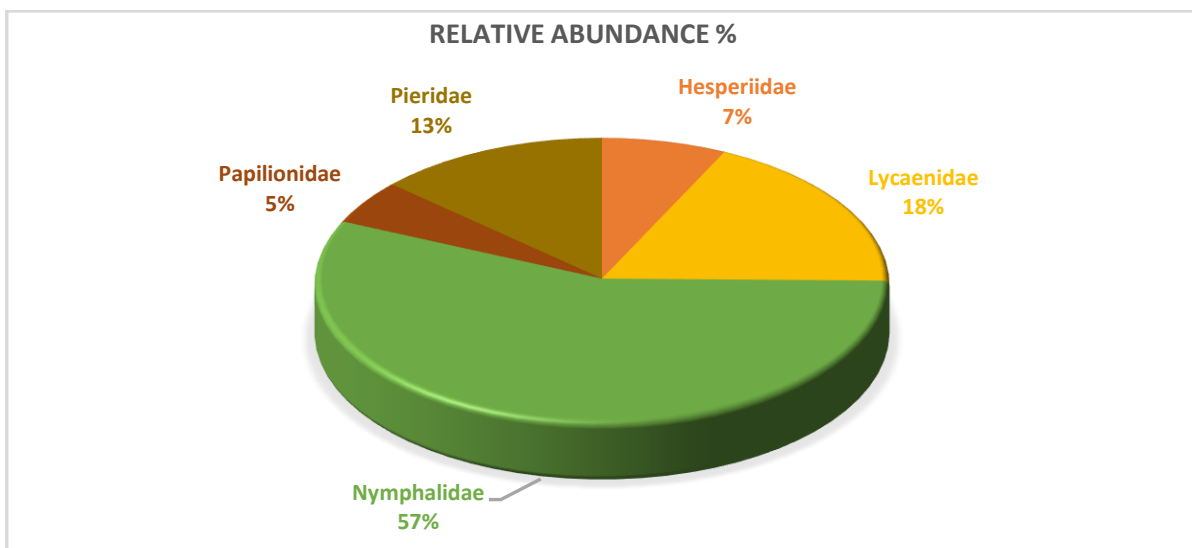


Fig. 8. Pie chart representing family wise relative abundance of butterfly species

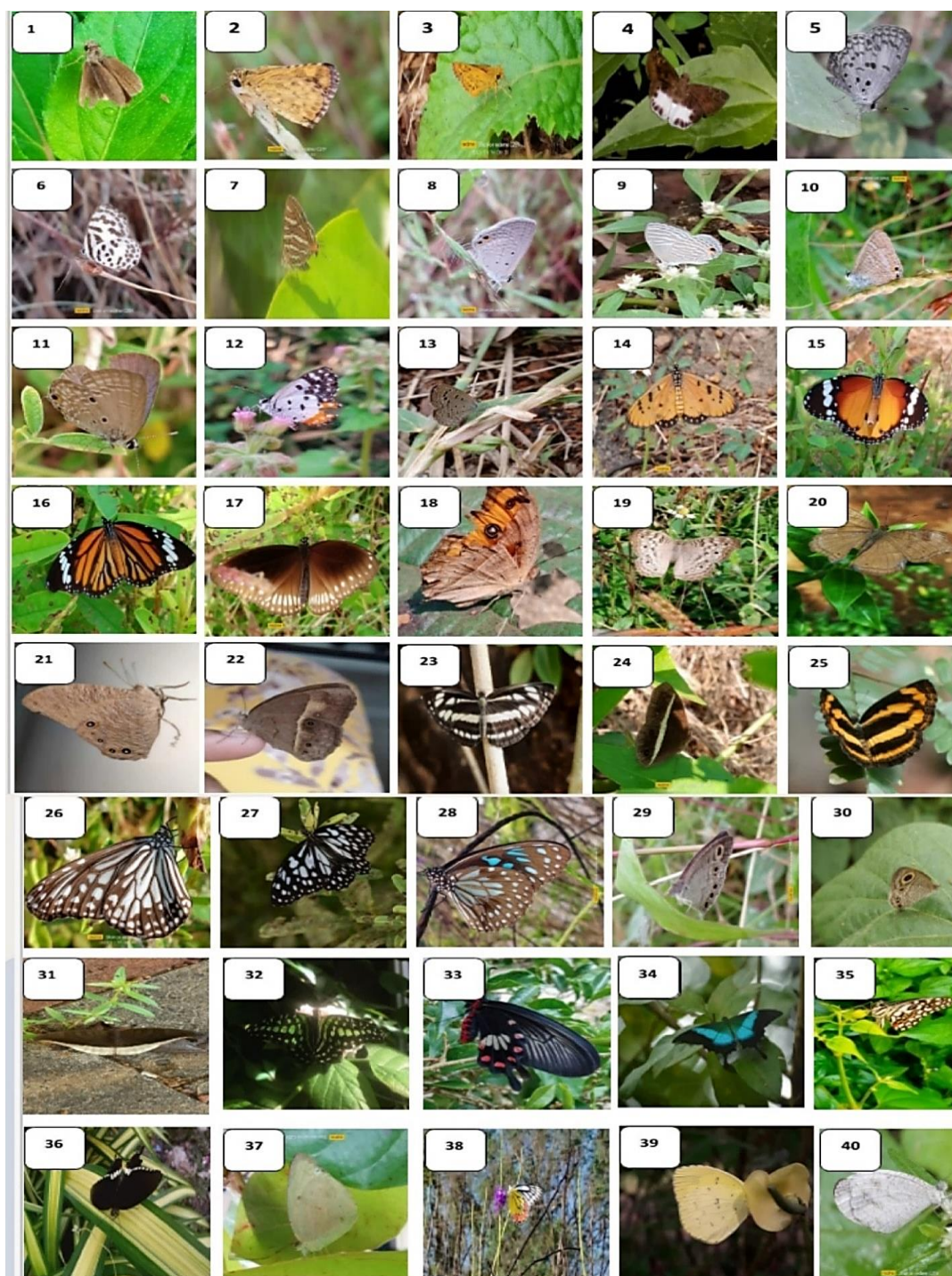


Fig. 9. Collage of butterflies documented at college campus

- 1) *Aeromachus pygmaeus* 2) *Ampittia dioscorides* 3) *Potanthus omaha* 4) *Tagiades litigiosa* 5) *Acytolepis puspa*
- 6) *Castalius rosimon* 7) *Cigaritis vulcanus* 8) *Euchrysops cnejus* 9) *Jamides celeno* 10) *Lampdus boeticus* 11)
- Luthrodes pandava* 12) *Talicauda nyseus* 13) *Zizeeria karsandra* 14) *Acraea terpiscore* 15) *Danaus chrysippus* 16)
- Danaus genutia* 17) *Euploea core* 18) *Junonia almana* 19) *Junonia atlites* 20) *Junonia iphita* 21) *Melanitis leda*
- 22) *Mycalesis Perseus* 23) *Neptis hylas* 24) *Orsotriaena medus* 25) *Pantoporia hardonia* 26) *Parantica aglea* 27)
- Ypthima huebneri* 28) *Tirumala limniace* 29) *Tirumala septentionsis* 30) *Ypthima baldus* 31) *Tanaecia lepidea* 32)
- Graphium agamemnon* 33) *Pachliopta aristolochiae* 34) *Papilio buddha* 35) *Papilio demoleus* 36) *Papilio polytes*
- 37) *Catopsilia pyranthe* 38) *Delias eucharis* 39) *Eurema hecabe* 40) *Leptosia nina*

Moreover, Family-wise Relative Abundance was calculated which reveals that the relative abundance of family Nymphalidae was highest with 57% followed by Lycaenidae with 18%, Pieridae with 13%, Hesperidae with 7% and Papilionidae with 5% (Table 3; Fig. 8).

The study conducted helped in assessing butterflies during the study period and thus to generate a preliminary checklist of butterflies at the campus of GCQ. Butterflies were captured photographically, this aided in creating a digital database for the campus. The baseline data presented could serve as reference for further research to be conducted in the campus site.

4. DISCUSSION

During the course of study at GCQ Campus, the maximum number of butterfly species were recorded under Family Nymphalidae, followed by Lycaenidae, Papilionidae, Hesperidae and Pieridae among the 40 species. Overall species abundance and richness revealed that Nymphalidae represented the most species, whilst Papilionidae, Hesperidae and Pieridae were the least individualized family in the study area. Availability of food, habitat destruction, migration, unfavorable climatic conditions, etc. alters the biodiversity all over the world. Dominance shown by family Nymphalidae may be due to availability of larval host plants [14].

Throughout the world Nymphalidae remains the largest representing family constituting one-third of the known butterfly species as they are ecologically well adapted [15]. Diversity of butterflies in any particular habitat is directly proportional to the availability of nectar plants and larval host plants vital for the early developmental stages of their life cycle [16]. Various researchers in their study observed a synonymous pattern of dominance of family Nymphalidae, a similar pattern of dominance was observed by different authors [17,18,19,14, 20,21,22].

Butterfly Garden of college campus has the presence of several nectar and larval host plants including the *Lantana camera* (Ghaneri) which is a nectar plant for *Danaus chrysippus* (plain tiger), *Cuphea hyssopifolia* (false heather) ; nectar plant for butterfly *Eurema hecabe* (common Grass yellow), *Wedelia trilobata* (creeping daisy); nectar plant for *Zizeeria karsandra* (Dark grass blue), *Stachytarpheta jamaicensis* (Blue Portweed) nectar plant; for butterfly *Pachliopta aristolochiae*

(Common rose) , *Annona squamosa* (Custard apple) ; nectar plant for butterfly *Graphium agamemnon* (Tailed jay), *Abrus precatorius* (Gunj); nectar plant for *Lampides boeticus* (Pea blue) and *Cassia fistula* (Bahava ,Balo) which acts as a host plant for butterfly *Catopsilia pyranthe* (mottled emigrant). Also, the botanical garden has many medicinal, herbal, flower potted plants, herbs and shrubs which also attracts the butterflies. The requirement of foliage as food for the growing larvae, and nectar and minerals as a nutritional source for the few adult butterfly species, are different for these two different stages of reproductive development. Perhaps, all these variations might have influenced the distribution of butterfly species, which belong to Hesperidae, Lycaenidae, Nymphalidae, Papilionidae and Pieridae families, differently. 8 species from the total species observed are listed in the Wildlife Protection act 1972 [23].

Second most dominant family was found to be Lycaenidae (Blues) which exclusively fed on grasses were sighted more often near the grasslands at auditorium, library and at the entrance, similar results were observed by [24] and [21] which may possibly due to the presence of grasslands on which they feed upon. Skippers were found close to the ground, their wingspan is lesser than other groups of butterflies, they were most active and sensitive to the slightest changes in the environment.

Butterflies are considered as crucial indicators, species of order Lepidoptera and are strongly sensitive to environmental factors such as temperature, humidity, rainfall, and velocity of wind [25,26] thus affecting their distribution in different habitats. In the present context, it may be assumed that the diversity of the butterfly varied in the three sites as a matter of the landscape differences existing in the butterfly garden, botanical garden, grasslands along the campus.

5. CONCLUSION

Butterflies are of large economic, aesthetic and biological value. Their presence in the ecosystem influences many other coexisting life forms as they play an important role in an ecological habitat. Therefore, the conservation of butterfly diversity is achievable by the enhancement of vegetation in habitats specifically preferred by butterflies. If we really want to conserve butterflies, practicing sustainable development is the need of the hour, maintaining the necessary

habitats i.e. the planting of host/ nectar plants is a must which are crucial for them for laying eggs, feeding etc. well regulation of anthropogenic activities should also be practiced.

Based on the results obtained, family Nymphalidae dominated the study site, especially butterfly garden. It can be concluded that even in a small site, butterfly communities varied significantly among different habitats. This preliminary checklist could serve as a reference for future research to be conducted in the study site. The study will also contribute to the available literature and database of butterflies in Goa. Studies can be conducted for understanding the ecological and conservational aspects associated with butterflies.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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