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Diversity of Butterfly (Lepidoptera: Rhopalocera) Fauna of Dibrugarh City in Assam, North East India

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Abstract

The present study was conducted to delineate the butterfly species diversity in Dibrugarh City, Upper Assam, India. The study was based on opportunistic surveys and photo documentation of butterflies made during 2019 to 2021. A total of 153 species belonging to six families and 23 sub-families were recorded, of which 19 species are legally protected in India under various schedules of Indian Wildlife Protection Act, 1972. The family Nymphalidae was dominant with 56 species, followed by Hesperiidae with 35, Lycaenidae with 32, Pieridae with 15 species, Papilionidae with 14 and Riodinidae with one species. The present study underscores the importance of vegetation growing nearby city areas for conservation of butterflies.

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Introduction

India is considered as one of the 17 "Megadiversity" Nations in the world with six "Biodiversity Hotspots"- Western Ghats and North-Eastern Himalayas. The state Assam located in the north eastern part of India, a constituent unit of the Eastern Himalayan Biodiversity Region, has diverse ecological habitats such as grasslands, forests, wetlands that harbors and sustain wide range of 'rare' and 'endemic' floral and faunal species due to the prevailing climatic conditions. Most part of Assam was once covered by forests but today due to anthropogenic causes, it exist in small to large fragmented patches, loosely joined together in four districts of eastern Assam namely Tinsukia, Dibrugarh, Sivasagar and part of Jorhat districts, along the state boundary with Arunachal Pradesh and Nagaland states (Singh 2017).

Among the 1.4 million species on earth, insects occupies a share of 53% and 15 to 16 thousand insects are butterflies (Hassan 1994). The North East India harbors approximately 50% of the total butterfly species of India (Gupta and Mondal, 2005). Butterflies are the most studied groups among the insects. They are very sensitive to habitat pattern and are severely affected by slightest changes in the environmental conditions such as increasing temperature, humidity and rainfall and so are also termed as indicator species (Rosenberg *et al.*, 1986). Butterflies are one of the most charming and easily recognizable insects with a variety of colors coated on their body. It belongs to the order Lepidoptera, the second largest group in insect that includes Butterflies and Moths, out of which about 17,820 are Butterflies (Shields, 1989). They play an important role in the functioning of ecosystem by pollinating wild plants and agro crops (Pywell, 2011). Biology, taxonomy and life history of butterflies are well studied since the early 18th century (Nelson and Anderson, 1994; Wood and Gillman, 1998).

Very few studies have been documented so far on butterfly species within Assam and adjacent areas of North East. Wood-Masonand and De Nice'ville (1887), Evans (1932), Cantlie (1952), Varshney & Chanda (1971) and Haribal (1992) published a list of butterflies from different parts of this region. Works on documentation of Nymphalid butterflies at Rani-Garbhanga Reserve Forest reported 109 species (Saikia *et al.*, 2010) and 154 species from Chakrashila Wildlife Sanctuarty (Choudhury and Ghosh, 2000), a preliminary study by Regional Research Laboratory Campus, Jorhat, Assam reported a total of 70 species of butterflies belonging to 45 genera (Bhuyan *et al.*, 2002). 292 species were reported from Jeypore-Dehing forest of eastern Assam (Gogoi, 2011). 116 Lycaenidae butterflies from Panbari Reserve Forest and adjoining areas in Kaziranga National park (Gogoi, 2015), 224 species of butterflies in Nambor–Doigrung Wildlife Sanctuary (Mudai 2015) and 237 species in eight reserve forest areas and Dehing-Patkai Wildlife Sanctuary, covering three districts (Tinsukia, Dibrugarh & Sibasagar) in the eastern part of upper Assam (Singh 2017). The literature review shows that the north eastern region of India supports a rich butterfly fauna. The International Union for Conservation of Nature and Natural Resources (IUCN) has nominated northeastern India as one of the 'swallowtail-rich zones' under the Swallowtail Conservation Action Plan,1984 (Bora and Meitei 2014). Owing to the importance of presence butterflies in an ecosystem, the present study was conducted for the evaluation of the diversity of butterfly fauna in Dibrugarh city situated in upper Assam of North East India.

Materials and methods

Study Area

Dibrugarh is situated in the eastern part of Assam, surrounded by Dhemaji and a part of Lakhimpur district in the north, part of Sivasagar district and Arunachal Pradesh in the south, Tinsukia district in the East and Sivasagar district in the West, with a geographical area of 3381 square kilometers. It extends from 27°5'38"N to 27°42'30"N latitude and 94°33'46"E to 95°29'8"E longitude. The district harbors a total of 144 tea gardens and 5 reserve forests which covers an area of 217941.648 hectares. A large tract of Tropical Rainforest could be witnessed in its eastern and southern regions, which is a part of

the Dehing Patkai wildlife sanctuary. The climate of Dibrugarh District is basically sub-tropical monsoon. It experiences mild winter, warm and humid summer. The summers are much rainier than the winters. The average annual temperature is 23.5 °C and the annual rainfall is 3034mm.

Fig. 1. Dibrugarh City showing study sites (Source: Google Earth).

Sampling Methods

The study was conducted on the outskirts of Dibrugarh City within a radius of 20km. Butterflies were surveyed in Jokai Reserve Forest cum Botanical Garden, city gardens, Dibrugarh University campus, Airport Road, Medical College Campus, areas adjacent to temples, Jalan Nagar Tea Estate, Mankata Tea Estate, and areas adjacent to river Brahmaputra during the monsoon and post monsoon period (Fig. 1).

The findings presented on this study are based on opportunistic surveys made by the authors for a period of 2 years from 2019 to 2021. Butterflies were photo documented in and around Dibrugarh City on a biweekly basis during monsoon and post monsoon period. To assist in proper identification, an effort was made to photograph the species from as many angles as possible. For proper identification and nomenclature, an attempt was made to use the latest guides and literature available: Kehimkar (2008, 2016), Varshney and Smetacek (2015), Paul Van Gasse (2013), Kunte *et al.,* (2012), Evans (1949) and Wynter-Blyth (1957). The butterflies are categorized into different status based on their sighting during the study period. The butterflies are categorized as C - Common (> 100 sightings), UC - Uncommon (51–100 sightings), NR – Not Rare (16–50 sightings) and R - Rare (2–15 sightings).

Results

Our study recorded 153 species of butterflies from six families and 23 sub-families belonging to 104 genus. The highest number of butterflies in the study belonged to the family Nymphalidae (56 species), followed by Hesperiidae (35 species), Lycaenidae (32 species), Pieridae (15 species), Papilionadae (14 species), and least was encountered from the family Riodinidae (1 species).

Table 1. List of butterflies recorded from Dibrugarh city together with common names, scientific names and relative status. Abundance acronyms: C - Common (> 100 sightings); UC - Uncommon (51–100 sightings); NR – Not Rare (16–50 sightings); R - Rare (2–15 sightings).

SL	Common Names	Scientific Names	Relative Status
Family: Hesperiidae, Sub-Family: Coeliadinae			
1	Small Green Awlet	*Burara amara* (Moore, [1866])	R
2	Orange-Striped Awlet	*Burara harisa* harisa (Moore, [1866])	R
3	Orange Awlet	*Burara jaina* jaina (Moore, [1866])	R
4	Branded Orange Awlet	*Burara oedipodea* belesis (Mabille, 1876)	R
5	Indian Awlking	*Choaspes benjaminii* japonicus (Murray, 1875)	R
6	Common Awl	*Hasora badra* badra (Moore, [1858])	NR
7	Common Banded Awl	*Hasora chromus* chromus (Cramer, [1780])	NR
Family: Hesperiidae, Sub-Family: Hesperiinae			
8	Pygmy Scrub Hopper	*Aeromachus pygmaeus* (Fabricius, 1775)	UC
9	Tiger Hopper	*Ampittia subvittatus* subradiatus Moore, 1878	NR
10	Chocolate Demon	*Ancistroides nigrita* diocles (Moore, [1866])	UC
11	Plain Palm Dart	*Cephrenes acalle* oceanica (Mabille, 1904)	UC
12	Giant Redeye	*Gangara thyrsis* thyrsis (Fabricius, 1775)	NR
13	Tree Flitter	*Hyarotis adrastus* praba (Moore, [1866])	NR
14	Chestnut Bob	*Iambrix salsala* salsala (Moore, [1866])	C
15	Dark Velvet Bob	*Koruthaialos butleri* (de Niceville, [1884])	UC
16	Common Redeye	*Matapa aria* (Moore, [1866])	UC
17	Restricted Demon	*Notocrypta curvifascia* curvifascia (C. & R. Felder, 1862)	UC
18	Common Dartlet	*Oriens gola* pseudolus (Mabille, 1883)	UC
19	Ceylon Dartlet	*Oriens goloides* (Moore, [1881])	UC
20	Great Swift	*Pelopidas assamensis* (de Niceville, 1882)	UC
21	Light Straw Ace	*Pithauria stramineipennis* stramineipennis Wood-Mason & de Niceville, [1887]	UC
22	Coon	*Psolos fuligo subfasciatus* (Moore, 1878)	UC
23	Tufted Ace	*Sebastonyma dolopia* (Hewitson, 1868)	R
24	Indian Palm Bob	*Suastus gremius* gremius (Fabricius, 1798)	UC
25	Dark Palm Dart	*Telicota bambusae bambusae* (Moore, 1878)	NR
26	Grass Demon	*Udaspes folus* (Cramer, [1775])	UC
Family: Hesperiidae, Sub-Family: Pyrginae			
27	White Banded Flat	*Calaenorrhinus asmara* consertus de Niceville, 1890	NR
28	Common Spotted Flat	*Calaenorrhinus leucocera* (Kollar, [1844])	UC
29	Chestnut Angle	*Odontoptilum angulatum* angulatum (C. & R. Felder, 1862)	R
30	Fulvous Pied Flat	*Pseudocoladenia dan* fabia (Evans, 1949)	C
31	Common Small Flat	*Sarangesa dasahara* dasahara (Moore, [1866])	NR
32	Sikkim White Flat	*Seseria sambara* sambara (Moore, [1866])	R
33	Suffused Snow Flat	*Tagiades japetus* ravi (Moore, [1866])	NR
34	Water Snow Flat	*Tagiades litigiosa* litigiosa Möschler, 1878	R
35	Spotted Snow Flat	*Tagiades menaka* menaka (Moore, [1866])	R
Family: Papilionidae, Sub-Family: Papilioninae			
36	Common Batwing	*Atrophaneura varuna* astorion (Westwood, 1842)	R
37	Great Windmill	*Byasa dasarada* dasarada (Moore, [1858])	R
38	Tailed Jay	*Graphium agamemnon* agamemnon (Linnaeus, 1758)	UC
39	Common Jay	*Graphium doson* axionides (Page & Treadaway, 2014)	NR
40	Common Bluebottle	*Graphium sarpedon* sirkari Page & Treadaway, 2013	UC
41	Common Raven	*Papilio castor* castor Westwood, 1842	UC
42	Common Mime	*Papilio clytia* clytia Linnaeus, 1758	UC
43	Lime Butterfly	*Papilio demoleus* demoleus Linnaeus, 1758	C
44	Red Helen	*Papilio helenus* helenus Linnaeus, 1758	NR
45	Great Mormon	*Papilio memnon* agenor Linnaeus, 1758	UC
46	Yellow Helen	*Papilio nephelus* chaon Westwood, 1845	NR
47	Common Mormon	*Papilio polytes* romulus Cramer, [1775]	C
48	Spangle	*Papilio protenor* euprotenor Fruhstorfer, 1908	NR
49	Common Birdwing	*Troides helena* cerberus (C. & R. Felder, 1865)	NR
Family: Pieridae, Sub-Family: Coliadinae			
50	Common Emigrant	*Catopsilia pomona pomona* (Fabricius, 1775)	C
51	Mottled Emigrant	*Catopsilia pyranthe pyranthe* (Linnaeus, 1758)	C
52	Three-spot Grass Yellow	*Eurema blanda silhetana* (Wallace, 1867)	C
53	Common Grass Yellow	*Eurema hecabe hecabe* (Linnaeus, 1758)	C

SL	Common Names	Scientific Names	Relative Status
54	Tree Yellow	*Gandaca harina assamica* Moore, 1906	NR
Family: Pieridae, Sub-Family: Pierinae			
55	Common Albatross	*Appias albina darada* (C. & R. Felder, [1865])	NR
56	Spot Puffin	*Appias lalage lalage* (Doubleday, 1842)	NR
57	Chocolate Albatross	*Appias lyncida eleonora* (Boisduval, 1836)	C
58	Striped Albatross	*Appias olferna* Swinhoe, 1890	NR
59	Redspot Jazebel	*Delias descombesi descombesi* (Boisduval, 1836)	NR
60	Redbase Jezebel	*Delias pasithoe pasithoe* (Linnaeus,1767)	NR
61	Great Orange Tip	*Hebomoia glaucippe glaucippe* (Linnaeus, 1758)	UC
62	Psyche	*Leptosia nina nina* (Fabricius, 1793)	C
63	Indian Cabbage White	*Pieris canidia indica* Evans, 1926	C
64	Green-veined White	*Pieris melete ajaka* Moore, 1865	NR
Family: Lycaenidae, Sub-Family: Curetinae			
65	Bright Sunbeam	*Curetis bulis bulis* (Westwood, [1851])	NR
Family: Lycaenidae, Sub-Family: Lycaenindae			
66	Purple Sapphire	*Heliophorus epicles latilimbata* (Fruhstorfer, 1908)	UC
Family: Lycaenidae, Sub-Family: Miletinae			
67	Apefly	*Spalgis epius epius* (Westwood, [1851])	NR
Family: Lycaenidae, Sub-Family: Polymatinae			
68	Common Hedge Blue	*Acytolepis puspa gisca* (Fruhstorfer, 1910)	NR
69	Common Ciliate Blue	*Anthene emolus emolus* (Godart, [1824])	C
70	Pointed Ciliate Blue	*Anthene lycaenina lycambes* (Hewitson, [1878])	NR
71	Elbowed Pierrot	*Caleta elna noliteia* (Fruhstorfer, 1918)	UC
72	Common Pierrot	*Castalius rosimon rosimon* (Fabricius, 1775)	C
73	Forgetmenot	*Catochrysops strabo strabo* (Fabricius, 1793)	NR
74	Lime Blue	*Chilades laius lajus* (Stoll, [1780])	UC
75	Metallic Cerulean	*Jamides alecto alocina* Swinhoe, 1915	NR
76	Dark Cerulean	*Jamides bochus bochus* (Stoll, [1782])	UC
77	Common Cerulean	*Jamides celeno aelianus* (Fabricius, 1793)	UC
78	Glistening Cerulean	*Jamides elpis pseudelpis* (Butler, [1879])	R
79	Peablue	*Lampides boeticus* (Linnaeus, 1767)	UC
80	Zebra Blue	*Leptotes plinius* (Fabricius, 1793)	UC
81	Malayan	*Megisba malaya sikkima* Moore, 1884	UC
82	Quaker	*Neopithecops zalmora zalmora* (Butler, [1870])	UC
83	Common Lineblue	*Prosotas nora nora* (C. Felder, 1860)	UC
84	Pale Grass Blue	*Pseudozizeeria maha maha* (Kollar, [1844])	UC
85	Dark Grass Blue	*Zizeeria karsandra* (Moore, 1865)	NR
Family: Lycaenidae, Sub-Family: Polyommatinae			
86	Red Pierrot	*Talicada nyseus nyseus* (Guerin, 1843)	R
Family: Lycaenidae, Sub-Family: Theclinae			
87	Centaur Oakblue	*Arhopala centaurus pirithous* (Moore, [1884])	UC
88	Common Imperial	*Cheritra freja evansi* Cowan, 1965	UC
89	Cornelian	*Deudorix epijarbas epijarbus* (Moore, [1858])	NR
90	Common Tit	*Hypolycaena erylus himavantus* Fruhstorfer, [1912]	C
91	Orchid Tit	*Hypolycaena othona othona* Hewitson, [1865]	NR
92	Yamfly	*Loxura atymnus continentalis* Fruhstorfer, [1912]	NR
93	Copper Flash	*Rapala pheretima petosiris* (Hewitson, [1863])	NR
94	Common Acacia Blue	*Surendra quercetorum quercetorum* (Moore, [1858])	NR
95	Blue Imperial	*Ticherra acte acte* (Moore, [1858])	UC
96	Fluffy Tit	*Zeltus amasa amasa* (Hewitson, [1865])	UC
Family: Nymphalidae, Sub-Family: Apaturinae			
97	Courtesan	*Euripus nyctelius nyctelius* (Doubleday, 1845)	NR
Family: Nymphalidae, Sub-Family: Biblidinae			
98	Angled Castor	*Ariadne ariadne pallidior* (Fruhstorfer, 1899)	NR
99	Common Castor	*Ariadne merione tapestrina* (Moore, 1884)	C
Family: Nymphalidae, Sub-Family: Charaxinae			
100	Tawny Rajah	*Charaxes bernardus hierax* C. & R. Felder, [1867]	UC
101	Common Nawab	*Charaxes bharata* C. & R. Felder, [1867]	UC
102	Yellow Rajah	*Charaxes marmax marmax* Westwood, 1847	R
Family: Nymphalidae, Sub-Family: Cyrestinae			
103	Common Maplet	*Chersonesia risa risa* (Doubleday, [1848])	NR
104	Common Map	*Cyrestis thyodamas thyodamas* Doyère, [1840]	R
Family: Nymphalidae, Sub-Family: Danainae			
105	Plain Tiger	*Danaus chryssipus chrysippus* (Linnaeus, 1758)	UC
106	Common Tiger	*Danaus genutia genutia* (Cramer, [1779])	NR

SL	Common Names	Scientific Names	Relative Status
107	Long-branded Blue Crow	*Euploea algea deione* Westwood, 1848	NR
108	Common Crow	*Euploea core core* (Cramer, [1780])	NR
109	Magpie Crow	*Euploea radamanthus radamanthus* (Fabricius, 1793)	NR
110	Glassy Tiger	*Parantica aglea melanoides* Moore, 1883	UC
111	Blue Tiger	*Tirumala limniace exoticus* (Gmélin, 1790)	UC
112	Dark Blue Tiger	*Tirumala septentrionis septentrionis* (Butler, 1874)	UC
Family: Nymphalidae, Sub-Family: Heliconiinae			
113	Indian Fritillary	*Argynnis hyperbius hyperbius* (Linnaeus, 1763)	NR
114	Red Lacewing	*Cethosia biblis tisamena* Fruhstorfer, 1912	NR
115	Leoperd Lacewing	*Cethosia cyane cyane* (Drury, [1773])	NR
116	Common Leopard	*Phalanta phalantha phalantha* (Drury, [1773])	UC
117	Vagrant	*Vagrans egista sinha* (Kollar, [1844])	R
118	Cruiser	*Vindula erota erota* (Fabricius, 1793)	UC
Family: Nymphalidae, Sub-Family: Limenitidinae			
118	Colour Sergeant	*Athyma nefte inara* (Westwood, 1850)	UC
120	Common Sergeant	*Athyma perius perius* (Linnaeus, 1758)	UC
121	Common Baron	*Euthalia aconthea garuda* (Moore, [1858])	UC
122	Gaudy Baron	*Euthalia lubentina lubentina* (Cramer, [1777])	NR
123	Dark Archduke	*Lexias dirtea dirtea* (Fabricius, 1793)	C
124	Commander	*Moduza procris procris* (Cramer, [1777])	UC
125	Common Sailer	*Neptis hylas kamarupa* Moore, [1875]	UC
126	Common Lascar	*Pantoporia hordonia hordonia* (Stoll, [1790])	UC
127	Short-Banded Sailer	*Phaedyma columella ophiana* (Moore, 1872)	NR
128	Common Earl	*Tanaecia julii appiades* (Ménétriés, 1857)	R
129	Grey Count	*Tanaecia lepidea lepidea* (Butler, 1868)	UC
Family: Nymphalidae, Sub-Family: Nymphalinae			
130	Great Eggfly	*Hypolimnas bolina jacintha* (Drury, 1773)	UC
131	Peacock Pansy	*Junonia almana almana* (Linnaeus, 1758)	C
132	Grey Pansy	*Junonia atlites atlites* (Linnaeus, 1763)	C
133	Chocolate Pansy	*Junonia iphita iphita* (Cramer, [1779])	C
134	Lemon Pansy	*Junonia lemonias lemonias* (Linnaeus, 1758)	UC
135	Orange Oakleaf	*Kallima inachus inachus* (Doyère, [1840])	NR
Family: Nymphalidae, Sub-Family: Pseudergolinae			
136	Constable	*Dichorragia nesimachus nesimachus* (Doyère, [1840])	R
137	Popinjay	*Stibochiona nicea nicea* (Gray, 1846)	R
Family: Nymphalidae, *Sub-Family:* Satyrinae			
138	Common Duffer	*Discophora sondaica zal* Westwood, [1851]	NR
139	Common Palmfly	*Elymnias hypermnestra undularis* (Drury, 1773)	C
140	Spotted Palmfly	*Elymnias malelas malelas* (Hewitson, 1863)	NR
141	Peal's Palmfly	*Elymnias peali* Wood-Mason, 1883	R
142	Common Evening Brown	*Melanitis leda leda* (Linnaeus, 1758)	C
143	Great Evening Brown	*Melanitis zitenius zitenius* (Herbst, 1796)	UC
144	Watson's Bushbrown	*Mycalesis adamsoni* Watson, 1897	R
145	White-bar Bushbrown	*Mycalesis anaxias aemate* Fruhstorfer, 1911	NR
146	Lilacine Bushbrown	*Mycalesis francisca sanatana* Moore, [1858]	R
147	Chinese Bushbrown	*Mycalesis gotama charaka* Moore, [1875]	R
148	Dark-brand Bushbrown	*Mycalesis mineus mineus* (Linnaeus, 1758)	UC
149	Common Bushbrown	*Mycalesis perseus blasius* Fabricius, 1798	UC
150	Nigger	*Orsotriaena medus medus* (Fabricius, 1775)	C
151	Common Fivering	*Ypthima baldus baldus* (Fabricius, 1775)	C
152	Common Fourring	*Ypthima huebneri* Kirby, 1871	C
Family: Riodinidae, Sub-Family: Nemeobiinae			
153	Punchinello	*Zemeros flegyas indicus* Fruhstorfer, 1898	C

Among the 153 species of butterflies recorded, 16% (25) were common, 36% (55) were uncommon, 31% (47) were not rare and 16% (24) were found to be rare. The relative status of the identified species in and around the Dibrugarh city are listed in Table 1. The presence of rare and not rare species marks the necessity of protection of the site in order to conserve them. Among the 153 species recorded, 19 species i.e 13% are legally protected in India under various schedules of the Indian Wildlife Protecton Act (WPA). Among them 3 species are protected under Schedule I (*Hypolycaena othona othona, Discophora sondaica zal*, *Elymnias peali*), 12 species under Schedule II (*Appias albina darada*, *Anthene lycaenina lycambes,*

Lampides boeticus, Euripus nyctelius nyctelius, Charaxes bernardus hierax, Charaxes marmax marmax, Lexias dirtea dirtea, Tanaecia lepidea lepidea, Melanitis zitenius zitenius, Mycalesis adamsoni, Mycalesis anaxias aemate, Mycalesis gotama charaka) and 4 species (*Hyarotis adrastus praba, Pelopidas assamensis, Euthalia lubentina lubentina, Euploea radamanthus radamanthus*) under Schedule IV of WPA.

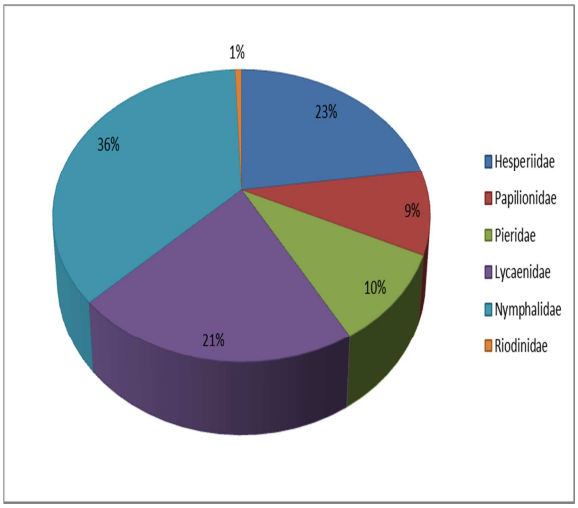

Fig. 2. Number of butterfly species encountered in different families in Dibrugarh City, Assam.

Discussion

The presence and status of butterflies are generally reflected through the types of habitat, vegetation and availability of food resources. The present survey shows Nymphalidae, was the highest recorded butterfly family (37%) in the city.

The genera *Mycalesis* from the sub family Satyrinae of Nymphalidae showed the highest presence, which is 11%. This could be due to the high availability of host plants. They are polyphagus and active fliers which helps them in navigating distant areas for resources (Bora and Meitei, 2014).

The highest number of uncommon species belonged to the family Nymphalidae (19 species) followed by Lycaenidae (15 species). Two families viz Hesperiidae and Nymphalidae consisted of the highest number of rare species i.e. 10 species each. Papilionadae consists of relatively large sized butterflies with diverse genera.

From Table 1, it was seen that 9% of the total encountered species belongs to the family Papilionadae. Among this highest diversity of species was found in the genera *Papilio*. Papiliionadae and Pieridae are very specific in terms of their host plants.

They are very sensitive to pollution and hence are restricted to the less polluted areas. Thus the abundance of Papillionadae family can be a good indicator of pollution.

Riodinidae are also called metal marks due to the presence of small, metallic spots on their wings. Only one variety of species i.e *Zemeros flegyas indicus* from the family Riodinidae was spotted in the studied area. Another study by Flora *et al.* 2020 also showed the least occurrence of Riodinidae butterflies.

Generally the abundance of Riodinidae may be more in a restricted area but their diversity is negligible. It is mainly due to their poor flight pattern for which they cannot explore much for migration.

Species found in high elevations cannot migrate to the main land and vice versa. The host plants of Riodinidae are not easily available or suited to diverse habitat. Butterfly species from the family Lycanadiae consists of species which are small and brightly coloured. The smaller size generally causes hindrance in their identification.

The species *Talicada nyseus nyseus* from the subfamily Polyommatinae is very rare in North East India but its abundance is found to be very high in the studied area.

This is due to the availability of the host plant – *Bryophyllum* in household gardens, as habitat creation, restoring the habitat of this species in the city.

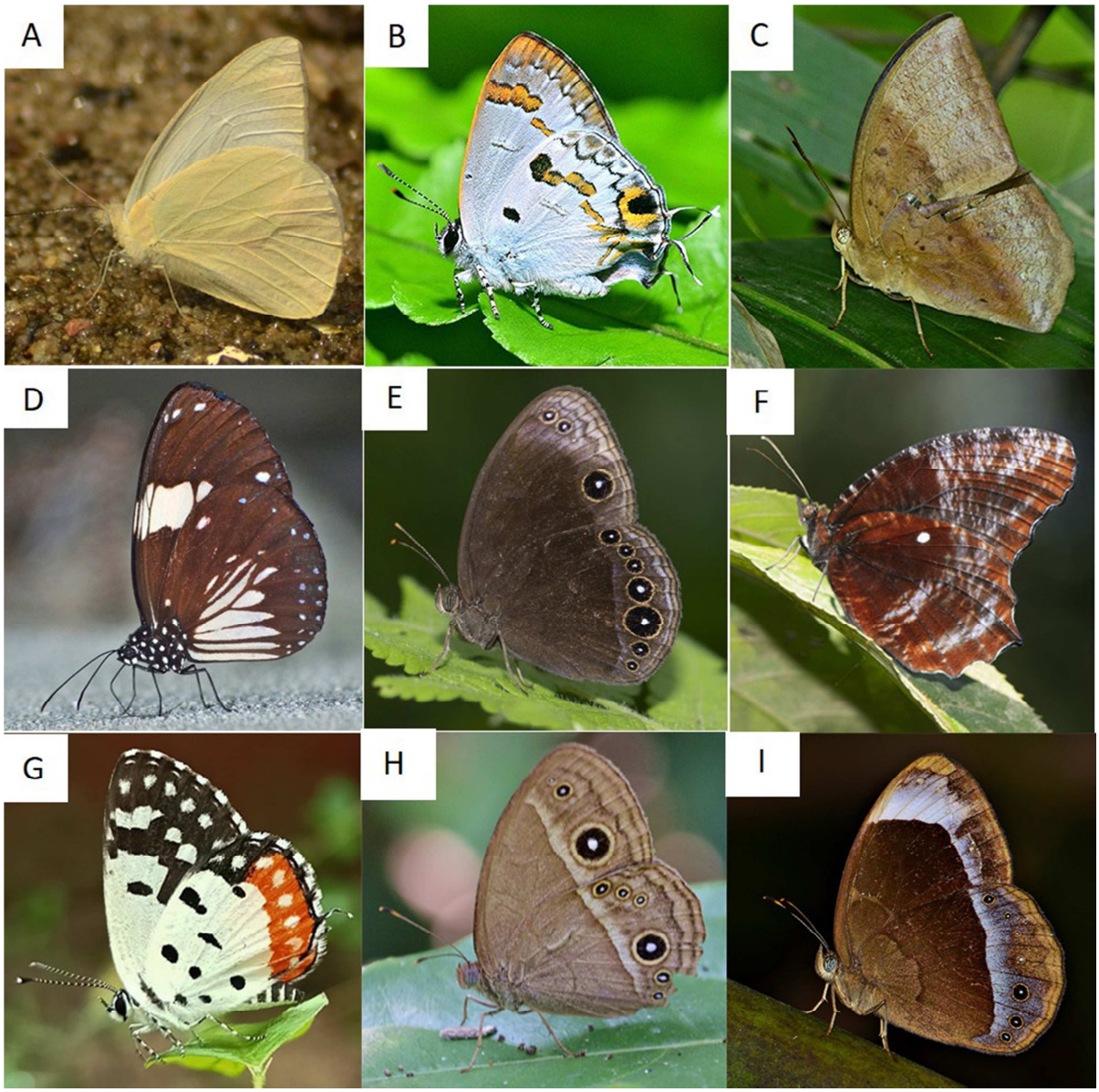

Fig. 3. Some notable species of the study area: A). *Appias albina darada*, B). *Hypolycaena othona othona,* C). *Discophora sondaica zal*, D). *Euploea radamanthus radamanthus*, E). *Mycalesis adamsoni*, F). *Elymnias peali*, G). *Talicada nyseus nyseus*, H). *Mycalesis gotama charaka*, I). *Mycalesis anaxias aemate.*

Conclusion

Butterflies are part of our natural heritage and have been studied for over 300 years. They are indicators of a healthy environment and healthy ecosystems. It has been widely used by ecologists as model organisms to study the impact of habitat loss, fragmentation and are extremely important for scientific research on climate change. Areas rich in butterflies are rich also in other invertebrates as they collectively provide a wide range of environmental benefits, including pollination, natural pest control, important element of the food chain and are prey for birds, bats and other insectivorous animals. The recorded species under WPA found in the study area must be protected by adopting proper conservation strategies. Researches must be conducted in different districts to identify and update the relative status of each species and accordingly adequate conservation and protection can be provided.

Tea gardens present in the area can be considered as ideal habitats for conserving these species only if the levels of sprayed pesticides are checked. Strict administrative rules must be adopted to stop any

illegal anthropogenic activities that can affect their presence. Ecotourism must be promoted to encourage the conservation efforts by cooperating with the government, local residence by adopting activities such as putting up maps, signage and display boards, preparing and providing pamphlets, photographs along with their seasonality for tourists, training nature guides of the area of availability. Butterfly gardens and parks can be set up in local areas or in house gardens by introducing butterfly host plants that can attract different species and can be flourished as suitable habitats to maintain the biodiversity naturally. Educational oraganizations can also be involved in educating the young minds by performing activities such as nature education camps, plantation, trekking, observation of wildlife, and series of nature conservation program, that will immensely help in survival and flourishment of this unique and important resource of the environment.

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