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Diversity and abundance of butterfly in Kalyani Lake park, West Bengal, India: A reconnaissance

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ABSTRACT

Butterfly species are one of the most important biodiversity indicators of nature. Study was done in Kalyani Lake Park area from June 2022 to December 2022 on status, abundance, and diversity of butterfly species. In recent times local butterfly species survives under threat and their count decreases. The objective of that study was to know about the abundance and diversity of butterfly species in the selected study area, to analyze what measures should be taken for conservation approach. From the present study, a total number of 1328 butterfly species individuals are found from 5 families belong to 44 genus, 58 species. Among them family Nymphalidae consists of 18 species followed by Lycaenidae (17 species), Papilionidae (5 species), Pieridae (8 species), Hesperiidae (10 species) were recorded. out of these 58 species, 3 species recognized as rare and vary rare type; these species of butterfly species are immediately needed to be conserved. By following a simple step everyone can contribute to butterfly species conservation; implantation of saplings, keep the park clean. This study focuses to identify the threats for butterfly species and to contribute in conservation approach.

Key words: Abundance, butterfly species, biodiversity, conservation, Kalyani Lake Park

INTRODUCTION

Butterflies are a large group of insect species belonging to the order Lepidoptera in phylum Arthropod (Robbins and Opler, 1997). There are more than 28,000 species of butterflies world wide, about 80 per cent of which are found in tropical regions. The subcontinent carries a diverse terrain, climate and vegetation that host about 1,504 species of butterfly species (Tiple, 2011; Nair et al., 2014). There are about 200,000 known species of Lepidoptera of which about 10% are butterfly species (Holloway et al., 1987; Qureshi, 2020). Butterfly species occupy an important position in the ecosystem, acting as pollinators, food has good source and aesthetic value (Klein et al., 2007; Syaripuddin et al., 2015; Day et al., 2017; Samal et al., 2021), enables monitoring of species diversity in a region on the potential functional role of the species. Tools to reduce human disturbance and pollution in urbanization, rural and managed areas and urban ecosystems can be used as species diversity monitors (Wilson, 1997; Mukherjee et al., 2015; Abdullahi et al., 2019; Iserhard et al., 2019).

Pollinators play an important role in the world's food supply and they have an important role in ecosystems (Losey and Vaughan, 2006; Lindstrom et al., 2018; Mukherjee and Mondal, 2020; Pradhan and Khaling, 2020). This taxon

is vulnerable due to their response to climatic conditions, land-use patterns, changing habitat and management intensity (Thomas, 2005; Rundlof et al., 2008; Zingg et al., 2018; Schwarz and Fartmann, 2021). They are important components of the food chain. Butterfly species play the role of pray of birds, bats, and other insectivorous animals. There may be minor changes in their habitat that cause immigration or local extinction (Blair, 1999; Kunte, 1997; Mennechez et al., 2003; Ghosh and Saha, 2016). They help in controlling the number of plants and insect population (Conrad et al., 2007; Kulkarni et al., 2021). Butterfly species and plants lives are exceptionally interlinked, which leads to different patterns in their distribution depending on the availability of their food plants (Feltwell, 1986; Silambarasan et al., 2016; Burghardt et al., 2009; Vina and Liu, 2017). Thus, conservation of butterfly species will improve our environment and enrich human life. Because it depends on plants, butterfly species diversity can reflect the overall flora diversity in a given area (Padhye et al., 2006; Dhadse, 2022).

Plant species that serve as rich nectar sources influence butterfly species occurrence (Tipple et al., 2006; Singh et al., 2020). Taxonomic and functional diversities of butterfly species can be increased by creating native vegetation outside the urban parks. In urban matrices, native vegetation's help to maintain the levels of functional butterfly species (Iserhard et al., 2019). A total of 58 butterfly species belonging to the five families of Papilionidae, Nymphalidae, Lycaenidae and Hesperiidae were identified in the present investigation. Butterfly species can be diverse protected by planting host-specific native plants to make sure that there will be at least the common species don't go on to the verge of devastation. The objective of the present study is quantification of butterfly species diversity, their status and abundance in and around the Kalyani Lake Park area.

MATERIALS AND METHODS

Study Area

The present study was conducted in Kalyani Lake Park, West Bengal, India from June 2022 to December 2022 to assess the diversity of butterfly species. Kalyani Lake Park is located in between 88°0.45' E longitudes and 22°0.98' N latitude of West Bengal, India. The vegetation of the area is very rich with a variety of flora species consisting of different types of woody plant, shrubs, herbs, palms, and climbers which are well present.

Fig. 1. Overview of the study area

Data collection

The field survey was conducted between July 2022 to December 2022. Butterfly species diversity at Kalyani Lake Park, West Bengal, India, was studied on the monsoon (June to September) and post monsoon (October and November) season. Butterfly species were carried out in the study area two days a week for a period of six months. Butterfly species were accessed in the study area from morning 10`am to afternoon 3 pm in the day time by direct observations during walking transects (Pollard, 1977; Pollard and Yates, 1993; Caldas and Robbins, 2003; Patil and Shende, 2014) of 200 m 500 m length with 2 m to 5 m on either side in the study area. Their identification was done during flight, feeding, basking, and mating activities using field guides (Kehimkar, 2013). Data were analyzed with the help of Microsoft Excel 2007 (Majumder et al., 2012; Trivedi et al., 2022) to understand butterfly species community structure in the study area.

RESULTS AND DISCUSSION

The butterfly fauna of Kalyani Lake Park area was studied to be fairly rich. A total of fifty-eight butterfly species representing 44 genera belonging to five different families were recorded (Fig. 2; Table 1 and 2). The present findings reveled that species diversity of Nymphalidae (31%) was the highest followed by Lycaenidae (29%), Hesperiidae (17%) and Pieridae (14%) while, Papilionidae (9%) has the lowest diversity. Nymphalidae was the most diverse family with 18 species consisting of 11 genera, followed by Lycaenidae (17 species, 13 genera), Hesperiidae (10 species, 10 genera), Pieridae (8 species, 7 genera), and Papilionidae (5 species, 3 generations). Among these species, 5 (9%) were not rare, 2 (3%) were very rare 1 (2%) were rare, 31 (53%) were commonly occurring and 19 (33%) were very common (Fig. 3). Among these 58 recorded species, Common four ring, Common crow, Gray pansy, Common grass yellow and Psyche were found in high frequencies in the Kalyani Lake Park (Fig. 5).

The study area has vegetation comprising shrubs, herbs, grasses, trees, and fruit plants. Following is a list of butterfly species along with their preferred food plants found in the study area (Table 3). The usefulness of Lepidoptera insects like butterfly species as an indicator of environmental conditions is a basis for study diversity of butterfly species at a spatiotemporal scale (Stefanescu et al., 2004). Butterfly species are indicators of a healthier ecosystem. They act as a pollinator, also serves as a prey for insect eating birds. Basically, butterfly species helps to maintain the food chain, in larger aspect the species richness (Tiple, 2012).

Table 1. Family-wise composition of butterfly community in Kalyani Lake Park

Family	Genus	Species	No. of individuals
Papilionidae	3	5	96
Nymphalidae	11	18	588
Pieridae	7	8	210
Lycaenidae	13	17	325
Hesperiidae	10	10	109
Total	44	58	1328

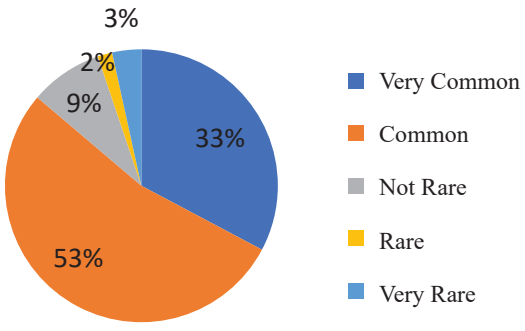

Fig. 2. Family-wise distribution of butterfly species at Kalyani Lake Park

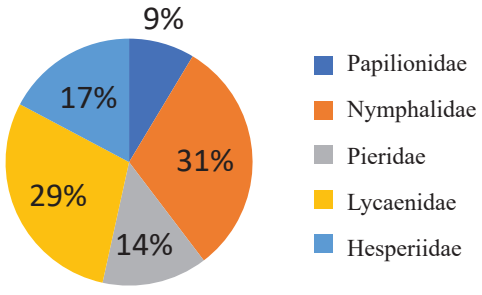

Fig. 3. Status abundance of butterfly species at Kalyani Lake Park

Table 2. Family-wise checklist of butterfly species observed in Kalyani Lake Park with its status

Sl.	Common name	Scientific name	Family	Status abundance
1	Common mormon	*Papilio polytes (Linnaeus)*	Papilionidae	C
2	Common jay	*Graphium doson (C. and R. Felder)*	Papilionidae	C
3	Tailed jay	*Graphium agamemnon (Linnaeus)*	Papilionidae	VC
4	Lime butterfly	*Papilio demoleus (Linnaeus)*	Papilionidae	C
5	Common rose	*Pachliopta aristolochiae (Fabricius)*	Papilionidae	C
6	Psyche	*Leptosia nina (Fabricius)*	Pieridae	C
7	Common grass yellow	*Eurema hecabe (Linnaeus)*	Pieridae	C
8	Eastern striped albatross	*Appias olferna (Swinhoe)*	Pieridae	C
9	Lemon emigrant	*Catopsilia pomona (Fabricius)*	Pieridae	C
10	Mottled emigrant	*Catopsilia pyranthe (Linnaeus)*	Pieridae	VC
11	Common gull	*Cepora nerissa (Fabricius)*	Pieridae	c
12	Common jezebel	*Delias eucharis*	Pieridae	C
13	Indian wanderer	*Pareronia hippia (Fabricius)*	Pieridae	C
14	Common quaker	*Neopithecops zalmora (Butler)*	Lycaenidae	C
15	Dark grass blue	*Zizeeria karsandra (Moore)*	Lycaenidae	C
16	Indian lime blue	*Chilades lajus (Stoll)*	Lycaenidae	VC
17	Plains cupid	*Chilades pandava(Horsfield)*	Lycaenidae	C
18	Common pierrot	*Castalius rosimon (Fabricius)*	Lycaenidae	C
19	Apefly	*Spalgis epius(Westwood)*	Lycaenidae	VR
20	Pale grass blue	*Psuedozizeeria maha*	Lycaenidae	C
21	Falcate oakblue	*Mahathala ameria (Hewitson)*	Lycaenidae	VR
22	Yamfly	*Loxura atymnus (Stoll)*	Lycaenidae	C
23	Common silverline	*Spindasis vulcanus (Fabricius)*	Lycaenidae	VC
24	Indigo flash	*Rapala varuna (Horsfield)*	Lycaenidae	R
25	Slate flash	*Rapala manea (Hewitson)*	Lycaenidae	C
26	Common lineblue	*Prosotas nora (C. Felder)*	Lycaenidae	VC
27	Pointed ciliate blue	*Anthene lycaenina (R. Felder)*	Lycaenidae	VC
28	Silverstreak blue	*Iraota timoleon (Stoll)*	Lycaenidae	C
29	Common ciliate blue	*Anthene emolus (Godart)*	Lycaenidae	C
30	Monkey puzzle	*Rathinda amor (Fabricius)*	Lycaenidae	NR
31	Chocolate pansy	*Junonia iphita (Cramer)*	Nymphalidae	NR
32	Grey pansy	*Junonia atlites (Linnaeus)*	Nymphalidae	VC
33	Peacock pansy	*Junonia almanac (Linnaeus)*	Nymphalidae	VC
34	Lemon pansy	*Junonia lemonias (Linnaeus)*	Nymphalidae	VC
35	Common palmfly	*Elymnias hypermnestra (Linnaeus)*	Nymphalidae	VC
36	Common four-ring	*Ypthima huebneri(Kirby)*	Nymphalidae	VC
37	Common five-ring	*Ypthima baldus (Fabricius)*	Nymphalidae	C
38	Common bushbrown	*Mycalesis perseus (Fabricius)*	Nymphalidae	VC

39	Plain tiger	*Danaus chrysippus (Linnaeus)*	Nymphalidae	VC
40	Striped tiger	*Danaus genutia (Cramer)*	Nymphalidae	VC
41	Blue tiger	*Tirumala limniace (Cramer)*	Nymphalidae	C
42	Common castor	*Ariadne merione (Cramer)*	Nymphalidae	C
43	Common crow	*Euploea core (Cramer)*	Nymphalidae	VC
44	Common evening brown	*Melanitis leda (Linnaeus)*	Nymphalidae	VC
45	Dark-branded bushbrown	*Mycalesis mineus (Linnaeus)*	Nymphalidae	C
46	Common sailer	*Neptis hylas (Linnaeus)*	Nymphalidae	C
47	Chestnut-streaked sailer	*Neptis jumbah (Moore)*	Nymphalidae	VC
48	Commander	*Moduza procris (Cramer)*	Nymphalidae	C
49	Chestnut bob	*Iambrix salsala (Moore)*	Hesperiidae	VC
50	Rice swift	*Borbo cinnara (Wallace)*	Hesperiidae	C
51	Straight swift	*Parnara guttatus (Bremer & Grey)*	Hesperiidae	C
52	Small branded swift	*Pelopidas mathias (Fabricius)*	Hesperiidae	C
53	Palm dart	*Telicota colon (Fabricius)*	Hesperiidae	NR
54	Common dartlet	*Oriens gola (Moore)*	Hesperiidae	VC
55	Suffused snow flat	*Tagiades gana (Moore)*	Hesperiidae	NR
56	Common redeye	*Matapa aria (Moore)*	Hesperiidae	C
57	Common bush hopper	*Ampittia dioscorides (Fabricius)*	Hesperiidae	NR
58	Indian palm bob	*Suastus gremius (Fabricius)*	Hesperiidae	C

** VC-Very Common (>100 sightings), C-Common (50-100 sightings), NR-Not Rare (15-30 sightings), R-Rare (5-10 sightings), VR-Very Rare (1-2 sighting).

Table 3. List of butterfly host plants of Kalyani Lake Park

Sl.	Butterfly species	Plant species name	Family
1	*Papilio polytes (Linnaeus)*	*Aegle marmelos*	Rutaceae
2	*Graphium doson (C. & R. Felder)*	*Polyalthia longifolia*	Annonaceae
3	*Graphium agamemnon (Linnaeus)*	*Huberantha cerasoides*	Annonaceae
4	*Papilio demoleus (Linnaeus)*	*Ixora coccinea*	Rutaceae
5	*Pachliopta aristolochiae (Fabricius)*	*Aristolochia indica*	Aristolochiaceae
6	*Leptosia nina (Fabricius)*	*Capparis* spp.	Capparaceae
7	*Eurema hecabe(Linnaeus)*	*Acacia* spp.	Fabaceae
8	*Appias olferna (Swinhoe)*	*Cleome rutidosperma*	Cleomaceae
9	*Catopsilia pomona (Fabricius)*	*Cassia* spp.	Fabaceae
10	*Catopsilia pyranthe (Linnaeus)*	*Cassia* spp.	Fabaceae
11	*Cepora nerissa (Fabricius)*	*Cleome viscosa*	Cleomaceae
12	*Delias eucharis (Drury)*	*Scurrula* spp.	Loranthaceae
13	*Pareronia hippia (Fabricius)*	*Capparis baducca*	Capparaceae
14	*Neopithecops zalmora (Butler)*	*Glycosmis pentaphylla*	Rutaceae
15	*Zizeeria karsandra (Moore)*	*Amaranthus* spp.	Amaranthaceae

16	*Chilades lajus (Stoll)*	*Glycosmis mauritiana*	Rutaceae
17	*Chilades pandava (Horsfield)*	*Acacia* spp.	Fabaceae
18	*Castalius rosimon (Fabricius)*	*Ziziphus* spp.	Rhamnaceae
19	*Spalgis epius (Westwood)*	*Mangifera indica*	Anacardiaceae
20	*Psuedozizeeria maha*	*Oxalis corniculata*	Oxalidaceae
21	*Mahathala ameria (Hewitson)*	*Terminalia* spp.	ombretaceae
22	*Loxura atymnus (Stoll)*	*Dioscorea* spp.	Dioscoreaceae
23	*Spindasis vulcanus (Fabricius)*	*Allophylus cobbe*	Sapindaceae
24	*Rapala varuna (Horsfield)*	*Zizyphus rugosa*	Rhamnaceae
25	*Rapala manea (Hewitson)*	*Camellia* spp.	Theaceae
26	*Prosotas nora (C. Felder)*	*Acacia* spp.	Fabaceae
27	*Anthene lycaenina (R. Felder)*	*Acacia* spp.	Fabaceae
28	*Iraota timoleon (Stoll)*	*Punica* spp.	Lythraceae
29	*Anthene emolus (Godart)*	*Mangifera indica*	Anacardiaceae
30	*Rathinda amor (Fabricius)*	*Ixora* spp.	Rutaceae
31	*Junonia iphita (Cramer)*	*Justicia neesii*	Acanthaceae-
32	*Junonia atlites (Linnaeus)*	*Sida rhombifolia*	Malvaceae
33	*Junonia almana (Linnaeus)*	*Sida rhombifolia*	Malvaceae
34	*Junonia lemonias (Linnaeus)*	*Sida rhombifolia*	Malvaceae
35	*Elymnias hypermnestra (Linnaeus)*	*Areca catechu*	Arecaceae
36	*Ypthima huebneri (Kirby)*	*Cynodon dactylon*	Poaceae
37	*Ypthima baldus (Fabricius)*	*Axonopus* spp.	Poaceae
38	*Mycalesis perseus (Fabricius)*	*Oplismenus compositus*	Poaceae
39	*Danaus chrysippus (Linnaeus)*	*Calotropis gigantea*	Apocynaceae
40	*Danaus genutia (Cramer)*	*Asclepias curasavica*	Apocynaceae
41	*Tirumala limniace (Cramer)*	*Asclepias* spp.	Apocynaceae
42	*Ariadne merione (Cramer)*	*Tragia involucrata*	Euphorbiaceae
43	*Euploea core (Cramer)*	*Ficus* spp.	Moraceae
44	*Melanitis leda (Linnaeus)*	*Brachiaria mutica*	Poaceae
45	*Mycalesis mineus (Linnaeus)*	*Setaria barbata*	Poaceae
46	*Neptis hylas (Linnaeus)*	*Canavalia* spp.	Fabaceae
47	*Neptis jumbah (Moore)*	*Ziziphus* spp.	Rhamnaceae
48	*Moduza procris (Cramer)*	*Mussaenda frondosa*	Rubiaceae
49	*Iambrix salsala (Moore)*	*Bambusa* spp.	Poaceae
50	*Borbo cinnara (Wallace)*	*Setaria pumila*	Poaceae
51	*Parnara guttatus (Bremer and Grey)*	*Axonopus* spp.	Poaceae
52	*Pelopidas mathias (Fabricius)*	*Axonopus* spp.	Poaceae
53	*Telicota colon (Fabricius)*	*Coccos nucifera*	Palmae
54	*Oriens gola (Moore)*	*Axonopus* spp.	Poaceae
55	*Tagiades gana (Moore)*	*Dioscorea* spp.	Dioscoreaceae
56	*Matapa aria (Moore)*	*Bambusa* spp.	Poaceae
57	*Ampittia dioscorides (Fabricius)*	*Leersia hexandra*	Poaceae
58	*Suastus gremius (Fabricius)*	*Calamus* spp.	Arecaceae

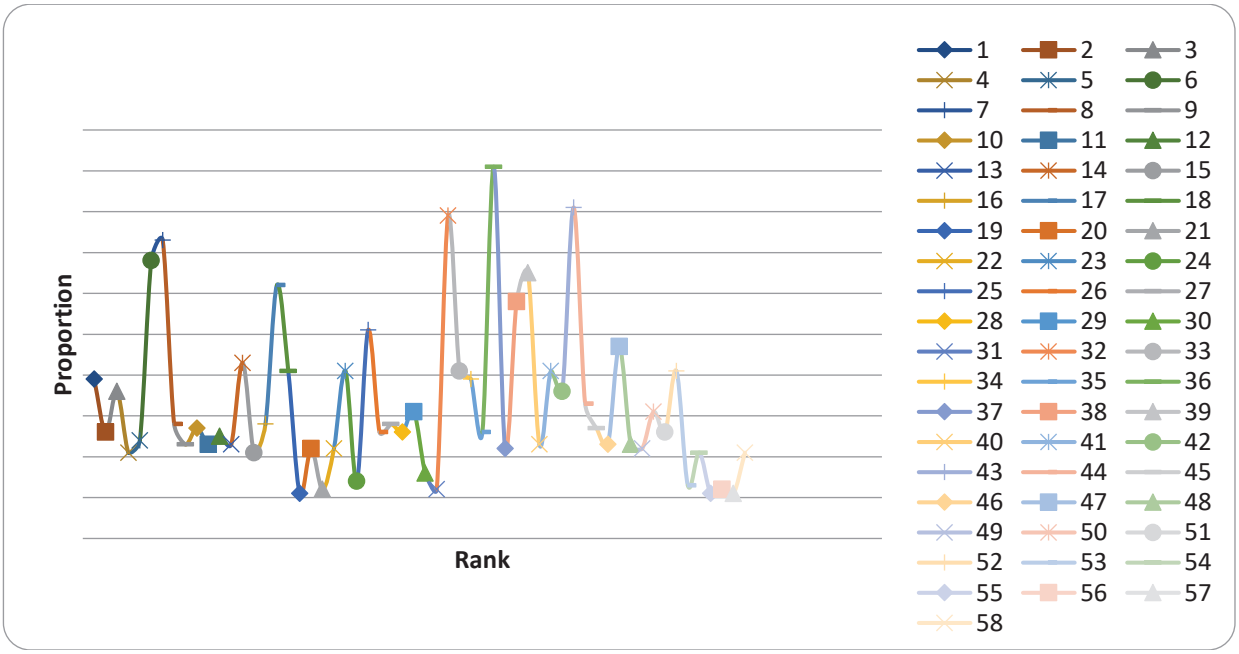

Fig. 4. Rank-abundance of butterfly species community in Kalyani Lake Park

Studies on butterfly species diversity gives us information about the species richness of that study area, we will learn about the vegetations of that landscape mainly about the adult nectar plants and host larval plants (Harrington and Stork, 1995; Tam and Bonebrake, 2016). The rich number of butterflies specially Nymphalids indicates floral diversity of this study area. The study area having large number of herbs, shrubs and trees seems to be a tropical climate plant species belonging to families such as Rutaceae, Annonaceae, Aristolochiaceae, Capparaceae, Fabaceae, Cleomaceae, Loranthaceae, Amaranthaceae, Rhamnaceae etc are found in the study area. Namely, the species are *Aegle marmelos, Polyalthia longifolia, Huberantha cerasoides, Ixora coccinea, Aristolochia indica, Capparis* spp., *Acacia* spp., *Cleome viscosa, Cassia* spp., *Cleome viscosa, Scurrula* spp., *Capparis baducca, Glycomis pentaphylla, Amaranthus* spp., *Glycosmis mauritiana, Acacia* spp., *Ziziphus* spp., *Mussaenda frondosa, Mangifera indica, Oxalis corniculata, Dioscorea* spp., *Allophylus cobbe, Zizyphus rugosa, Punica* spp., *Bambusa* spp., *Calotropis gigantea , Coccos nucifera, Ficus* spp., *Sida* spp., and *Lantana camara.* This kind of rich vegetation provides appropriate feeding and breeding place of butterfly species (Kaneria et al., 2013; Mohapatra et al., 2013; Dasgupta and Rao, 2014).

Along with seasonal and climatic changes butterfly species variety also varies (Thomas et al., 2004). March- April and October are the peak seasons for butterfly species abundance in India identified by Wynter-Blyth (1957). Butterfly abundance can be affected by Excess heat, humidity, rainfall etc. Our present study was done in the month of July to December, the monsoon and post monsoon (Tiple and Khurad, 2009).

From our present study highest number of butterfly species found from family Nymphalidae 18 species (31%) followed by Lycaenidae 17 species (29%), Hesperiidae 10 species (17%), Pieridae 8 species (14%), Papilionidae 5 species (9 %), (Table 1, Fig. 2). From the Nymphaladae family the butterfly species found in this study are *Junonia iphita, Junonia atlites, Junonia almana, Junonia lemonias, Elymnias hypermnestra, Ypthima huebneri, Ypthima baldus, Mycalesis perseus, Danaus chrysippus, Danaus genutia, Tirumala limniace, Ariadne merione, Euploea core, Melanitis leda, Mycalesis mineus, Neptis hylas, Moduza procris, Neptis jumbah;* from the family Lycaenidae. Butterfly species found in this recent study are *Neopithecops*

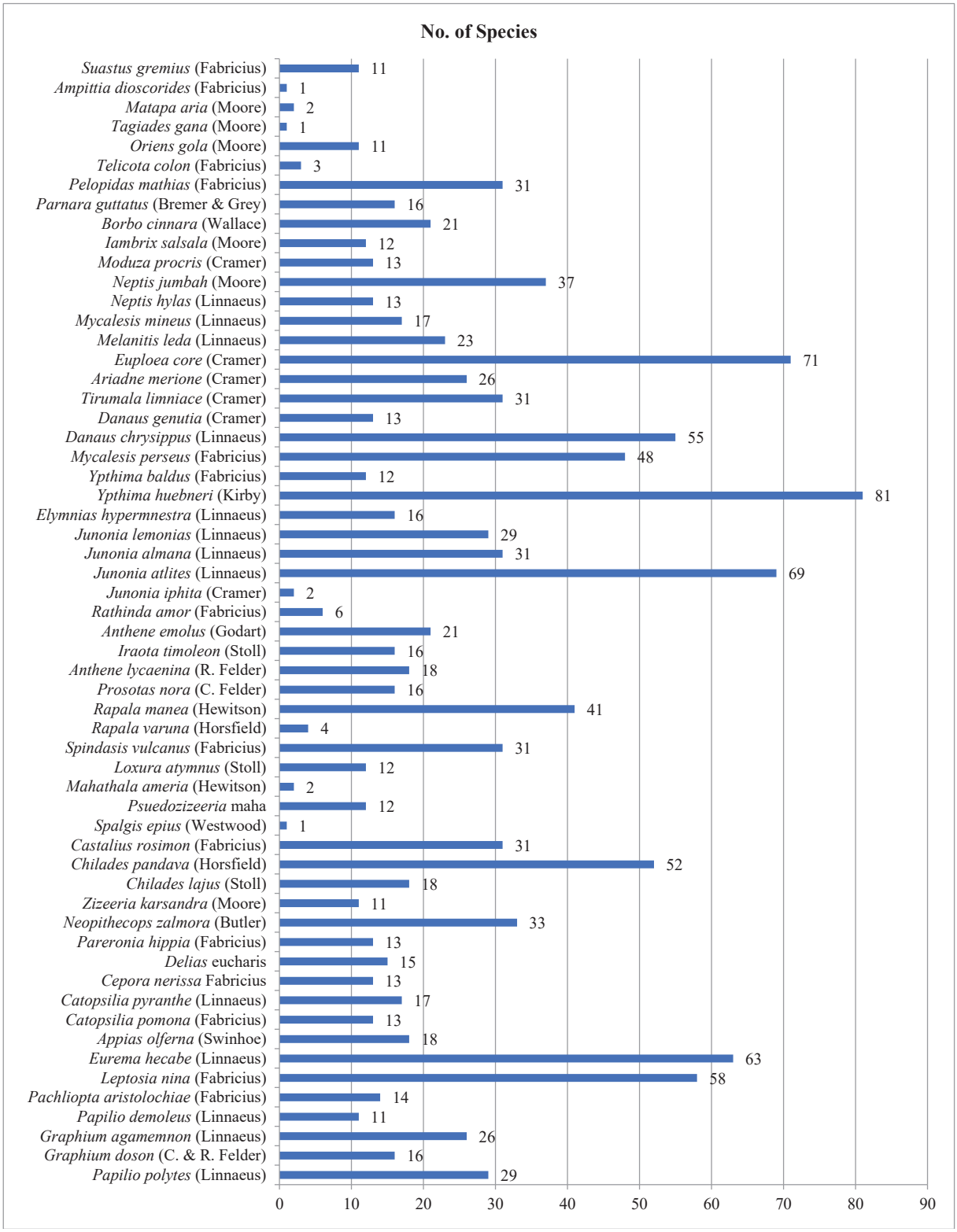

Fig. 5. Distribution of butterfly species at Kalyani Lake Park

zalmora, Zizeeria karsandra, Chilades lajus, Chilades pandava, Castalius rosimon, Spalgis epius, Psuedozizeeria maha, Mahathala ameria, Loxura atymnus, Spindasis vulcanus, Rapala varuna, Rapala manea, Prosotas nora, Anthene lycaenina, Iraota timoleon, Anthene emolus, Rathinda amor; from the family Papilionidae butterfly species that found in this recent study are *Papilio polytes, Graphium doson, Graphium agamemnon, Papilio demoleus, Pachliopta aristolochiae;* from the family Pieridae butterfly species that found in this recent study are *Leptosia nina, Eurema hecabe, Appias olferna, Catopsilia pomona, Catopsilia pyranthe, Delias eucharis, Cepora nerissa, Pareronia hippia;* from the family Hesperiidae butterfly species found in this recent study are *Iambrix salsala, Borbo cinnara, Parnara guttatus, Pelopidas mathias, Telicota colon, Oriens gola, Tagiades gana, Matapa aria, Ampittia dioscorides, Suastus gremius* (Table 2).

Status abundance of butterflies from this study recognized are very common 19 species (33%), common 31 species (53%), not rare 5 species (9%), rare 1 species (2%), very rare 2 species (3%). For the common, very common and not rare species the environment, food supply, breeding places of Study area is mostly friendly (Fig. 4). More than 48 species of butterfly recognized in dominant highest numbers in this study area. The most dominant butterfly species of this study area are *Ypthima huebneri, Euploea core, Junonia iphita, Eurema hecabe, Leptosia nina, Danaus chrysippus, Chilades pandava, Mycalesis perseus, Rapala manea etc.* (Fig. 5). From the present study, one butterfly species designated as rare species in this study area i.e., Indigo Flash *(Rapala varuna)* from the family Lycaenidae and two butterfly species are designated as Very rare; Apefly (*Spalgis epius*) from the family Lycaenidae, Falcate Oak blue *(Mahathala ameria)* from the family Lycaenidae.

CONCLUSION

The present findings of this study show us that Kalyani Lake Park is a resourceful habitat for butterfly species. Moreover, parks are one of the very appropriate place for butterfly species conservation. If proper management taken, a few steps to keep clean the park, implant some saplings routinely diversity of butterfly species may increase. This study also helps to understand the importance of butterfly species in nature and as well as the symbiotic relation between butterfly species and plants. Butterfly species are important to maintain the food web which is an essential component of ecosystem. It also acts as a bio indicator. Now a days, increased urbanization, improper garbage disposition, severe pollution, deforestations etc. seriously affect the butterfly populations. Now, at least to maintain the present levels of butterfly diversity, more saplings need to be planted, urban places be cleaned, parks hygiene and management may be taken care of to conserve a healthy ecosystem at this region.

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