International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 04-08-2023, Accepted: 20-08-2023, Published: 06-09-2023
Volume 8, Issue 9, 2023, Page No. 1-10

Urban butterflies (Rhopalocera) of Golaghat district, Assam, India

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Abstract
Butterflies are one of the most diverse sensitive groups of insects, key indicators of the health of an ecosystem, and play a crucial role in ecosystem functioning. Urbanization is one of the principal causes of the degradation of natural ecosystems and habitat fragmentation responsible for the decline in species diversity to a huge extent. Butterflies are considered the most affected group by urbanization, which leads to a significant reduction in population in urban areas. Butterfly populations should be monitored and updated periodically to document species diversity and distribution patterns in a specific area, which could provide insight into the present statuses of the recorded species that may facilitate further research for their conservation. The present study was undertaken to explore the diversity, and seasonal variation of butterflies available in the urban area of Golaghat district aiming to document the number of butterflies along with their conservation status. In this study, a total of 127 species, 1233 individuals, representing six families (Papilionidae, Pieridae, Lycaenidae, Riodinidae, Nymphalidae, and Hesperiidae) and 88 genera were recorded from the study area. Family-wise distribution of butterfly diversity in the study area showed dominance of Nymphalidae which accounted for maximum species richness. To our knowledge, it is the first attempt to record the urban butterfly diversity of Golaghat district.

Keywords: Lepidoptera, butterfly diversity, urban diversity, conservation, IUCN status, seasonal abundance

Introduction

Butterflies are one of the most diverse, sensitive groups of insects, key indicators of the health of an ecosystem, and play a crucial role in ecosystem functioning (Gilbert & Singer, 1975; Kunte, 1997) [7, 16]. Among insects, butterflies are the most attractive creatures and an important element of the food chain. They belong to the order Lepidoptera, (Lepidos means "scales" and Ptera means "wings") sub-order Rhopalocera, considered the best taxonomically studied groups of Arthropods (Gilbert & Singer, 1975; Kristensen *et al*., 2007; Regier *et al*., 2009) [7, 15, 24]. The order Lepidoptera comprises Butterflies and Moths of which nearly 17,820 species are Butterflies (Kristensen *et al*., 2007; Shields, 1989) [15, 26]. Since the early 18th century, butterfly diversity has been studied systematically and to date around 20,000 species have been identified worldwide (Heppner, 1998). Diversity studies of butterflies are the important for the butterfly ecology with major conservation implications (Bora and Meitei, 2014) [3]. This figure is not constant due to the ongoing discovery of new butterfly species and controversies surrounding the correct identification of a few species. They are diurnal insects and are considered important pollinating agents after bees (Rija, 2022) [25]. Butterflies are very sensitive to any minute environmental changes resulting as a consequence of urbanization, industrialization, loss of forest areas etc (Forister *et al*., 2010; Gilbert & Singer, 1975) [6, 7]. Butterflies are considered as good bioindicators of the environment. They have a very short life cycle and have different habitat requirements and food preferences for mating, breeding and nectaring (Subedi *et al*., 2021; Tiple *et al*., 2006) [29, 32]. During the larval stages, they rely on specific plant resources and thus they are more affected by increasing anthropogenic pressures than other species (Bibi *et al*., 2022; Herrmann *et al*., 2023; Menéndez *et al*., 2007) [2, 11, 18].

India ranks among 17 mega biodiversity countries in the world and home to almost 1,501 species of butterflies (Kunte, 1997) [16]. Northeast India is one of the major hotspots for biodiversity, which can be differentiated into the Northeast hills, Eastern Himalayas and the Brahmaputra Valley (Gogoi, 2015; Joshi & Dhyani, 2014) [8, 13]. The complex biogeography of this region with unique tectonic and climatic conditions makes the area abundantly rich in diverse flora and fauna (Joshi & Dhyani, 2014) [13]. However, due to a dearth of adequate studies, butterfly diversity in the Northeastern region of India is not accurately recorded to date. It is evident from the literature that new species and new records of butterfly sightings are constantly being added to the list of butterflies in northeastern India. Pertin *et al*., (2020) [22] reported *Rohana tonkiniana* from Arunachal Pradesh, India. Very recently, Thapa and Bhuyan (2023) [31] recorded Blue Glassy Tiger (*Ideopsois similis*) in Assam, India for the first time.

Assam, being a unit of the Eastern Himalayan Region, with diverse climatic conditions, topological variation and ecological habitats such as forests, grasslands and forests, harbours a rich diversity of butterflies, around 962 species representing five families have been recorded from Assam to date, of which 69 species belongs to Papilionidae, 269 Lycaenidae, 356 Nymphalidae, 57 Pieridae and 211 species from the family Hesperiidae (Bortamuly & Dey, 2022; Gogoi, 2015; Joshi & Dhyani, 2014; Mudai *et al*., 2015) [4, 8, 13, 19]. Although many major taxonomic and natural history works on butterflies have been reported from Assam, Arunachal Pradesh, Manipur, Sikkim, Naga Hills and Burma, maximum areas have remained practically unexplored (Bhutia & Sharma, 2020.; Irungbam *et al*., 2020; Singh, 2015; Sondhi & Kunte, 2016) [1, 12, 27, 28].

Global changes in the environment, for instance loss of forest areas, agricultural contamination and climate change are exerting a strong pressure on biodiversity, creating

significant changes in distribution patterns, as well as community composition (Kristensen *et al*., 2007; Rija, 2022; Subedi *et al*., 2021; Wilson *et al*., 2004) [15, 25, 29, 34]. Urbanization is a major cause of the degradation of natural ecosystems and habitat fragmentation responsible for massive reduction species diversity to a huge extent. Insects are considered as most affected groups by urbanization, which leads to a significant reduction in population in urban areas (Forister *et al*., 2010; Kuussaari *et al*., 2021; Menéndez *et al*., 2007) [6, 17, 18]. Habitat destruction and urbanization are the biggest threats to the survival of insects (Kuussaari *et al*., 2021; Tzortzakaki *et al*., 2019) [17, 33]. The diversity of butterfly species is directly affected by the rapid growth in human populations' worldwide, intense use of fertilizers and pesticides, rapidly growing industries, nitrogen emissions from industrial sources as well as habitat destruction. (Forister *et al*., 2010; Menéndez *et al*., 2007) [6, 18]. The butterflies are specific in habitat selection and season-specific (Menéndez *et al*., 2007; Nimbalkar *et al*., 2011) [18, 21]. They are the best bioindicators, sudden decrease in population of which indicates the undesirable activities and disturbances in the environment resulting from urbanization (Kocher and Williams, 2000; Thomas *et al*., 1998). The study of biological indicators help us to understand biodiversity and most of the studies of butterfly biodiversity are from forest ecosystem (Mukherjee *et al*., 2015) [20]. °C

The Golaghat District of Upper Assam is a key area for biodiversity conservation in the world. Despite its species richness, no proper documentation of butterfly diversity covering the overall area has been undertaken to date. The present study was undertaken to explore the diversity, and seasonal variation of butterflies available in the urban area of Golaghat district aiming to document the number of butterflies along with their conservation status. To our knowledge, it is the first attempt to record the urban butterfly diversity of Golaghat district.

Materials and Methods

Study area: This study was conducted in the urban area of Golaghat district of upper Assam. The district is bordered by the Brahmaputra River to the north, Nagaland to the south, Karbi Anglong and Nagaon districts to the west and Jorhat to the east, covering an area of 3,502 square kilometres (Bortamuly & Dey, 2022; Gogoi, 2015) [4, 8]. The climate is tropical, with the majority of summer and monsoon months characterized by warm and humid weather. The average yearly rainfall is 1300 mm and the highest precipitation occurs in the months of June and July. The average minimum and maximum temperatures in June and December are 8 ℃ and 38 ℃, respectively. In the last few years, Golaghat has experienced an intense urbanization process.

Study period: In order to evaluate the diversity of butterfly species, this study was carried out for 18 months between January 2022 and July 2023. The area was fully explored in the morning hours and afternoon hours, depending on the weather conditions, twice a month in the four seasons, i.e. premonsoon (March to May), monsoon (June to September), postmonsoon (October to November), and winter (December to February). Therefore, a total of 36 samples have been collected during the study period by conducting two samplings per month.

Sample Collection: An extensive field study was carried out in the selected study site using the Pollard Walk Method (Pollard and Yates, 1993;) [23]. For collection of data, the study area was divided into transects and each transect was walked slowly in the morning and afternoon hours avoiding rainy and windy days to record the maximum number of butterfly species. Photographic evidences were recorded using a mobile and a Nikon DSLR camera. The data for each species encountered during the survey was recorded in the field data sheet including date, time, habitat and locality. The collection of live specimens was avoided in this study.

Identification and categorization: Species identification was done based on their behavioural and morphological characteristics by direct observation and photographs following suitable keys of Evans 1932 [5]; Talbot, 1939; Wynter-Blyth 1957; Haribal 1992; and Kehimkar 2008 [10, 14, 30, 35].

Data Analysis

The data on the number of recorded butterflies have been summarized. Microsoft Excel (version 2016) has been used for simple descriptive analysis and graphical presentation of data.

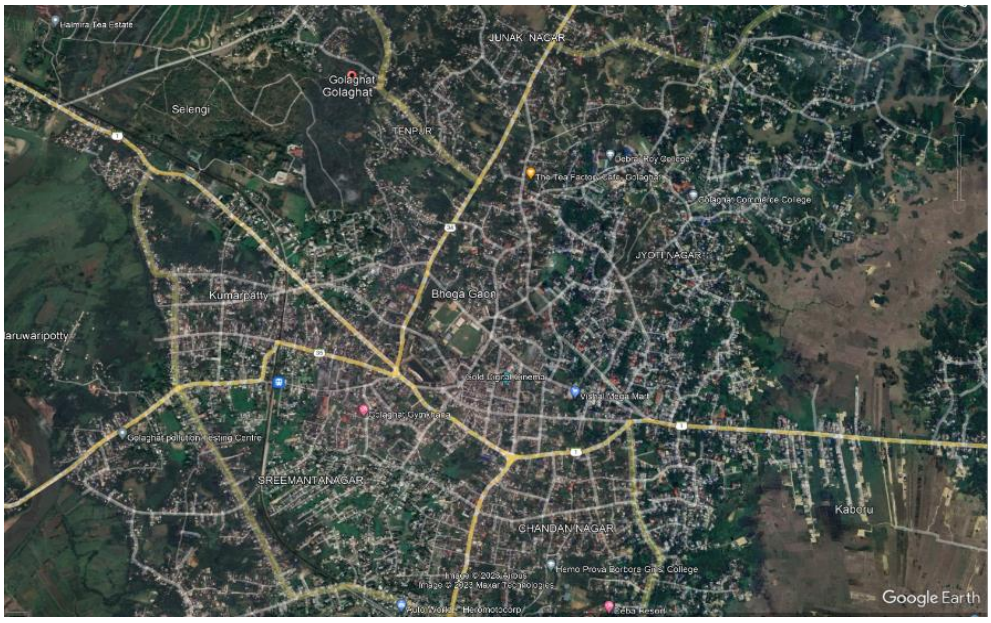

Fig 1: Map showing the study area

Results

In this study, a total of 127 species of butterflies, 1233 individuals, representing six families (Papilionidae, Pieridae, Lycaenidae, Riodinidae, Nymphalidae, and Hesperiidae) and 88 genera were recorded from the study area (Table 1). The photographs of some of the observed butterflies are given in Plate I-IV. Family-wise distribution of butterfly diversity in the study area showed the dominance of Nymphalidae which accounted for maximum species richness, comprising 46 species (46 species, 36%) followed by Lycaenidae (29 species, 23%) and Hesperiidae (24 species, 19%) (Figure 2). Important sightings include *Papilio clytia clytia, Castalius rosimon rosimon, Acytolepis puspa, Discophora sondaica zal, Elymnias malelas, Lethe europa niladana, Phaedyma columella ophiana* legally protected under Schedule I; *Eurema andersonii jordani, Appias lyncida, Delias pasithoe, Prosotas dubiosa indica, Lampides boeticus, Euploea mulciber mulciber, Euthalia aconthea garudas, Lexias dirtea khasiana, Tanaecia lepidea lepidea, Bibasis sena* protected under Schedule II; *Euploea core core, Baoris farri farri* protected under Schedule IV according to Indian Wildlife Protection Act, 1972. The study also revealed a record of the highest number of species (115 species) in the monsoon period (June-September) followed by pre-monsoon (March-May) (103 species). A total of 80 species were observed during post-monsoon (October-November) and the least number of species (53 species) were observed during the winter season (December-February) (Figure-3).

Table 1: Annotated list of Butterflies recorded from the urban area of Golaghat District of Assam.

Sl. No.	Common Name	Scientific Name	IUCN	WPA, 1972	Endemism to NE India
Family: Papilionidae					
01	Common Jay	*Graphium doson axion*			
02	Tailed Jay	*Graphium agamemnon Agamemnon*			
03	Common Bluebottle	*Graphium sarpedon sarpedon*			
04	Five-bar Swordtail	*Graphium antiphates pompilius*			
05	Common Rose	*Pachliopta aristolochiae aristolochiae*			
06	Common Birdwing	*Troides helena Cerberus*	LC		
07	Common Mime	*Papilio clytia clytia*		Schedule I	
08	Common Mormon	*Papilio polytes*			
09	Great Mormon	*Papilio memnon agenor*			
10	Red Helen	*Papilio helenus Helenus*			
11	Yellow Helen	*Papilio nephelus chaon*			Endemic
12	Lime Butterfly	*Papilio demoleus demoleus*			
13	Common Peacock	*Papilio bianor*			
14	Paris Peacock	*Papilio paris*			
Family: Pieridae					
15	One-Spot Grass Yellow	*Eurema andersonii jordani*	LC	Schedule II	
16	Common Grass Yellow	*Eurema hecabe hecabe*			
17	Three-Spot Grass Yellow	*Eurema blanda*			
18	Common Emigrant	*Catopsilia Pomona*			
19	Mottled Emigrant	*Catopsilia pyranthe*			
20	Great Orange Tip	*Hebomoia glaucippe*			
21	Yellow Orange Tip	*Ixias pyrene familiaris*			
22	Eastern Striped Albatross	*Appias olferna*			Endemic
23	Chocolate Albatross	*Appias lyncida*		Schedule II	
24	Indian Cabbage White	*Pieris canidia*			
25	Red-Based Jezebel	*Delias pasithoe*		Schedule II	
26	Red- Spot Jezebel	*Delias descombesi descombesi*			Endemic
27	Psyche	*Leptosia nina*			
Family: Lycaenidae					
28	Angled Sunbeam	*Curetis acuta*			
29	Apefly	*Spalgis epeus epeus*			
30	Common Ciliate Blue	*Anthene emolus emolus*			
31	Common Lineblue	*Prosotas nora*			
32	Tailless Lineblue	*Prosotas dubiosa indica*		Schedule II	
33	Angled Pierrot	*Caleta decidia*	LC		
34	Common Pierrot	*Castalius rosimon rosimon*		Schedule I	
35	Striped Pierrot	*Tarucus spp.*			
36	Common Cerulean	*Jamides celeno aelianus*			
37	Dark Cerulean	*Jamides bochus bochus*			
38	Forget-me-Not	*Catochrysops strabo Strabo*			
39	Pea Blue	*Lampides boeticus*		Schedule II	
40	Lime Blue	*Chilades lajus*			
41	Plains Cupid	*Chilades pandava pandava*			
42	Zebra Blue	*Leptotes plinius*			
43	Pale Grass Blue	*Pseudozizeeria maha*			
44	Lesser Grass Blue	*Zizina otis*			
45	Dark Grass Blue	*Zizeeria karsandra*			

46	Common Quaker	*Neopithecops zalmora zalmora*			
47	Common Hedge Blue	*Acytolepis puspa*		Schedule I	
48	Purple Sapphire	*Heliophorus epicles*			
49	Centaur Oakblue	*Arhopala centaurus pirithous*			
50	Common Tit	*Hypolycaena erylus himavantus*			
51	Fluffy Tit	*Zeltus amasa*			
52	Yamfly	*Loxura atymnus continentalis*			
53	Common Imperial	*Cheritra freja evansi*	LC		
54	Red Flash	*Rapala iarbus airbus*			Endemic
55	Copper Flash	*Rapala pheretima petosiris*			
56	Slate Flash	*Rapala manea*			
Family: Riodinidae					
57	Punchinello	*Zemeros flegyas*			
Family: Nymphalidae					
58	Glassy Tiger	*Parantica aglea melaniodes*			
59	Blue Tiger	*Tirumala limniace*			
60	Plain Tiger	*Danaus chrysippus chrysippus*			
61	Striped Tiger	*Danaus genutia genutia*			
62	Striped Blue Crow	*Euploea mulciber mulciber*		Schedule IV	
63	Blue King Crow	*Euploea klugii klugii*			
64	Common Crow	*Euploea core core*		Schedule IV	
65	Common Nawab	*Polyura athamas athamas*			
66	Tawny Rajah	*Charaxes bernardus*			
67	Common Duffer	*Discophora sondaica zal*		Schedule I	Endemic
68	Common Palmfly	*Elymnias hypermnestra*			
69	Spotted Palmfly	*Elymnias malelas*		Schedule I	
70	Tiger Palmfly	*Elymnias nesaea*			Endemic
71	Common Evening Brown	*Melanitis leda leda*			
72	Dark Evening Brown	*Melanitis phedima*			
73	Bamboo Treebrown	*Lethe europa niladana*		Schedule I	
74	Angled Red Forester	*Lethe chandica*			
75	Dark-Brand Bushbrown	*Mycalesis mineus*			
76	Long-Brand Bushbrown	*Mycalesis visala*			
77	Nigger	*Orsotriaena medus*			
78	Common Four-Ring	*Ypthima huebneri*			
79	Common Five-Ring	*Ypthima baldus*			
80	Tawny Coster	*Acraea terpsicore*			
81	Leopard Lacewing	*Cethosia cyane*			
82	Cruiser	*Vindula erota*			
83	Large Yeoman	*Cirrochroa aoris aoris*			
84	Commander	*Moduza procris*			
85	Common Sergeant	*Athyma perius*			
86	Colour Sergeant	*Athyma inara*			
87	Knight	*Lebadea martha*			
88	Common Lascar	*Pantoporia hordonia hordonia*			
89	Common Sailer	*Neptis hylas*			
90	Short-Banded Sailer	*Phaedyma columella ophiana*		Schedule I	
91	Indian Red Admiral	*Vannesa indica*			
92	Common Baron	*Euthalia aconthea garudas*		Schedule II	
93	Dark Archduke	*Lexias dirtea khasiana*		Schedule II	Endemic
94	Grey Count	*Tanaecia lepidea lepidea*		Schedule II	
95	Common Maplet	*Chersonesia risa risa*			
96	Common Castor	*Ariadne merione*			
97	Common Jester	*Hestinalis lilaea khasiana*			
98	Grey Pansy	*Junonia atlites*			
99	Chocolate Pansy	*Junonia iphita*			
100	Peacock Pansy	*Junonia almana*	LC		
101	Lemon Pansy	*Junonia lemonias*			
102	Yellow Pansy	*Junonia hierta*	LC		
103	Great Eggfly	*Hypolimnas bolina jacintha*			
Family: Hesperiidae					
104	Branded Orange Awlet	*Burara oedipodea belesis*			
105	Orange Tail Awl	*Bibasis sena*		Schedule II	
106	Common Banded Awl	*Hasora chromus*			
107	Common Snow Flat	*Tagiades japetus ravi*			
108	Suffused Snow Flat	*Tagiades gana athos*			
109	Water Snow Flat	*Tagiades litigiosa litigiosa*			
110	Common Spotted Flat	*Celaenorrhinus leucocera*			

111	Fulvous Pied Flat	*Pseudocoladenia dan*			
112	Common Small Flat	*Sarangesa dasahara dasahara*			
113	Bush Hopper	*Ampittia dioscorides dioscorides*			
114	Moore's Banded Ace	*Halpe porus*			
115	Indian Palm Bob	*Suastus gremius gremius*			
116	Chestnut Bob	*Lambrix salsala salsala*			
117	Coon	*Psolos fuligo subfasciatus*			Endemic
118	Restricted Demon	*Notocrypta curvifascia*			
119	Chocolate Demon	*Ancistroides nigrita diocles*			
120	Grass Demon	*Udaspes folus*			
121	Giant Redeye	*Gangara thyrsis*			
122	Common Redeye	*Matapa aria*			
123	Obscure Banded Swift	*Pelopidas agna*			
124	Small Paintbrush Swift	*Baoris chapmani*			Endemic
125	Paintbrush Swift	*Baoris farri farri*		Schedule IV	
126	Common Dartlet	*Oriens gola*			
127	Indian Dartlet	*Oriens goloides*			

*LC-Least concerned

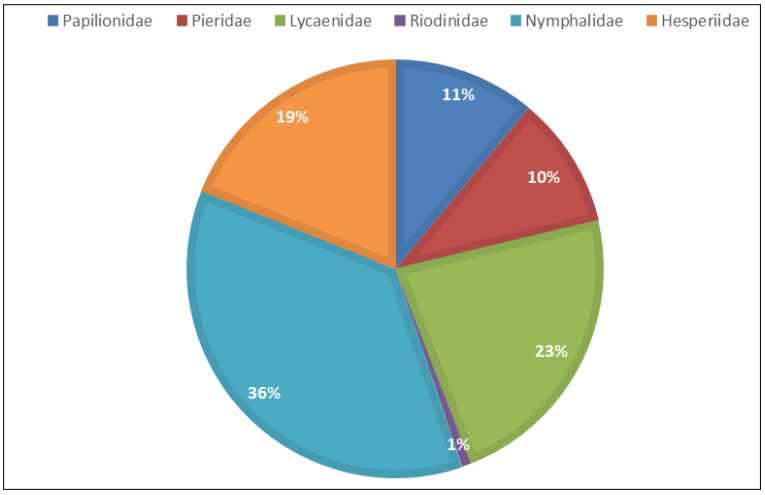

Fig 2: Family-wise dominance of butterfly diversity recorded in the study area

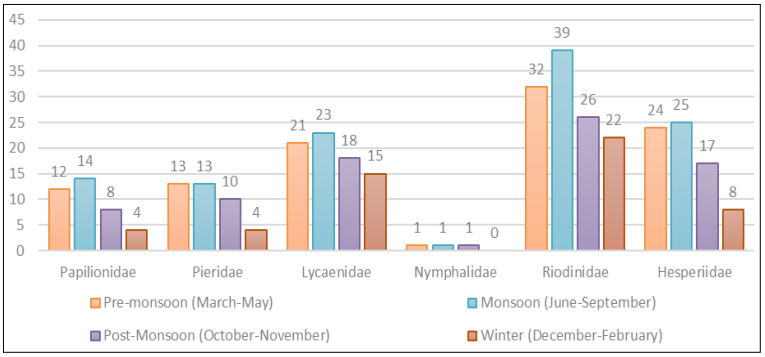

Fig 3: Season-wise record of butterfly species from different families

Discussion

The current study is the first detailed work on urban butterfly diversity recorded from the urban area of Golaghat district, Assam. Apart from the butterfly species protected under the wildlife protection act, of 1972, nine butterfly species *Papilio nephelus chaon, Appias olferna, Delias descombesi descombesi, Rapala iarbus airbus, Discophora sondaica zal, Elymnias nesaea, Lexias dirtea khasiana, Psolos fuligo subfasciatus,* and *Baoris chapmani* were recorded which are restricted to Eastern Himalayan region. *Graphium doson axion, Graphium sarpedon sarpedon, Troides helena Cerberus, Papilio polytes* and *Papilio clytia clytia,* from papillionidae family; *Eurema hecabe hecabe, Catopsilia pomona, Pieris canidia, Hebomoia glaucippe* and *Leptosia nina* belongs to the family Pieridae are commonly available in all the seasons. Out of 46 species of the Nymphalidae family, only 22 species were recorded in all the seasons, and 39 species were recorded in the monsoon period alone. Abundance of *Euploea core core, Polyura athamas athamas, Discophora sondaica zal, Elymnias hypermnestra, Melanitis leda leda, Tirumala limniace, Ypthima huebneri, Athyma perius, Lebadea Martha, Pantoporia hordonia hordonia, Neptis hylas, Euthalia aconthea garudas, Chersonesia risa risa, Ariadne merione, Hestinalis lilaea khasiana, Vannesa indica, Charaxes bernardus, Lethe chandica, Lethe europa niladana, Cethosia cyane Elymnias malelas* and *Cirrochroa aoris aoris* of Nymphalidae family was highest in the urban

area. On the other hand, 15 species representing the family Lycaenidae: *Anthene emolus emolus, Prosotas nora, Castalius rosimon rosimon, Jamides celeno aelianus, Tarucus spp, Zizina Otis, Neopithecops zalmora zalmora, Acytolepis puspa, Heliophorus epicles, Hypolycaena erylus himavantus, Cheritra freja evansi, Spalgis epeus epeus, Catochrysops strabo Strabo, Zizeeria karsandra* and *Curetis acuta* were observed commonly in the study area in all the seasons. *Zemeros flegyas*, the only butterfly representing Riodinidae family is a very commonly available butterfly recorded in all the seasons except in the winter. 19 species, protected under the Wildlife Protection Act, 1972 were also recorded in this study.

The butterfly diversity of the Golaghat district is mostly unexplored. Mudai *et al*., (2015) [19], reported a total of 224 species belonging to five families and 137 genera from Nambor-Doigrung wildlife sanctuary, located around 26 km away from the urban area. A total of 84 species were recorded from the family Nymphalidae followed by 62 species from the Lycaenidae family, the dominance of which is similar to this study. Gogoi, (2015) [8], studied lycaenid butterflies from the Panbari reserve forest of Kaziranga and recorded a total of 116 taxa from the region (Gogoi, 2015) [8]. Another study was conducted by Bortamuly and Dey, (2022) [4] in the Bongal Gaon of Golaghat district, and recorded 171 species of butterflies belonging to 105 genera representing six families with sightings of 'rare' and 'very rare' Moth Butterfly, *Liphyra brassolis* (Westwood, 1864), the Veined Palmer, *Hidari bhawani* (de Nicéville, 1889) butterflies, which is very high compared to the present study, indicating the effect of urbanization, habitat loss and low availability of host plants in the urban area (Bortamuly & Dey, 2022) [4].

Butterflies are of critical importance for conserving the functioning of ecosystems, however, their diversity is threatened due to increased environmental changes, habitat destruction, urbanization etc. which will decline the lepidopteran diversity or may lead to extinction if required attention is not given (Kuussaari *et al*., 2021; Menéndez *et al*., 2007; Mukherjee *et al*., 2015) [17, 18, 20]. They are considered flagship species for the conservation of insect diversity. Any effort that targets the conservation of butterflies also saves many species in the region. The current study reports significantly high butterfly diversity in the urban area which is also rich in floral diversity that provides a suitable environment for completing the life cycles of these creatures (Forister *et al*., 2010; Tiple *et al*., 2006) [6, 32]. In addition to that, the presence of home gardens and commercial gardens may contribute to high species diversity in the study area.

Photo plate

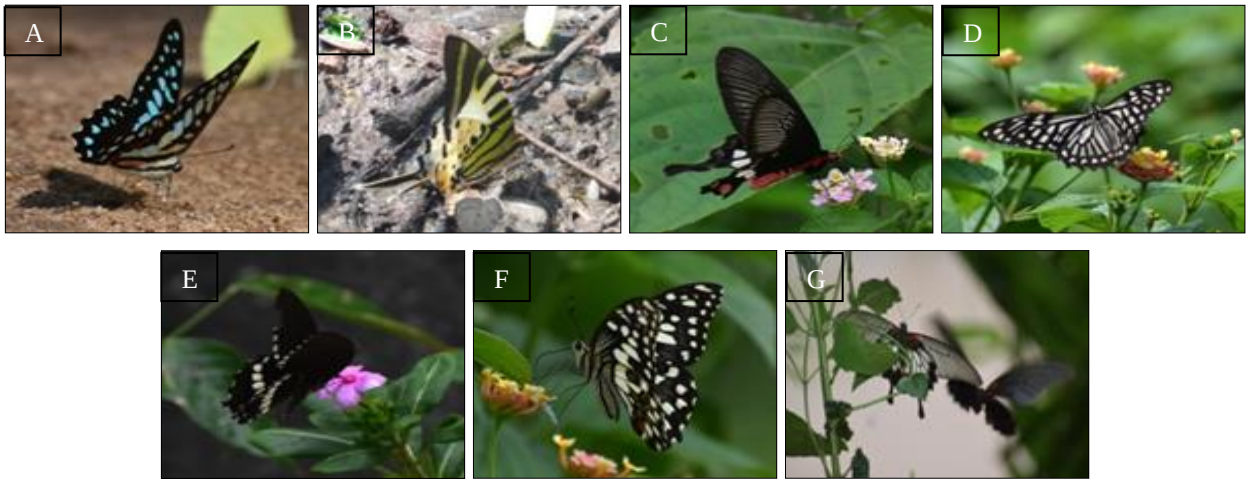

Plate Ia: Photographs shows the Papilionidae butterflies recorded in Urban Areas of Golaghat District during the study period (A: *Graphium doson*; B: *Graphium agamemnon*; C: *Pachliopta aristolochiae*; D: *Papilio clytia*; E: *Papilio polytes*; F: *Papilio demoleus*; K: *Papilio memnon*).

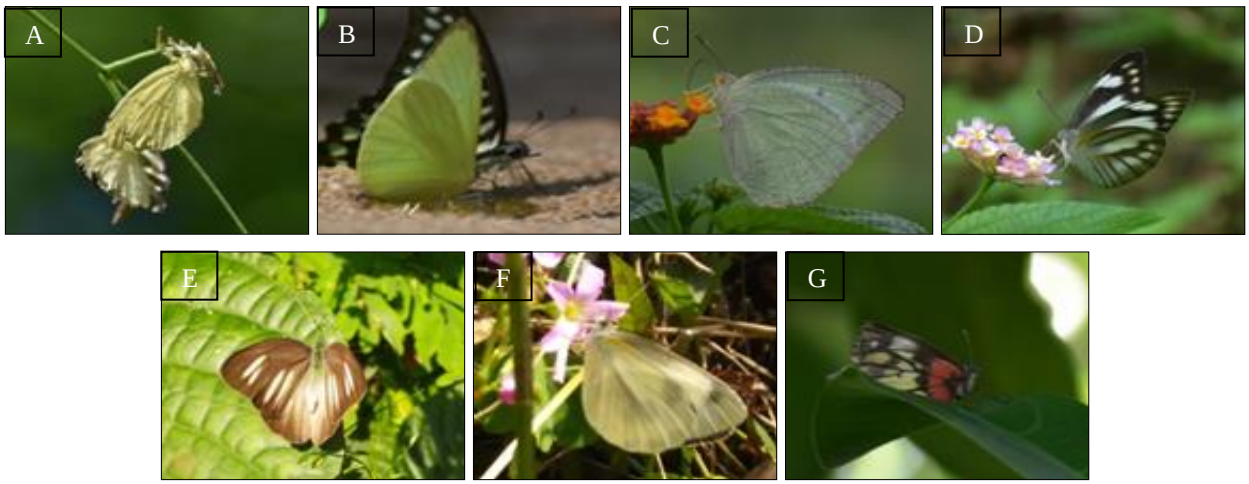

Plate Ib: Photographs shows the Pieridae butterflies recorded in Urban Areas of Golaghat District during the study period (A: *Eurema hecabe*; B: *Catopsilia pomona*; C: *Catopsilia pyranthe*; D: *Appias olferna*; E: *Appias lyncida*; F: *Pieris canidia*; G: *Delias pasithoe*).

Plate IIa: Photographs shows the Lycaenidae butterflies recorded in Urban Areas of Golaghat District during the study period (A: *Curetis acuta*; B: *Spalgis epeus*; C: *Anthene emolus*; D: *Castalius rosimon*; E: *Catochrysops strabo*; F: *Chilades pandava*; G: *Leptotes plinius*; H: *Pseudozizeeria maha*; I: *Zizina karsandra*; J: *Neopithecops zalmora*; K: *Acytolepis puspa*; L: *Heliophorus epicles*; M: *Loxura atymnus*; N: *Cheritra freja*).

Plate IIb: Photographs shows the Riodinidae butterflies recorded in Urban Areas of Golaghat District during the study period (A: *Zemeros flegyas*).

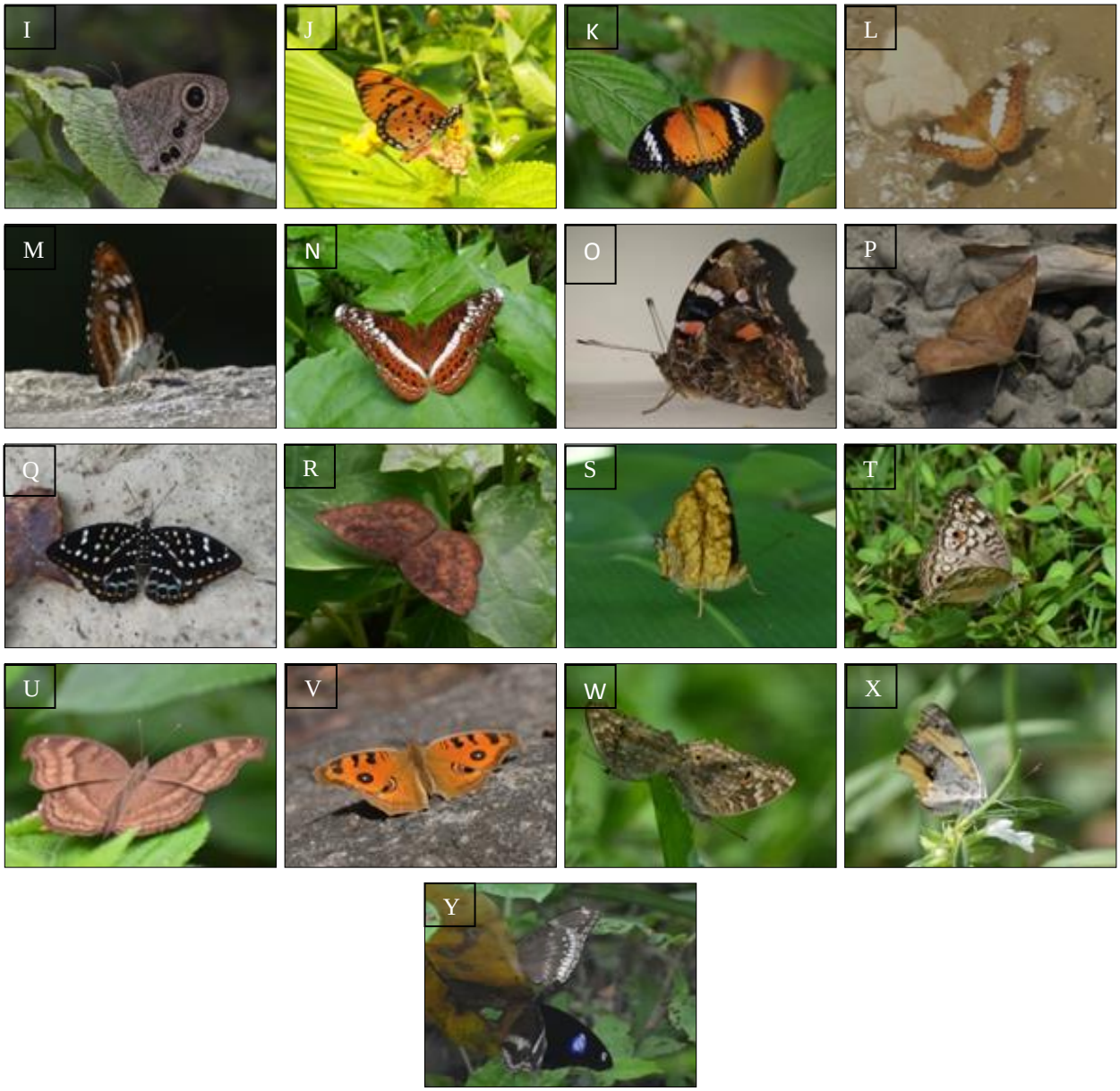

Plate III: Photographs shows the Nymphalidae butterflies recorded in Urban Areas of Golaghat District during the study period (A: *Tirumala limniace*; B: *Danaus chrysippus*; C: *Danaus genutia*; D: *Euploea klugii*; E: *Polyura athamas*; F: *Elymnias hypermnestra*; G: *Melanitis leda*; H: *Lethe chandica*; I: *Ypthima baldus*; J: *Acraea terpsicore*; K: *Cethosia cyane*; L: *Moduza procris*; M: *Athyma inara*; N: *Lebadea martha*; O: *Vannesa indica*; P: *Euthalia aconthea*; Q: *Lexias dirtea*; R: *Ariadne merione*; S: *Hestinalis lilaea*; T: *Junonia atlites*; U: *Junonia iphita*; V: *Junonia almana*; W: *Junonia lemonias*; X: *Junonia hierta*; Y: *Hypolimnas bolina*).

Plate IV: Photographs shows the Hesperiidae butterflies recorded in Urban Areas of Golaghat District during the study period (A: *Tagiades japetus*; B: *Tagiades gana*; C: *Sarangesa dasahara*; D: *Ampittia dioscorides*; E: *Halpe porus*; F: *Psolos fuligo*; G: *Udaspes folus*).

Conclusion

The current study is a preliminary study that provides solid foundations for the future. Further studies of habitat suitability, and nectar plant choices are necessary for the conservation of the butterfly population from further population declines. Design of adequate management strategies is important aiming to enhance the butterfly diversity and conservation of endemic and rare species protected under the schedules of the Wildlife (Protection) Act, 1972. The occurrence of rich butterfly species diversity confirms the presence of required resources in the urban area of Golaghat district, thus proper implementation of conservation strategies should be a high priority to prevent the butterflies from extinction.

Conflict of Interest: None to declare

Acknowledgement: None

Authors contribution: MKT and SS did the field survey, MKT and RB did the identification. SS did data analysis and prepared the manuscript**.**

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