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Kismat Neupane & Mahamad Sayab Miya

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Butterfly diversity of Putalibazar Municipality, Syangja District, Gandaki Province, Nepal

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Abstract: A study was carried out to find the butterfly species diversity and abundance in Putalibazar Municipality, Syangja, Gandaki, Nepal, from June 2019 to July 2020. Pollard walk method was used for data collection in three different habitat types: forest, agricultural land, and settlement area. The study was performed in all seasons: pre-monsoon, monsoon, post monsoon and winter. A total of 180 butterfly species from 108 genera and six families were recorded. The overall Shannon-Wiener diversity index (H) was 4.48. The highest diversity was represented by the Nymphalidae with 67 species (H= 3.79). Butterfly diversity and species abundance was highest in the forest area (147 species, 1199 individuals; H= 4.47). The highest species richness (109 species) was observed in the monsoon season.

Keywords: Abundance, dominance, Pollard walk method, richness

Nepali abstract: पुतलीबजार नगरपालिका, स्याङ्जा, गण्डकी, नेपालमा पुतली प्रजातिको बढिथिता र प्रचुरता थाहा पाउनका लागि जुन २०१९ देखि जुलाई २०२० सम्म यो अध्ययन सन्चालन गरिएको थियो। पोलार्ड वाक बढि प्रयोग गरि तिनै फरक बासस्थान (वन, कृषि जमिन र बासस्थान क्षेत्र) बाट तथ्यांक सङ्कलन गरिएको थियो। यो अध्ययन चार वटै मौसममा (प्र-मनसुन, मनसुन, पोष्ट-मनसुन र वनिटर) सन्चालन गरिएको थियो। कुल १८० प्रजातिका पुतलीहरु रेकर्ड गरिएका थिए जुन १०८ जेनेरा र ६ फेमिलीमा समबन्धित छन्। कुल स्यानीन-वनिर डाइभर्सिटी इन्डेक्स (H) ४.४८ थियो। सबैभन्दा बढि विविधता (६७ प्रजाति, H=३.७९) नमिफालिडी फेमिलिबाट पाइएको थियो। तयसैगरि वन क्षेत्रबाट सबैभन्दा बढि विविधता र प्रचुरता (१४७ प्रजाति, १,१९९ सङ्ख्या र H=४.४७) पाइएको थियो। साथै मनसुनमा सबैभन्दा बढि विविधता (१०९ प्रजाति) पाइएको थियो। यो अध्ययनले उक्त क्षेत्रमा पुतलीको थप अनुसन्धान र संरक्षण गर्न मद्दत गर्नेछ।

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Author contributions: KN: conceptualization, research design, field work, data collection, species identification, draft review and revision. MSM: research design, field work, data collection, species identification, data analysis and interpretation, manuscript drafting, editing, critical review and revisions.

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INTRODUCTION

Butterflies play crucial roles in pollination and food chains, and they serve as bio-indicators in terrestrial ecosystems (Tiple 2007) of vegetative structure, habitat quality (Sawchik et al. 2005) and climate change (Permesan et al. 1999). India is home to over 1,500 species of butterfly (Tiple 2011), and Nepal of more than 660 species (Smith 2011). The main sources of butterfly research in different parts of Nepal are Smith (1994, 2006, 2011), Khanal (2006, 2008), Bhusal & Khanal (2008), and Acharya & Vijyan (2015). No previous studies have been carried out on butterflies in the Syangja District, hence this study examined species diversity and abundance in Putalibazar municipality, Gandaki, Nepal.

MATERIALS AND METHODS

Study area

The study was carried out in Putalibazar municipality (28.100°N and 83.871°E) from June 2019 to July 2020 covering an area of 146.21km². It is surrounded by

Kaski District and Tanahu District in the east, Adhikhola rural-municipality, Arjun chaupari rural-municipality, and Bhirkot municipality in the west, Kaski District and Phedikhola rural-municipality in the north, and Biruwa rural-municipality and Bhirkot municipality in the south. The study was carried out in an altitude range of 760 to 835 m, in three habitat types; forest, agriculture land and settlement area. The forest is dominated by *Schima wallichii* and *Castanopsis indica*. Major agriculture crops planted in the study area are maize, rice, millet, and the settlement is near the forest area and agriculture land. The study area map is shown in Figure 1.

Butterfly survey

Pollard walk method was used for the butterfly survey (Pollard 1977). Transects of 300–500 m, two in each habitat type were set up. Butterflies were observed within a 5-m width; 2.5 m to each side of the transect. Butterflies were recorded in all the four seasons: pre-Monsoon (March–May), monsoon (June–September), post-monsoon (October–November), and winter (December–February). Field visits were made twice a month, from 0900 h to 1600 h. Sunny days were

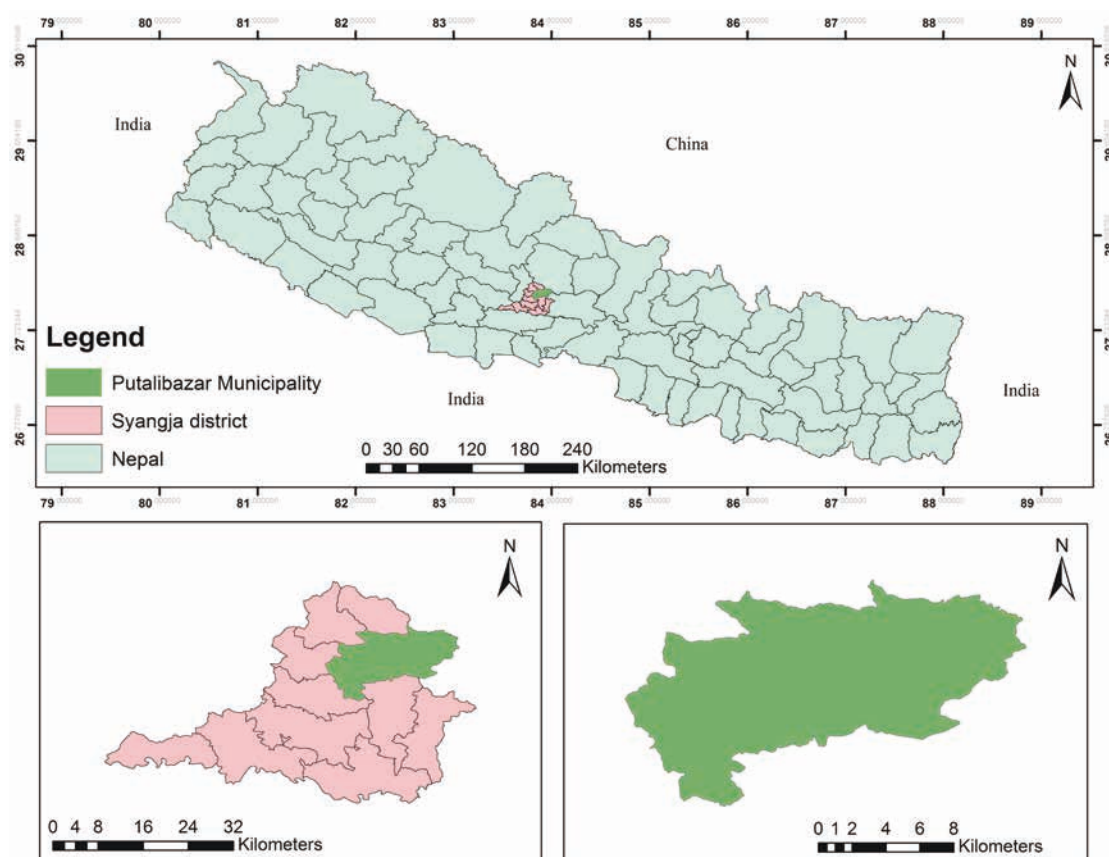


Figure 1. Study area map showing Putalibazar municipality.

preferred to ensure maximum detection of butterflies during the survey. Direct field observations followed by photography were used to record species. Field guides by Smith (2011) and Smith et al. (2016) were used to identify butterflies in the field. Photographs were taken by Smartphone (Samsung Galaxy J7 Nxt and Samsung Galaxy J7 Prime 2). Species that were difficult to identify in the field were later identified through internet references (<https://www.ifoundbutterflies.org/>), (<https://www.projectnoah.org/>), and consulting with experts. Butterflies are classified based on (Kehimkar 2016). Local status of the butterfly is determined based on (Tiple et al. 2005) as: very common (>100 sightings), common (50–100 sightings), fairly common (15–50 sightings), rare (2–15 sightings), and very rare (<2 sightings). National status (Nepal) is based on Smith (2011) and Smith et al. (2016).

Data analysis

Species richness of butterflies was determined based on the total number of species recorded. Diversity was calculated using the Shannon-Wiener diversity index, and species evenness was calculated using Shannon equitability:

Shannon-Wiener

$$\text{diversity index (H)} = - \sum_{i=1}^n P_i * \ln P_i$$

$$\text{Shannon equitability (E)} = \frac{H}{H_{\max}}, \text{ here, } H_{\max} = \ln(S)$$

Where, P_i = Proportion of individuals belonging to the i^{th} species, n = total number of individuals, S = number of species. Data were analyzed with MS excel software.

RESULTS AND DISCUSSION

A total of 180 butterfly species under 108 genera and six families were recorded during the survey (Table 1, Images 1–179). The overall Shannon-Wiener diversity index was 4.48. Species richness, abundance, evenness and diversity indices are given in Table 2 and Table 3.

A total of 147 species of butterflies were found in the forest, 100 in agricultural land, and 39 in the settlement area; 25 species were found in all three habitat types, and 77 species were found only in the forest. Species composition in different habitat types is shown in Table 1 and Figure 2. Of the six recorded butterfly families, Nymphalidae represented the maximum species richness with 67 species, followed by Lycaenidae (42

species), Hesperidae (26 species), Pieridae (23 species), Papilionidae (16 species), and Riodinidae (6 species). The family-wise composition of butterfly species and genera is given in (Figure 3). The highest species richness was observed in monsoon season comprising 109 species, followed by pre-monsoon (76 species), post-monsoon (63 species), and winter (22 species). Season-wise species richness is mentioned in Figure 4.

The diversity of butterfly species is higher ($H = 4.48$) in this small study area. Among 660 species of butterflies in Nepal (Smith 2011), butterfly species recorded in the study area which is about 27% of the total butterfly species in Nepal. Among the recorded species during the survey, a total of 13 species (7%) (Tree Yellow *Gandaca harina*, Blue Imperial *Ticherra acte*, Chocolate Royal *Remelena jangala*, Green Oakblue *Arhopala eumolpus*, Indian Purple Sapphire *Heliophorus indicus*, Tailed Judy *Abisara neophron*, Autumn Leaf *Doleschallia bisaltide*,

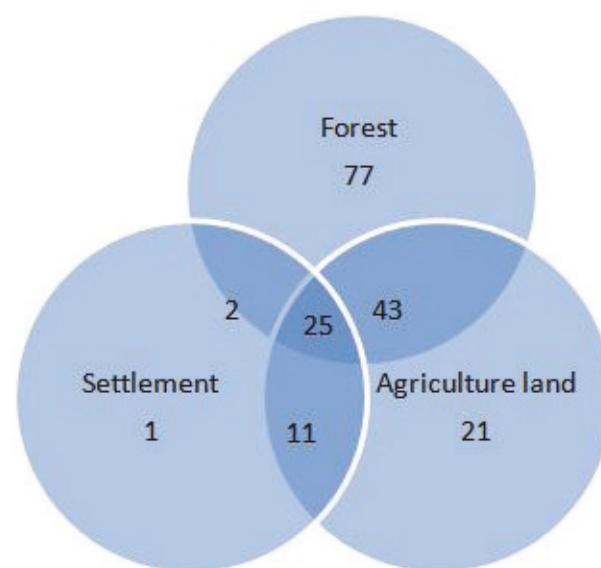


Figure 2. Butterfly species composition in different habitat types

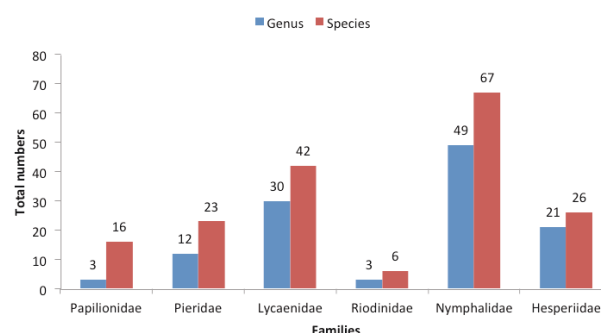


Figure 3. Family-wise composition of butterfly genera and species.

Table 1. List of butterflies recorded from Putalibazar Municipality, Syangja.

	Scientific names	Common names	Habitat types	Local status	Status (Nepal)
Papilionidae (16)					
1.	<i>Graphium agamemnon</i> Linnaeus, 1758	Tailed Jay	A & S	R	C
2.	<i>Graphium cloanthus</i> (Westwood, 1841)	Glassy Bluebottle	F	R	FC
3.	<i>Graphium dason</i> Felder & Felder, 1864	Common Jay	A & F	FC	FC
4.	<i>Graphium sarpedon</i> (Linnaeus, 1758)	Common Bluebottle	A & S	FC	C
5.	<i>Papilio arcturus</i> (Westwood, 1842)	Blue Peacock	A & S	R	C
6.	<i>Papilio bianor</i> Cramer, 1777	Common Peacock	F & S	R	C
7.	<i>Papilio clytia dissimilis</i> Linnaeus, 1758	Common Mime	F	R	FC
8.	<i>Papilio demoleus</i> (Linnaeus, 1758)	Lime Swallowtail	A, F & S	FC	VC
9.	<i>Papilio helenus</i> (Linnaeus, 1758)	Red Helen	F	R	C
10.	<i>Papilio machaon</i> (Linnaeus, 1758)	Common Yellow Swallowtail	A	R	C
11.	<i>Papilio memnon</i> Linnaeus, 1758	Great Mormon	A & F	FC	C
12.	<i>Papilio nephelus</i> Boisduval, 1836	Yellow Helen	F	R	FC
13.	<i>Papilio paris</i> Linnaeus, 1758	Paris Peacock	A & F	FC	C
14.	<i>Papilio polytes</i> Linnaeus, 1758	Common Mormon	A, F & S	FC	VC
15.	<i>Papilio protenor</i> Cramer, 1775	Spangle	A & F	FC	C
16.	<i>Triodes aeacus</i> (Felder & Felder, 1860)	Common Birdwing	F	R	NE
Pieridae (23)					
17.	<i>Appias lalage lalage</i> (Doubleday, 1842)	Himalayan Spot Puffin	F	VR	NE
18.	<i>Appias lyncida</i> (Cramer, 1779)	Chocolate Albatross	A & S	FC	FC
19.	<i>Catopsilia pomona crocale</i> Fabricius, 1775	Common Emigrant	A, F & S	FC	VC
20.	<i>Catopsilia pomona pomona</i> (Fabricius, 1775)	Lemon Emigrant	A, F & S	FC	VC
21.	<i>Catopsilia pyranthe</i> Linnaeus, 1758	Mottled Emigrant	A & F	FC	VC
22.	<i>Cepora nadina</i> (Lucas, 1852)	Lesser Gull	A & F	R	FC
23.	<i>Cepora nerissa</i> Fabricius, 1775	Common Gull	A & F	FC	C
24.	<i>Colias fieldii</i> (Menetries, 1855)	Dark Clouded Yellow	A & S	R	C
25.	<i>Delias acalis</i> (Godart, 1819)	Red-breast Jezebel	A & F	R	FC
26.	<i>Delias descombesi</i> (Boisduval, 1836)	Red-spot Jezebel	F	R	LC
27.	<i>Delias eucharis</i> (Drury, 1773)	Common Jezebel	F & S	R	FC
28.	<i>Delias hyparete</i> (Linnaeus, 1758)	Painted Jezebel	A & S	R	VC
29.	<i>Delias posithoe</i> (Linnaeus, 1767)	Red-base Jezebel	A & F	R	VC
30.	<i>Eurema blanda</i> (Boisduval, 1836)	Three-spot Grass Yellow	A, F & S	C	VC
31.	<i>Eurema brigitta</i> (Stoll, 1780)	Small Grass Yellow	A, F & S	C	C
32.	<i>Eurema hecabe</i> (Linnaeus, 1758)	Common Grass Yellow	A, F & S	VC	VC
33.	<i>Eurema laeta</i> (Boisduval, 1836)	Spotless Grass Yellow	A & S	FC	C
34.	<i>Gandaca harina</i> (Horsfield, 1829)	Tree Yellow	F	R	R
35.	<i>Genopteryx rhamni</i> (Linnaeus, 1758)	Common Brimstone	F	R	C
36.	<i>Hebomoia glaucippe</i> (Linnaeus, 1758)	Great Orange Tip	A & F	FC	FC
37.	<i>Ixias pyrene</i> (Linnaeus, 1764)	Yellow Orange Tip	A & F	FC	C
38.	<i>Pieris canidia</i> (Linnaeus, 1768)	Indian Cabbage White	A, F & S	VC	VC
39.	<i>Pontia daplidice</i> (Linnaeus, 1758)	Bath White	A & F	FC	C
Lycaenidae (42)					
40.	<i>Acytolepis puspa</i> (Horsfield, 1828)	Common Hedge Blue	A	R	VC
41.	<i>Arhopala centaurus</i> (Fabricius, 1775)	Centaur Oakblue	F	FC	VC
42.	<i>Arhopala eumolpus</i> Cramer, 1780	Green Oakblue	F	R	R
43.	<i>Arhopala oenea</i> (Hewitson, 1869)	Hewitson's Dull Oakblue	F	R	FC



	Scientific names	Common names	Habitat types	Local status	Status (Nepal)
44.	<i>Arhopala paramuta</i> (D. Niceville, 1884)	Hooked Oakblue	F	R	VC
45.	<i>Castalius rosimon</i> Fabricius, 1775	Common Pierrot	A & F	FC	VC
46.	<i>Catapaecilma major</i> (Druce, 1895)	Common Tinsel	F	R	FC
47.	<i>Catochrysops strabo</i> (Fabricius, 1793)	Forget-me-not Blue	A	FC	VC
48.	<i>Celastrina lavenduralis</i> (Moore, 1877)	Plain Hedge Blue	A	R	NE
49.	<i>Chliaria othona</i> (Hewitson, 1865)	Orchid Tit	F	R	C
50.	<i>Curetis acuta</i> Moore, 1877	Angled Sunbeam	F	R	NE
51.	<i>Curetis bulis</i> (Westwood, 1851)	Bright Sunbeam	F	R	C
52.	<i>Euchrysops cnejus</i> (Fabricius, 1798)	Gram Blue	A	FC	C
53.	<i>Everes lacturnus</i> (Godart, 1824)	Indian Cupid	A & F	FC	VC
54.	<i>Heliophorus epicles</i> (Godart, 1824)	Purple Sapphire	A & F	FC	VC
55.	<i>Heliophorus indicus</i> (Fruhstorfer, 1908)	Indian Purple Sapphire	F	R	R
56.	<i>Heliophorus sena</i> (Kollar, 1844)	Sorrel Sapphire	F	R	LC
57.	<i>Iraota timoleon</i> (Stoll, 1790)	Silverstreak Blue	F	R	FC
58.	<i>Jamides bochus</i> (Stoll, 1782)	Dark Cerulean	A	R	C
59.	<i>Jamides celeno</i> (Cramer, 1775)	Common Cerulean	A, F & S	FC	VC
60.	<i>Lampides boeticus</i> (Linnaeus, 1767)	Pea Blue	A & S	FC	VC
61.	<i>Lestranicus transpectus</i> (Moore, 1879)	White-banded Hedge Blue	A	R	C
62.	<i>Loxura atymnus</i> Stoll, 1780	Yamfly	A	R	FC
63.	<i>Megisba malaya</i> (Horsfield, 1828)	Malayan	A	R	FC
64.	<i>Poritia hewitsoni</i> (Moore, 1866)	Common Gem	F	R	NE
65.	<i>Prosotas dubiosa</i> (Semper, 1879)	Tailless Line Blue	F	R	C
66.	<i>Prosotas nora</i> (Felder, 1860)	Common Line blue	F	FC	VC
67.	<i>Pseudozizeeria maha</i> (Kollar, 1844)	Pale Grass Blue	A, F & S	VC	VC
68.	<i>Rapala manea</i> (Hewitson, 1863)	Slate Flash	F	R	VC
69.	<i>Rapala nissa</i> (Kollar, 1844)	Common Flash	F	FC	VC
70.	<i>Rapala pheretima</i> (Hewitson, 1863)	Copper Flash	F	R	C
71.	<i>Rapala rectivitta</i> (Moore, 1879)	Shot Flash	F	R	FC
72.	<i>Remelena jangala</i> (Horsfield, 1829)	Chocolate Royal	F	VR	R
73.	<i>Spindasis lohita</i> (Horsfield, 1829)	Long-banded Silverline	F	R	C
74.	<i>Spindasis syama</i> Horsfield, 1829	Club Silverlines	F	R	C
75.	<i>Surendra quercetorum</i> (Moore, 1858)	Common Acacia Blue	F	VR	C
76.	<i>Taraka hamada</i> (Druce, 1875)	Forest Pierrot	F	R	NE
77.	<i>Ticherra acte</i> (Moore, 1858)	Blue Imperial	F	VR	R
78.	<i>Udara dilectus</i> (Moore, 1879)	Pale Hedge Blue	A & F	FC	VC
79.	<i>Zeltus amasa</i> (Hewitson, 1865)	Fluffy Tit	F	R	FC
80.	<i>Zizeeria karsandra</i> (Moore, 1865)	Dark Grass Blue	A & F	FC	NE
81.	<i>Zizina otis</i> (Fabricius, 1787)	Lesser Grass Blue	A & F	FC	C
Riodinidae (6)					
82.	<i>Abisara bifasciata</i> Moore, 1877	Plum Judy	F	R	FC
83.	<i>Abisara fylla</i> (Westwood, 1851)	Dark Judy	A	R	VC
84.	<i>Abisara neophron</i> (Hewitson, 1861)	Tailed Judy	F	R	R
85.	<i>Dodona egeon</i> (Westwood, 1851)	Orange Punch	F	R	C
86.	<i>Dodona eugenes</i> Bates, 1868	Tailed Punch	F	R	C
87.	<i>Zemeros flegyas</i> Cramer, 1780	Punchinello	A & F	FC	VC
Nymphalidae (67)					
88.	<i>Abrota ganga</i> Moore, 1858	Sergeant Major	F	R	FC
89.	<i>Acraea terpsicore</i> Linnaeus, 1758	Tawny Coster	F	R	FC

	Scientific names	Common names	Habitat types	Local status	Status (Nepal)
90.	<i>Aglais cashmirensis</i> (Kollar, 1844)	Indian Tortoiseshell	A, F & S	FC	VC
91.	<i>Argynnis childreni</i> (Gray, 1831)	Large Silverstripe	F	R	C
92.	<i>Argynnis hyperbius</i> (Linnaeus, 1763)	Indian Fritillary	A	R	VC
93.	<i>Athyma nefte</i> Cramer, 1780	Color Sergeant	F	R	C
94.	<i>Athyma perius</i> Linnaeus, 1758	Common Sergeant	A & F	FC	VC
95.	<i>Athyma ranga</i> Moore, 1858	Blackvein Sergeant	F	R	R
96.	<i>Athyma selenophora</i> (Kollar, 1844)	Staff Sergeant	A & F	FC	C
97.	<i>Cethosia biblis</i> (Drury, 1773)	Red Lacewing	F	R	FC
98.	<i>Cethosia cyane</i> (Drury, 1773)	Leopard Lacewing	F	R	R
99.	<i>Charaxes bernardus</i> (Fabricius, 1793)	Tawny Rajah	F	VR	LC
100.	<i>Chersonesia risa</i> (Doubleday, 1848)	Common Maplet	A & F	FC	FC
101.	<i>Cupha erymanthis</i> Drury, 1773	Rustic	F	R	C
102.	<i>Cyrestis thyodamas</i> Boisduval, 1836	Common Map	A & F	FC	VC
103.	<i>Danaus chrysippus</i> Linnaeus, 1758	Plain Tiger	A, F & S	FC	VC
104.	<i>Danaus genutia</i> (Cramer, 1779)	Common Tiger	A, F & S	FC	VC
105.	<i>Discophora sondaica</i> Boisduval, 1836	Common Duffer	F	R	FC
106.	<i>Doleschallia bisaltide</i> Cramer, 1777	Autumn Leaf	F	VR	R
107.	<i>Elymnias malelas</i> (Hewitson, 1863)	Spotted Palmfly	A, F & S	R	C
108.	<i>Euploea core</i> (Cramer, 1780)	Common Indian Crow	A, F & S	FC	VC
109.	<i>Euploea mulciber</i> (Cramer, 1777)	Striped Blue Crow	A & F	FC	VC
110.	<i>Euthalia aconthea</i> (Cramer, 1777)	Common Baron	A & F	FC	C
111.	<i>Euthalia lubentina</i> (Cramer, 1777)	Gaudy Baron	F	R	R
112.	<i>Hestialis nama</i> (Doubleday, 1844)	Circe	A & F	R	C
113.	<i>Hypolimnas bolina</i> Linnaeus, 1758	Great Eggfly	A & F	R	C
114.	<i>Hypolimnas misippus</i> (Linnaeus, 1764)	Danaid Eggfly	F	VR	R
115.	<i>Junonia almana</i> Linnaeus, 1758	Peacock Pansy	A & S	FC	VC
116.	<i>Junonia altites</i> (Linnaeus, 1763)	Grey Pansy	A, F & S	FC	C
117.	<i>Junonia iphita</i> (Cramer, 1779)	Chocolate Pansy	A & F	FC	VC
118.	<i>Junonia lemonias</i> Linnaeus, 1758	Lemon Pansy	A, F & S	FC	VC
119.	<i>Junonia orithya</i> (Linnaeus, 1758)	Blue Pansy	A & F	R	VC
120.	<i>Kallima inachus</i> (Doyere, 1840)	Orange Oakleaf	F	FC	C
121.	<i>Kaniska canace</i> (Linnaeus, 1763)	Blue Admiral	F	R	C
122.	<i>Lethe europa</i> Fabricius, 1787	Bamboo Treebrown	A & F	FC	C
123.	<i>Lethe confusa</i> Aurivillius, 1897	Banded Treebrown	A & F	FC	VC
124.	<i>Lethe mekera</i> (Moore, 1858)	Common Red Forester	F	FC	NE
125.	<i>Melanitis leda</i> (Linnaeus, 1758)	Common Evening Brown	A, F & S	FC	VC
126.	<i>Melanitis phedima</i> (Cramer, 1780)	Dark Evening Brown	A, F & S	FC	C
127.	<i>Mycalis francisca</i> Stoll, 1780	Lilacine Bushbrown	F	FC	C
128.	<i>Mycalis malsara</i> (Moore, 1858)	White-line Bushbrown	A & F	R	C
129.	<i>Mycalis perseus</i> Fabricius, 1775	Common Bushbrown	A, F & S	FC	VC
130.	<i>Mycalis visala</i> Moore, 1858	Long-brand Bushbrown	A & F	FC	C
131.	<i>Nemetis chandica</i> Moore, 1858	Angled Red Forester	F	FC	FC
132.	<i>Neptis cartica</i> Moore, 1872	Plain Sailer	F	R	C
133.	<i>Neptis hylas</i> Linnaeus, 1758	Common Sailer	A, F & S	FC	VC
134.	<i>Neptis soma</i> Moore, 1858	Creamy Sailer	F	R	C
135.	<i>Orsotriaena medus</i> (Fabricius, 1775)	Jungle Brown	A & F	FC	VC
136.	<i>Pantoporia hordonia</i> (Stoll, 1790)	Common Lascar	A & F	FC	VC
137.	<i>Parantica aglea</i> (Stoll, 1782)	Glassy Tiger	A, F & S	FC	VC



	Scientific names	Common names	Habitat types	Local status	Status (Nepal)
138.	<i>Phalanta phalanta</i> Drury, 1773	Common Leopard	A & S	R	C
139.	<i>Polyura athamas</i> Drury, 1773	Common Nawab	F	R	VC
140.	<i>Sephisa Chandra</i> (Moore, 1858)	Eastern Courtier	F	R	FC
141.	<i>Stibochiona nicea</i> (Gray, 1846)	Popinjay	F	R	FC
142.	<i>Symbrenthia hypselis</i> (Godart, 1824)	Spotted Jester	A	R	C
143.	<i>Symbrenthia lilaea</i> (Hewitson, 1864)	Common Jester	A & F	FC	VC
144.	<i>Symbrenthia niphanda</i> Moore, 1872	Blue-tail Jester	F	R	FC
145.	<i>Tanaecia julii</i> Lesson, 1837	Common Earl	F	FC	C
146.	<i>Tanaecia lepidea</i> (Butler, 1868)	Grey Count	A & F	FC	VC
147.	<i>Tirumala limniace</i> (Cramer, 1775)	Blue Glassy Tiger	A & F	R	C
148.	<i>Tirumala septentrionis</i> (Butler, 1874)	Dark Blue Tiger	A	R	C
149.	<i>Vagrans egista</i> (Cramer, 1780)	Vagrant	F	R	C
150.	<i>Vanessa cardui</i> (Linnaeus, 1758)	Painted Lady	A	R	VC
151.	<i>Vanessa indica</i> (Herbst, 1794)	Indian Red Admiral	A, F & S	FC	VC
152.	<i>Ypthima baldus</i> Fabricius, 1775	Common Five-ring	A, F & S	VC	VC
153.	<i>Ypthima huebneri</i> Kirby, 1871	Common Four-ring	A, F & S	C	VC
154.	<i>Ypthima newara</i> Moore, 1875	Newari Three-ring	A & F	FC	C
Hesperiidae (26)					
155.	<i>Aeromachus pygmaeus</i> (Fabricius, 1775)	Pygmy Scrub Hopper	F	R	R
156.	<i>Ancistroides nigrita</i> (Latreille, 1824)	Chocolate Demon	A	VR	NE
157.	<i>Borbo bevani</i> (Moore, 1878)	Bevan's Swift	A & S	R	VC
158.	<i>Borbo cinnara</i> (Wallace, 1866)	Rice Swift	A	R	C
159.	<i>Burara harisa</i> (Moore, 1866)	Orange Awlet	S	R	NE
160.	<i>Burara jaina</i> (Moore, 1866)	Orange Awl	F & S	R	NE
161.	<i>Caltoris tulsii</i> D. Niceville, 1884	Purple Swift	F	R	FC
162.	<i>Celaenorhinus munda</i> (Moore, 1884)	Himalayan Spotted Flat	F	VR	FC
163.	<i>Erionota torus</i> Evans, 1941	Sikkim Palm Red-eye	F	VR	FC
164.	<i>Halpe homolea</i> (Hewitson, 1868)	Common Ace	F	R	FC
165.	<i>Hasora badra</i> (Moore, 1858)	Common Awl	F	R	R
166.	<i>Iambrix salsala</i> (Moore, 1866)	Chestnut Bob	A & F	R	C
167.	<i>Matapa aria</i> (Moore, 1865)	Common Red-eye	A	VR	FC
168.	<i>Notocrypta curvifascia</i> (C. & R. Felder, 1862)	Restricted Demon	A & F	R	VC
169.	<i>Parnara guttata</i> (Bremer & Grey, 1852)	Straight Swift	A & F	R	VC
170.	<i>Potanthus pseudomaesa</i> (Moore, 1881)	Indian Dart	F	R	VC
171.	<i>Potanthus trachala tytleri</i> Evans, 1914	Detached Dart	A	R	NE
172.	<i>Pseudocoladenia dan</i> (Fabricius, 1787)	Fulvous Pied Flat	F	R	C
173.	<i>Sarangesa dasahara</i> (Moore, 1866)	Common Small Flat	A & F	FC	C
174.	<i>Sebastonyma dolopia</i> (Hewitson, 1868)	Tufted Ace	F	R	FC
175.	<i>Spialia galba</i> (Fabricius, 1793)	Indian Skipper	A	FC	C
176.	<i>Tagiades litigiosa</i> Moschler, 1878	Water Snow Flat	F	R	C
177.	<i>Tagiades menaka</i> (Moore, 1866)	Spotted Snow Flat	F	R	C
178.	<i>Telicota bambusae</i> Moore, 1878	Dark Palm Dart	A	R	C
179.	<i>Telicota colon</i> Fabricius, 1775	Pale Palm Dart	F	R	FC
180.	<i>Udaspes folus</i> (Cramer, 1775)	Grass Demon	A	R	VC

VC—Very Common | FC—Fairly Common | LC—Locally Common | C—Common | R—Rare | VR—Very Rare | NE—Not Evaluated | F—Forest | A—Agriculture land | S—Settlement area

Table 2. Species richness, abundance, evenness, and diversity indices for different habitat types.

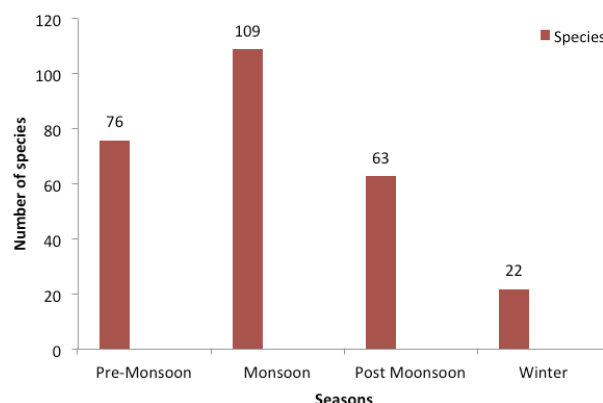
Habitat types	Species richness	Species abundance	Species evenness	Shannon-Wiener diversity index
Forest	147	1,199	0.89	4.47
Agriculture land	100	849	0.90	4.16
Settlement	39	274	0.89	3.28

Table 3. Species richness, abundance, evenness, and diversity indices for each butterfly family.

	Family name	Species richness	Species abundance	Species evenness	Shannon-Wiener Diversity index
1.	Papilionidae	16	237	0.89	2.48
2.	Pieridae	23	587	0.76	2.37
3.	Lycaenidae	42	405	0.74	2.77
4.	Roidinidae	6	25	0.73	1.32
5.	Nymphalidae	67	911	0.90	3.79
6.	Hesperiidae	25	157	0.90	2.93
Total		180	2,322	0.86	4.48

Blackvein Sergeant *Athyma ranga*, Danaid Eggfly *Hypolimnas misippus*, Gaudy Baron *Euthalia lubentina*, Leopard Lacewing *Cethosia cyane*, Common Awl *Hasora badra*, and Pygmy Scrub Hopper *Aeromachus pygmaeus* are rare for Nepal (Smith 2011; Smith et al. 2016). Also, 62 species (34 %) are common, 57 species (32 %) are very common, 33 species (18 %) are fairly common, three species (3 %) are locally common for Nepal, and 12 species (6 %) are not evaluated (Smith 2011; Smith et al. 2016) (Table 1; Figure 5). On behalf of the local status of recorded butterflies, 12 species (7 %) were found to be very rare, followed by rare 96 species (53 %), fairly common 65 species (36 %), common 3 species (2 %), and very common four species (2 %) in the study area (Table 1; Figure 6).

Nymphalidae represented the highest Shannon-Wiener diversity index ($H = 3.79$, 67 species) which means high species diversity, followed by Hesperiidae ($H = 2.93$), Lycaenidae ($H = 2.77$), Papilionidae ($H = 2.48$), Pieridae ($H = 2.37$), and Riodinidae ($H = 1.32$). The highest species abundance was shown by Pieridae (587 individuals), followed by Satyridae (466 individuals), Nymphalidae (911 individuals), Lycaenidae (405 individuals), Papilionidae (237 individuals), Hesperiidae (157 individuals), and Riodinidae (25 individuals). Single individuals of Common Birdwing *Troides Helena*, Himalayan Spot Puffin *Appias lalage lalage*, Blue Imperial *Ticherra acte*, Chocolate Royal *Remelena jangala*, Common Acacia Blue *Surendra quercetrum*, Autumn Leaf *Doleschallia bisaltide*, Danaid Eggfly


Figure 4. Season-wise species richness of butterfly.

Hypolimnas misippus, Chocolate Demon *Ancistroides nigrita*, Common Red-eye *Matapa aria*, Himalayan Spotted Flat *Celaenorrhinus munda*, Sikkim Palm Red-eye *Erionota torus*, and Tawny Rajah *Charaxes bernardus* were recorded in forest habitat.

The Shannon-Wiener diversity index for forest was 4.47, which represented the high species diversity, may be due to high plant diversity (Bair & Launar 1997; Paddhye et al. 2006). The highest species richness was observed in monsoon season, which might be due to high rainfall and humidity that results in high plant diversity (Bhusal & Khanal 2008; Acharya & Vijayan 2015).

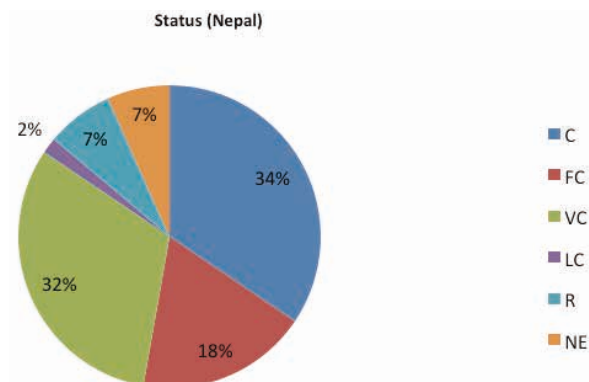


Figure 5. National status of recorded butterflies.

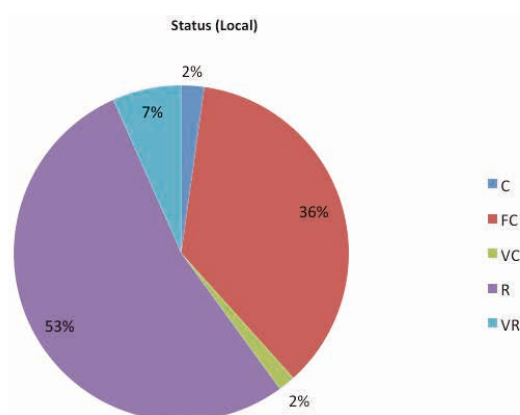


Figure 6. Local status of recorded butterflies.

CONCLUSION

The present study provided a species diversity assessment of butterflies in the study area. Regular monitoring and study would be needed to update the butterfly species checklist in this area. No butterfly conservation activities were performed in the study area. Hence, effective conservation policies and activities should be employed by local government to preserve this high butterfly diversity.

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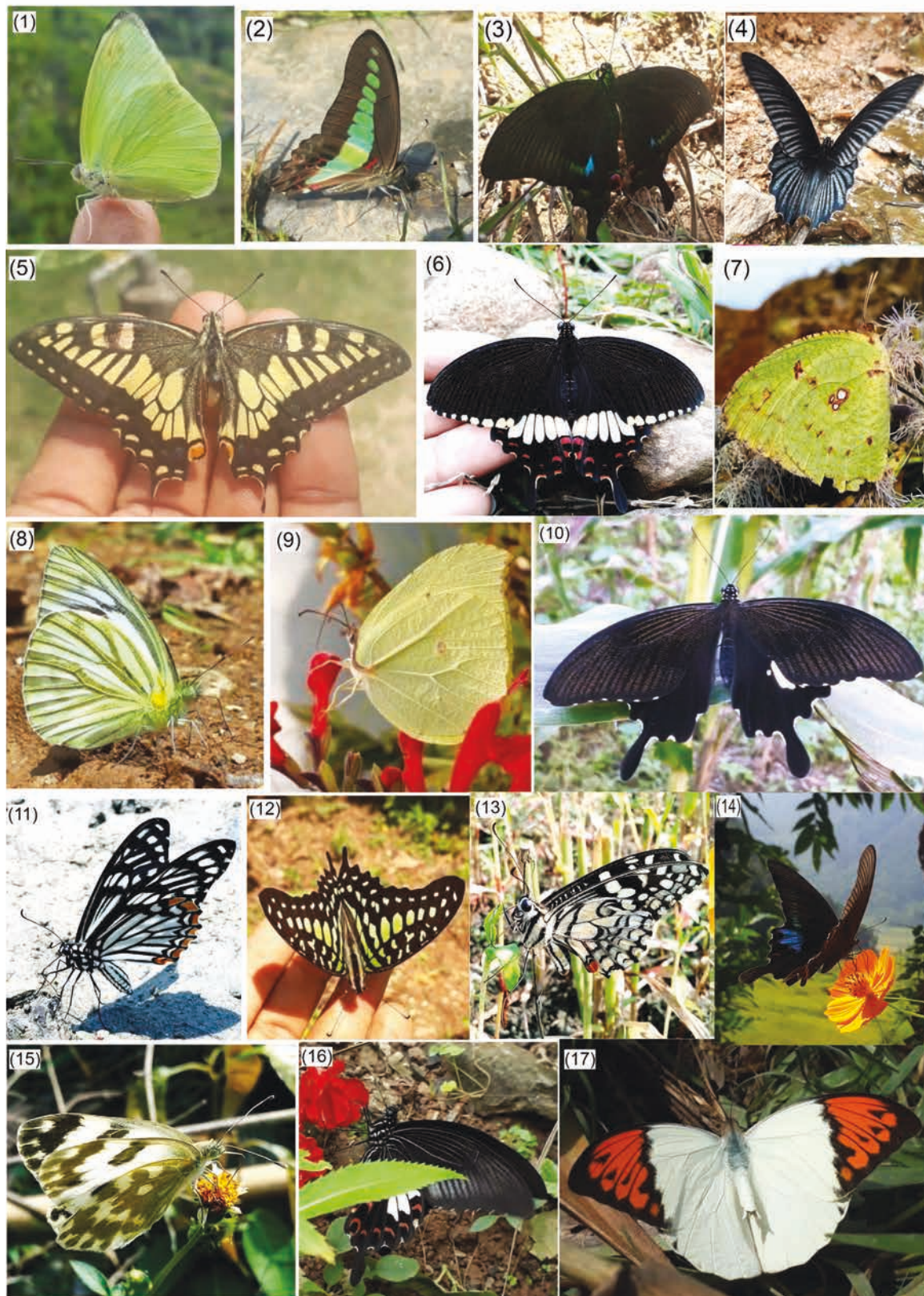


Image 1–17. 1—Common Emigrant © K Neupane | 2—Common Bluebottle © K Neupane | 3—Common Peacock © K Neupane | 4—Spangle © MS Miya | 5—Common Yellow Swallowtail © K Neupane | 6—Common Mormon © MS Miya | 7—Mottled Emigrant © MS Miya | 8—Common Gull © K Neupane | 9—Common Brimstone © K Neupane | 10—Yellow Helen © K Neupane | 11—Common Mime © MS Miya | 12—Tailed Jay © K Neupane | 13—Lime Swallowtail © MS Miya | 14—Blue Peacock © K Neupane | 15—Bath White © MS Miya | 16—Red Helen © K Neupane | 17—Great Orange Tip © K Neupane.

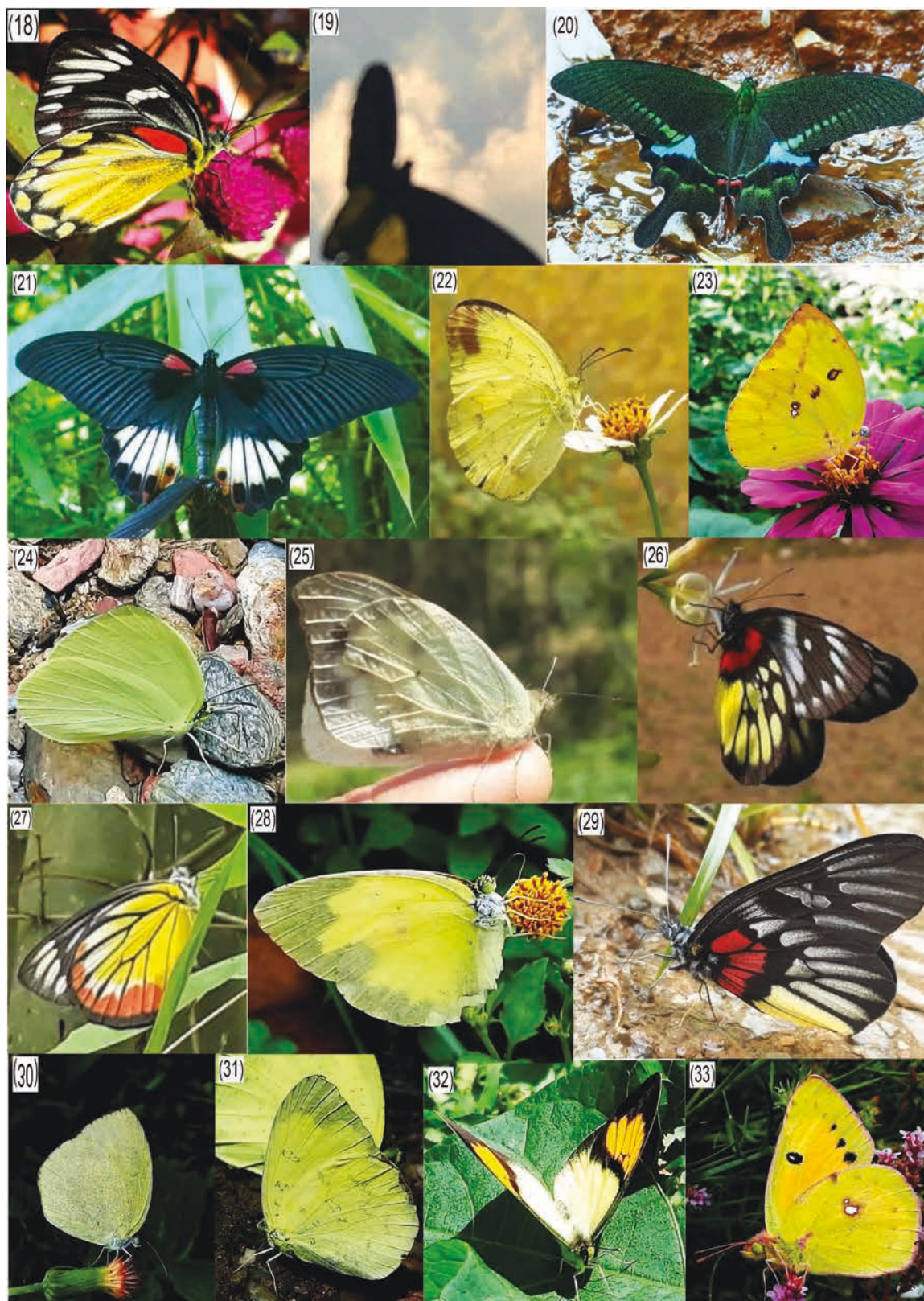


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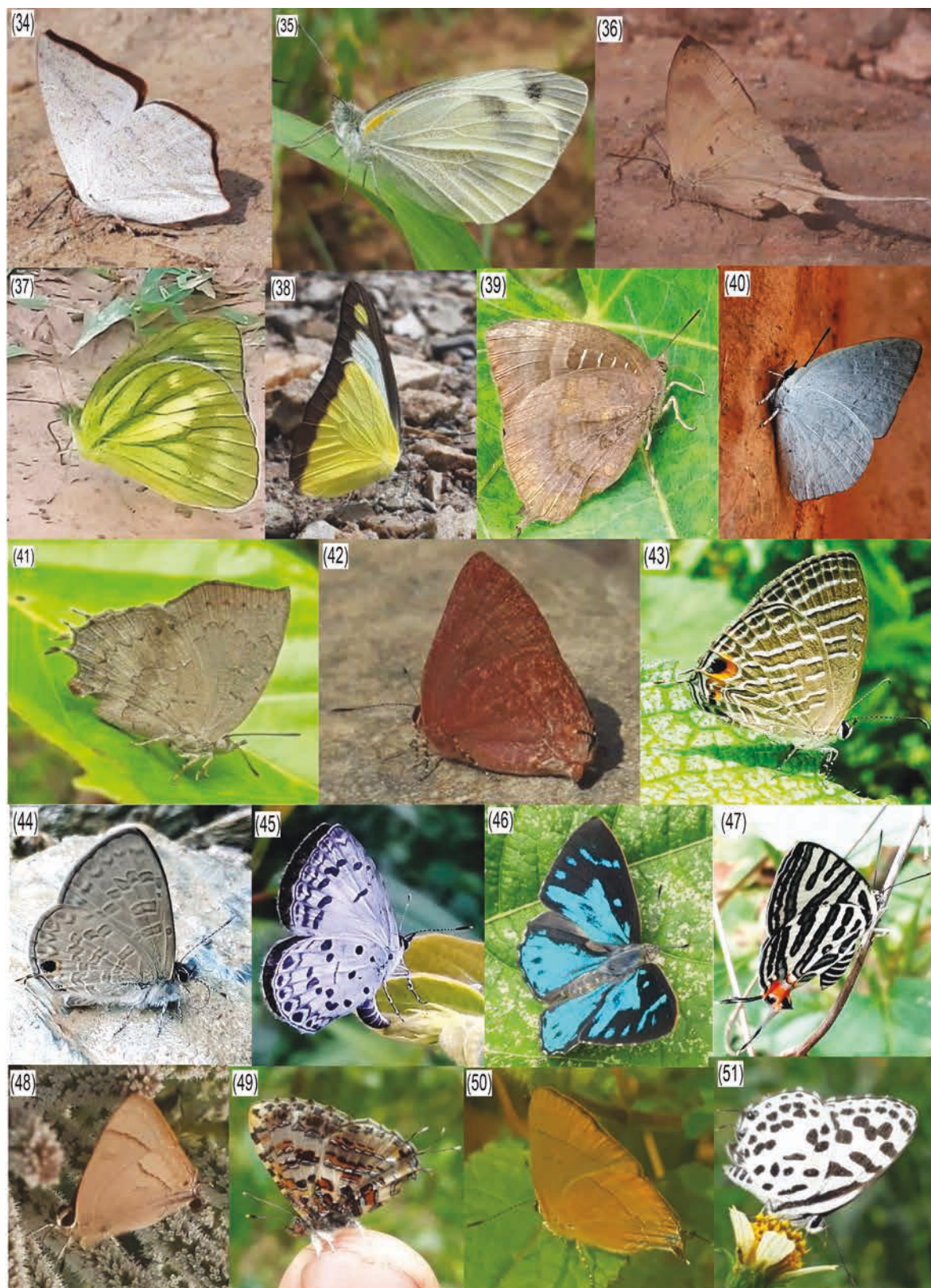


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Image 165–177. 165—Indian Dart © K Neupane | 166—Pale Dart © K Neupane | 167—Purple Swift © K Neupane | 168—Tufted Ace © K Neupane | 169—Pigmy Scrub Hopper © K Neupane | 170—Rice Swift © MS Miya | 171—Restricted Demon © K Neupane | 172—Spotted Snow Flat © K Neupane | 173—Water Snow Flat © K Neupane | 174—Indian Skipper © MS Miya | 175—Dark Palm Dart © MS Miya | 176—Straight Swift © K Neupane | 177—Common Small Flat © MS Miya | 178—Glassy Bluebottle © K Neupane | 179—Common Jay © K Neupane.



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