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**COMMUNICATION**

**BUTTERFLY DIVERSITY OF PUTALIBAZAR MUNICIPALITY, SYANGJA DISTRICT, GANDAKI PROVINCE, NEPAL**

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 4.8. 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, 3199 individuals; H= 4.47). The highest species richness (103 species) was observed in the monsoon season.

Keywords: Abundance, dominance, Pollard walk method, richness

Nepali abstract: पुस्तकीयकर तत्वावधान, स्थलात, जनावरी, स्थलातमा वनविद्या पर्यालोचना व पर्यटन विद्या पाइ गए वातावरण अवसान २०१९ देखि २०२० सालमा विभिन्न प्रजातिको जन्तुमा अनुसन्धान हुनेछ। प्रयोग गरिएको तथाकथा पर्यटन विद्या, हावानिहरू, विविध वनजीविका तथा वनस्पति विभिन्न वनक्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धान गरिएको तथाकथा प्रजातिको निवास विध्या वन, अन्य (धरा, भूभाग, जलस्रोत, जनावरिको जन्तुमा अनुसन्धान) क्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धान पाइएका तथाकथा वनक्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धानका अनुसार प्रजातिको निवास विध्या वन, अन्य (स्थलात, पर्यटन विद्या, हावानिहरू, विविध वनक्षेत्र) तथाकथा वनक्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धान गरिएको तथाकथामा रेपोर्ट तथाकथा प्रजातिको निवास विध्या वनक्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धान गरिएको तथाकथामा रेपोर्ट तथाकथा प्रजातिको निवास विध्या वनक्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धान गरिएको तथाकथामा रेपोर्ट तथाकथा प्रजातिको निवास विध्या वनक्षेत्रमा हुनेछ। जनावरिको जन्तुमा अनुसन्धान गरिएको तथाकथामा रेपोर्ट तथाकथा प्रजातिको निवास विध्या वनक्षेत्रमा हुनेछ।

Key words: Abundance, dominance, Pollard walk method, richness

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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
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:

\[
\text{Shannon-Wiener diversity index (H)} = -\sum_{i=1}^{n} p_i \ln p_i
\]

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

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 given 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), Hesperiidae (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 eumolphus, Indian Purple Sapphire Heliophorus indicus, Tailed Judy Abisara neophron, Autumn Leaf Doleschallia bisaltide,
Table 1. List of butterflies recorded from Putalibazar Municipality, Syangja.

| Scientific names | Common names | Habitat types | Local status | Status (Nepal) |
|------------------|--------------|---------------|--------------|---------------|
| Papilionidae (16) |              |               |              |               |
| 1. Graphium agamemnon (Linnaeus, 1758) | Tailed Jay | A & S | R | C |
| 2. Graphium cloanthus (Westwood, 1841) | Glassy Bluebottle | F | R | FC |
| 3. Graphium dasan Felder & Felder, 1864 | Common Jay | A & F | FC | FC |
| 4. Graphium doson (Felder & Felder, 1864) | Common Bluebottle | A & S | FC | C |
| 5. Papilio arcturus (Westwood, 1842) | Blue Peacock | A & S | R | C |
| 6. Papilio bianor Cramer, 1777 | Common Peacock | F & S | R | C |
| 7. Papilio clytia dissimilis (Linnaeus, 1758) | Common Mime | F | R | FC |
| 8. Papilio demoleus (Linnaeus, 1758) | Lime Swallowtail | A, F & S | FC | VC |
| 9. Papilio helenus (Linnaeus, 1758) | Common Yellow Swallowtail | A | R | C |
| 10. Papilio machaon (Linnaeus, 1758) | Great Mormon | A & F | FC | C |
| 11. Papilio nepheus Boisduval, 1836 | Yellow Helen | F | R | FC |
| 12. Papilio paris Linnaeus, 1758 | Paris Peacock | A & F | FC | C |
| 13. Papilio polyes Linnaeus, 1758 | Common Mormon | A, F & S | FC | VC |
| 14. Papilio protenor Cramer, 1775 | Spangle | A & F | FC | C |
| 15. Triodes aeacus (Felder & Felder, 1860) | Common Birdwing | F | R | NE |
| Pieridae (23) | | | | |
| 17. Appias lalage lalage (Doubleday, 1842) | Himalayan Spot Puffin | F | VR | NE |
| 18. Appias lyncida (Cramer, 1779) | Chocolate Albatross | A & S | FC | FC |
| 19. Catopsilia pomona crocale Fabricius, 1775 | Common Emigrant | A, F & S | FC | VC |
| 20. Catopsilia pomona pomona (Fabricius, 1775) | Lemon Emigrant | A, F & S | FC | VC |
| 21. Catopsilia pyranthe Linnaeus, 1758 | Mottled Emigrant | A & F | FC | VC |
| 22. Cepora nadina (Lucas, 1852) | Lesser Gull | A & F | R | FC |
| 23. Cepora narissa Fabricius, 1775 | Common Gull | A & F | FC | C |
| 24. Colias fieldii (Menetries, 1855) | Dark Clouded Yellow | A & S | R | C |
| 25. Delias acalis (Godart, 1819) | Red-breast Jezebel | A & F | R | FC |
| 26. Delias descampsii (Boisduval, 1836) | Red-spot Jezebel | F | R | LC |
| 27. Delias eucharis (Drury, 1773) | Common Jezebel | F & S | R | FC |
| 28. Delias hyparete (Linnaeus, 1758) | Painted Jezebel | A & S | R | VC |
| 29. Delias postice (Linnaeus, 1767) | Red-base Jezebel | A & F | R | VC |
| 30. Eurema blanda (Boisduval, 1836) | Three-spot Grass Yellow | A, F & S | C | VC |
| 31. Eurema brigitta (Stoll, 1780) | Small Grass Yellow | A, F & S | C | C |
| 32. Eurema hecale (Linnaeus, 1758) | Common Grass Yellow | A, F & S | VC | VC |
| 33. Eurema laeta (Boisduval, 1836) | Spotless Grass Yellow | A & S | FC | C |
| 34. Gandaca harina (Horsfield, 1829) | Tree Yellow | F | R | R |
| 35. Genaptyryx rhanni (Linnaeus, 1758) | Common Brimstone | F | R | C |
| 36. Heczomoea glorippe (Linnaeus, 1758) | Great Orange Tip | A & F | FC | VC |
| 37. Ixias pyrene (Linnaeus, 1764) | Yellow Orange Tip | A & F | FC | C |
| 38. Pieris candia (Linnaeus, 1768) | Indian Cabbage White | A, F & S | VC | VC |
| 39. Ponta doplidice (Linnaeus, 1758) | Bath White | A & F | FC | C |
| Lycæiidae (42) | | | | |
| 40. Acytolepis puspa (Horsfield, 1828) | Common Hedge Blue | A | R | VC |
| 41. Arhopala centaurus (Fabricius, 1775) | Centaur Oakblue | F | FC | VC |
| 42. Arhopala eumolpus Cramer, 1780 | Green Oakblue | F | R | R |
| 43. Arhopala aenea (Hewitson, 1869) | Hewitson's Dull Oakblue | F | R | FC |
| Scientific names                  | Common names          | Habitat types | Local status | Status (Nepal) |
|----------------------------------|-----------------------|---------------|--------------|----------------|
| 44. Arhopala paramuta (D. Niceville, 1884) | Hooked Oakblue        | F             | R            | VC             |
| 45. Castalius rosison Fabricius, 1775 | Common Pierrot        | A & F         | FC           | VC             |
| 46. Catopeolina major (Druce, 1895)    | Common Tinsel         | F             | R            | FC             |
| 47. Catochrysops strabo (Fabricius, 1793) | Forget-me-not Blue    | A             | FC           | VC             |
| 48. Celasturia lavenuralis (Moore, 1877) | Plain Hedge Blue      | A             | R            | NE             |
| 49. Chilaria othona (Hewitson, 1865)    | Orchid Tit            | F             | R            | C              |
| 50. Curetis acuta Moore, 1877         | Angled Sunbeam        | F             | R            | NE             |
| 51. Curetis bulis (Westwood, 1851)    | Bright Sunbeam        | F             | R            | C              |
| 52. Euchrysops creajus (Fabricius, 1798) | Gram Blue             | A             | FC           | C              |
| 53. Everes lacturnus (Godart, 1824)   | Indian Cupid          | A & F         | FC           | VC             |
| 54. Heliophorus epicles (Godart, 1824) | Purple Sapphire      | A & F         | FC           | VC             |
| 55. Heliophorus indicus (Fruhstorfer, 1908) | Indian Purple Sapphire | F          | R            | R              |
| 56. Heliothrophus sena (Kollar, 1844)  | Sorrel Sapphire       | F             | R            | LC             |
| 57. Iribata timoleon (Stoll, 1790)    | Silverstreak Blue    | F             | R            | FC             |
| 58. Jamides bochus (Stoll, 1782)      | Dark Cerulean         | A             | R            | C              |
| 59. Jamides celomo (Cramer, 1775)     | Common Cerulean       | A, F & S      | FC           | VC             |
| 60. Lampides boeticus (Linnaeus, 1767) | Pea Blue              | A & S         | FC           | VC             |
| 61. Lestranicus transpectus (Moore, 1879) | White-banded Hedge Blue | A           | R            | C              |
| 62. Loxura atymnus Stoll, 1780        | Yamfly                | A             | R            | FC             |
| 63. Megisba malaya (Horsfield, 1828)  | Malayan               | A             | R            | FC             |
| 64. Poritia hewitsoni (Moore, 1866)   | Common Gem            | F             | R            | NE             |
| 65. Prosotas dubiosa (Semper, 1879)   | Tailell Line Blue     | F             | R            | C              |
| 66. Prosotas nori (Felder, 1860)      | Common Line blue      | F             | FC           | VC             |
| 67. Pseudoaenina moha (Kollar, 1844)  | Pale Grass Blue       | A, F & S      | VC           | VC             |
| 68. Rapala mane (Hewitson, 1863)      | Slate Flash           | F             | R            | VC             |
| 69. Rapala nissa (Kollar, 1844)       | Common Flash          | F             | FC           | VC             |
| 70. Rapala pheretima (Hewitson, 1863) | Copper Flash          | F             | R            | C              |
| 71. Rapala rectivitta (Moore, 1879)   | Shot Flash            | F             | R            | FC             |
| 72. Remelena jangala (Horsfield, 1829) | Chocolate Royal       | F             | VR           | R              |
| 73. Spindasis ishita (Horsheld, 1829) | Long-banded Silverline | F         | R            | C              |
| 74. Spindasis syma Horsheld, 1829     | Club Silverlines      | F             | R            | C              |
| 75. Surendra queretorum (Moore, 1858) | Common Acacia Blue    | F             | VR           | C              |
| 76. Terasa hamada (Druce, 1875)       | Forest Pierrot        | F             | R            | NE             |
| 77. Ticherra acte (Moore, 1858)       | Blue Imperial         | F             | VR           | R              |
| 78. Léda dilectus (Moore, 1879)       | Pale Hedge Blue       | A & F         | FC           | VC             |
| 79. Zeltus amosa (Hewitson, 1865)     | Fluffy Tit            | F             | R            | FC             |
| 80. Zizeeria karsandra (Moore, 1865)  | Dark Grass Blue       | A & F         | FC           | NE             |
| 81. Zizina otti (Fabricius, 1787)     | Lesser Grass Blue     | A & F         | FC           | C              |

**Riodinidae (6)**

| Scientific names                  | Common names | Habitat types | Local status | Status (Nepal) |
|----------------------------------|--------------|---------------|--------------|----------------|
| 82. Abisara bifasciato Moore, 1877 | Plum Judy    | F             | R            | FC             |
| 83. Abisara fylla (Westwood, 1851) | Dark Judy    | A             | R            | VC             |
| 84. Abisara neophron (Hewitson, 1861) | Tailed Judy | F             | R            | R              |
| 85. Dodona eggan (Westwood, 1851)  | Orange Punch | F             | R            | C              |
| 86. Dodona eugenes Bates, 1868    | Tailed Punch  | F             | R            | C              |
| 87. Zemererregas Cramer, 1780     | Punchinello   | A & F         | FC           | VC             |

**Nymphalidae (67)**

| Scientific names                  | Common names | Habitat types | Local status | Status (Nepal) |
|----------------------------------|--------------|---------------|--------------|----------------|
| 88. Abrota ganga Moore, 1858      | Sergeant Major | F             | R            | FC             |
| 89. Achara terpsicore Linnaeus, 1758 | Tawny Coster | F             | R            | FC             |
| Scientific names                                      | Common names       | Habitat types | Local status | Status (Nepal) |
|------------------------------------------------------|--------------------|---------------|--------------|---------------|
| 90. Aglais cashmirensis (Kollar, 1844)               | Indian Tortoiseshell | A, F & S     | FC           | VC            |
| 91. Argytnis childreni (Gray, 1831)                 | Large Silverstripe  | F             | R            | C             |
| 92. Argytnis hyperburs (Linnaeus, 1763)             | Indian Fritillary  | A             | R            | VC            |
| 93. Athyma nefte Cramer, 1780                       | Color Sergeant     | F             | R            | C             |
| 94. Athyma perius Linnaeus, 1758                     | Common Sergeant    | A & F         | FC           | VC            |
| 95. Athyma ranga Moore, 1858                         | Blackvein Sergeant | F             | R            | R             |
| 96. Athyma selenophora (Kollar, 1844)                | Staff Sergeant     | A & F         | FC           | C             |
| 97. Cethosia biblis (Drury, 1773)                    | Red Lacewing       | F             | R            | FC            |
| 98. Cethosia cyane (Drury, 1773)                     | Leopard Lacewing   | F             | R            | R             |
| 99. Charaxes bernardus (Fabricius, 1793)             | Tawny Rajah        | F             | VR           | LC            |
| 100. Chersonesia rusa (Doubleday, 1848)              | Common Maplet      | A & F         | FC           | VC            |
| 101. Cupha erymanthis Drury, 1773                    | Rustic             | F             | R            | C             |
| 102. Cyrestis thyodamas Boisduval, 1836              | Common Map         | A & F         | FC           | VC            |
| 103. Danaus chrysippus Linnaeus, 1758                | Plain Tiger        | A, F & S      | FC           | VC            |
| 104. Danaus genutia (Cramer, 1779)                  | Common Tiger       | A, F & S      | FC           | VC            |
| 105. Discophora sondaica Boisduval, 1836             | Common Duffer      | F             | R            | FC            |
| 106. Doloeschallia lisaalide Cramer, 1777           | Autumn Leaf        | F             | VR           | R             |
| 107. Elymnias malelas (Hewitson, 1863)               | Spotted Palmfly    | A, F & S      | R            | C             |
| 108. Euploea core (Cramer, 1780)                    | Common Indian Crow | A, F & S      | FC           | VC            |
| 109. Euploea meliciber (Cramer, 1777)                | Striped Blue Crow  | A & F         | FC           | VC            |
| 110. Euthalia aconthea (Cramer, 1777)                | Common Baron       | A & F         | FC           | C             |
| 111. Euthalia dubentina (Cramer, 1777)               | Gaudy Baron        | F             | R            | R             |
| 112. Hestinalis nema (Doubleday, 1844)               | Circe              | A & F         | R            | C             |
| 113. Hypolimnas bolina Linnaeus, 1758                | Great Eggfly       | A & F         | R            | C             |
| 114. Hypolimnas misipus (Linnaeus, 1764)             | Danaid Eggfly      | F             | VR           | R             |
| 115. Junonia almana Linnaeus, 1758                   | Peacock Pansy      | A & S         | FC           | VC            |
| 116. Junonia alites (Linnaeus, 1763)                 | Grey Pansy         | A, F & S      | FC           | C             |
| 117. Junonia iphite (Cramer, 1779)                  | Chocolate Pansy    | A & F         | FC           | VC            |
| 118. Junonia lamonias Linnaeus, 1758                 | Lemon Pansy        | A, F & S      | FC           | VC            |
| 119. Junonia arthea (Linnaeus, 1758)                 | Blue Pansy         | A & F         | R            | VC            |
| 120. Killima inachus (Doyere, 1840)                  | Orange Oakleaf     | F             | FC           | C             |
| 121. Kaniska canace (Linnaeus, 1763)                 | Blue Admiral       | F             | R            | C             |
| 122. Lethe europa Fabricius, 1787                    | Bamboo Treebrown   | A & F         | FC           | C             |
| 123. Lethe confusa Aurivillius, 1897                 | Banded Treebrown   | A & F         | FC           | VC            |
| 124. Lethe mekero (Moore, 1858)                      | Common Red Forester| F             | FC           | NE            |
| 125. Melanitis iedo (Linnaeus, 1758)                 | Common Evening Brown| A, F & S   | FC           | VC            |
| 126. Melanitis phedima (Cramer, 1780)                | Dark Evening Brown | A, F & S      | FC           | C             |
| 127. Mycalesis francisca Stoll, 1780                 | Lilacine Bushbrown | F             | FC           | C             |
| 128. Mycalesis molsana (Moore, 1858)                 | White-line Bushbrown| A & F       | R            | C             |
| 129. Mycalesis perseus Fabricius, 1775               | Common Bushbrown   | A, F & S      | FC           | VC            |
| 130. Mycalesis visala Moore, 1858                    | Long-brand Bushbrown| A & F      | FC           | C             |
| 131. Nemets chandica Moore, 1858                     | Angled Red Forester| F             | FC           | VC            |
| 132. Neptis cartica Moore, 1872                     | Plain Sailer       | F             | R            | C             |
| 133. Neptis hylas Linnaeus, 1758                     | Common Sailer      | A, F & S      | FC           | VC            |
| 134. Neptis soma Moore, 1858                         | Creamy Sailer      | F             | R            | C             |
| 135. Orsinaena medus (Fabricius, 1775)               | Jungle Brown       | A & F         | FC           | VC            |
| 136. Pantoporia hardonius (Stoll, 1790)              | Common Lascar      | A & F         | FC           | VC            |
| 137. Parantica aglea (Stoll, 1782)                   | Glassy Tiger       | A, F & S      | FC           | VC            |
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| Scientific names | Common names | Habitat types | Local status (Nepal) |
|------------------|--------------|---------------|---------------------|
| **Scientific names** | **Common names** | **Habitat types** | **Local status** |
| 138. Phalanta phalanta Drury, 1773 | Common Leopard | A & S | R |
| 139. Polyura athamas Drury, 1773 | Common Nawab | F | R |
| 140. Sephsa Chandra (Moore, 1858) | Eastern Courtier | F | R |
| 141. Stibochiona riceo (Gray, 1846) | Popinjay | F | R |
| 142. Symbrenthia haeppeli (Godart, 1824) | Spotted Jester | A | R |
| 143. Symbrenthia ilaea (Hewitson, 1864) | Common Jester | A & F | R |
| 144. Symbrenthia nipheada Moore, 1872 | Blue-tail Jester | F | R |
| 145. Tanaecia juli Lessom, 1837 | Common Earl | F | C |
| 146. Tanaecia lepidea (Butler, 1868) | Grey Count | A & F | C |
| 147. Tiriomala limniace (Cramer, 1775) | Blue Glassy Tiger | A & F | C |
| 148. Tiriomala septentrions (Butler, 1874) | Dark Blue Tiger | A | C |
| 149. Vagrans egista (Cramer, 1780) | Vagrant | F | R |
| 150. Vanessa cardui (Linnaeus, 1758) | Painted Lady | A | R |
| 151. Vanessa indica (Herbst, 1794) | Indian Red Admiral | A, F & S | VC |
| 152. Ypthima baldus (Godart, 1824) | Spotted Jester | A & F | FC |
| 153. Ypthima lilaea (Hewitson, 1864) | Common Jester | A, F & S | C |
| 154. Ypthima niphanda Moore, 1872 | Blue-tail Jester | F | R |
| 155. Aeromachus pygmaeus (Fabricius, 1775) | Pygmy Scrub Hopper | F | R |
| 156. Ancistroides nigrita (Latreille, 1824) | Chocolate Demon | A | VR |
| 157. Borbo bevani (Moore, 1878) | Bevan’s Swift | A & S | R |
| 158. Borbo cinnara (Wallace, 1866) | Rice Swift | A | R |
| 159. Burara harisa (Moore, 1866) | Orange Awlet | S | R |
| 160. Burara joins (Moore, 1866) | Orange Awl | F & S | R |
| 161. Caloris tulsi D. Niceville, 1884 | Purple Swift | F | R |
| 162. Celaenorrhinus mundu (Moore, 1884) | Himalayan Spotted Flat | F | VR |
| 163. Erionota torus Evans, 1941 | Sikkim Palm Red-eye | F | VR |
| 164. Halpe homolea (Hewitson, 1866) | Common Ace | F | R |
| 165. Hassora badi (Moore, 1858) | Common Awl | F | R |
| 166. Iambrix alta (Moore, 1866) | Chestnut Bob | A & F | R |
| 167. Matapa ario (Moore, 1865) | Common Red-eye | A | VR |
| 168. Notocrypta curvifascia (C. & R. Felder, 1862) | Restricted Demon | A & F | R |
| 169. Parmara guttata (Bremer & Grey, 1852) | Straight Swift | A & F | R |
| 170. Potanthus pseudoaes (Moore, 1881) | Indian Dart | F | R |
| 171. Potanthus trachola tytleri Evans, 1914 | Detached Dart | A | R |
| 172. Pseudocoladenia dan (Fabricius, 1787) | Fulvous Pied Flat | F | R |
| 173. Sarangesa dasahara (Moore, 1866) | Common Small Flat | A & F | C |
| 174. Sebastonyma dilopia (Hewitson, 1868) | Tufted Ace | F | R |
| 175. Spialia balga (Fabricius, 1793) | Indian Skipper | A | FC |
| 176. Fagiades iligiosa Moschler, 1878 | Water Snow Flat | F | R |
| 177. Fagiades menaka (Moore, 1866) | Spotted Snow Flat | F | R |
| 178. Telicota bambusa Moore, 1878 | Dark Palm Dart | A | R |
| 179. Telicota zolon Fabricius, 1775 | Palm Palm Dart | F | R |
| 180. Lidaspes fulus (Cramer, 1775) | Grass Demon | A | R |

Glossary:

- 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. Riodinidae   | 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 *Athyama 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 Emperial *Ticherra acte*, Chocolate Royal *Remelena jangala*, Common Acacia Blue *Surendra quercetrum*, Autumn Leaf *Doleschallia bisaltide*, Danaid Eggfly *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).
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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