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Butterfly Diversity in Kakrebihar Forest Area, Birendranagar, Surkhet, Nepal

Buddhi Ram Oli 1, Manoj Sharma 2 & Birendra Shahi 3

1 Central Department of Zoology, T.U. Kirtipur, Kathmandu Nepal;
buddhiramoli.2049@gmail.com
ORCID ID: 0000-0001-8629-5070
2 Central Department of Zoology, T.U. Kirtipur, Kathmandu Nepal;
munu.nepal50@gmail.com
ORCID ID: 0000-0001-7287-9729
3 Birendranagar-03, Surkhet, Nepal; Email: vren shahi321@gmail.com
munu.nepal50@gmail.com

Abstract

Butterfly diversity changes with habitat and meteorological factors. They are facing threats due to many environmental and anthropogenic causes so need their diversity and status investigation to initiate conservation programs. The butterfly diversity study was conducted at Kakrebihar protected forest, the first government protected forest, during January to December 2021. The data was collected using Ocular Point Observation Method. Capture and release method along with photography was used for butterfly identification. Total of 431 individuals of 33 species of butterflies were recorded belonging to 24 genera and 7 families. Among recorded families of butterflies, Nymphalidae was dominant family followed by family Hisperiidae. Among recorded butterfly species, 17 species were very common, 15 were common and one was rare. The total butterfly diversity and evenness were recorded to be high in the study area.

The butterfly diversity was found to be high during post-monsoon season followed by monsoon and pre-monsoon season and its lowest during winter season.

Key words
Lepidoptera, species richness, diversity, Kakrebihar, West Nepal

Introduction

Butterflies taxonomically well studied group of insects (Sundufu and Dumbuya, 2008). In Nepal, study on butterfly was started since 1826 A.D. (Khanal and Smith, 1997, Smith, 2011). Global butterfly diversity is represented about 19,238 species (Weiss et al., 1988). Nepal harbors 670 species of butterflies belonging to 263 genera and 11 families (KC, 2020). The distribution pattern of butterflies varies with respect to physiographic zones (Bhusal and Khanal, 2008). About 50%, 81% and 13% butterflies are found in Terai, Midland and Highland ecological zones of Nepal respectively (Smith, 2011).

Butterflies are good pollinators, indicators of climate change and have important role in ecosystem (Simonson et al., 2001 and Hamer et al., 2005). Butterflies prefer only particular types of habitat (Patel and Pandya, 2014) and response quickly to the habitat changes (Bourn and Thomas, 2002). Butterflies show floral preference hence floral diversity plays key role in butterfly diversity and distribution (Arya et al., 2014). Butterfly diversity is highest in areas where large amount of host plants are available (Ghorai and Sengupta, 2014) and lowest in shrubs, grassland and open areas (DeVries, 1988).

Environmental components have vital role in the species composition of butterflies. Some of the butterfly fauna present year around although many butterfly species are seasonal (Kunte, 1997). The flying capacity and special ecological needs of the species play vital role in the distribution of that species. The global declination of butterflies has been indicated by many researchers in different parts of the world due to habitat degradation, climate change, use of pesticides and deforestation (Smith, 1994). The diversity of the butterfly should be known from the concerned area for the conservation which is lacking from Surkhet valley including Kakrebihar forest area. The major aim of this research was to explore the diversity and local status of butterfly from Kakrebihar forest area, Birendranagar, Surkhet, Nepal.

Methods

Study area

Kakrebihar – The study area, is the historical place with about 1.7 km^2 located at Birendranagar Municipality, Surkhet – the provincial center of Karnali province (fig. 1). The study area is mainly covered by forest dominated with *Sorea robusta* and *Pinus roxburgi*. The Kakrebihar forest also has grassland and open areas. Kakrebihar is tourist area as it historical place and has reconstructed historical temple at about center and top point of the forest. The people around the study area get enter to the forest for the collection of forest products including firewood, animal fodders, mushrooms etc.

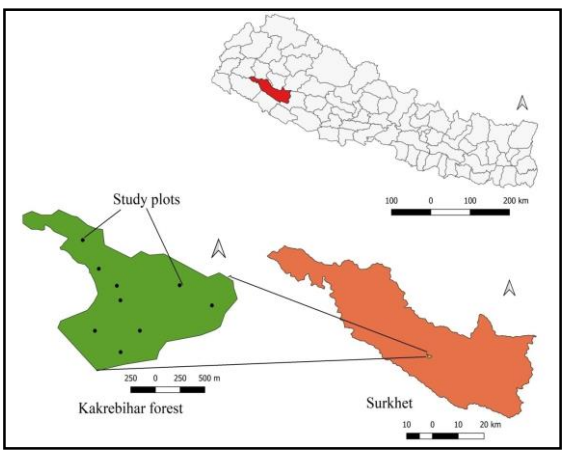

Fig. 1: Map of study area (Kakrebihar forest, Surkhet).

Field data collection

For butterfly survey, total 10 study plots of 50 m × 50 m area were established in different landscapes of Kakrebihar area representing forest (7 plots), grassland (1 plot) and open area (2 plots). The survey was carried out from January to December of 2021. In each season (pre-monsoon, monsoon, post-monsoon and winter), sampling plots were visited twice to record butterfly fauna. For each visit, we spent 2 days; hence total 16 days of sampling effort was given (2 days/visit × 2 visits per season × 4 seasons = 16 days). Observation was carried out during 8:00 hr. to 14:00 hr. Butterflies were captured using sweeping net and released immediately after identification with the help of field guides (Smith, 1994; 2010; 2011). Some of the butterflies were photographed in their natural habitat with Nikon D3400 (L 135) camera and later identified. Collecting live specimens was strictly avoided in this study.

Data Analysis

Data collected during study periods was arranged by using Microsoft Excel Version 2010. Diversity index was calculated by using Shannon-Weiner Index (H) whereas Pielou's evenness index (J) was also calculated to compare the relative abundance of butterflies recorded during the study period. Status of Butterfly species were categorized as very common (VC) (≥ 10), common (C) (≥ 5 to < 10) and rare (R) (< 5) based on the frequency of sightings in study area.

Results

Family composition of butterfly species

In total 431 individuals of 33 butterfly species were recorded during study period (Table 1). Recorded species belong to 24 genera and 7 families. Family Nymphalidae was the most abundant family which contributes maximum number of species (11) followed by Pieridae (7), Lycaenidae (4), Satyridae (4), Papilionidae (3), Danaidae (3) and Hesperiidae (1) (Fig. 2, Table 1).

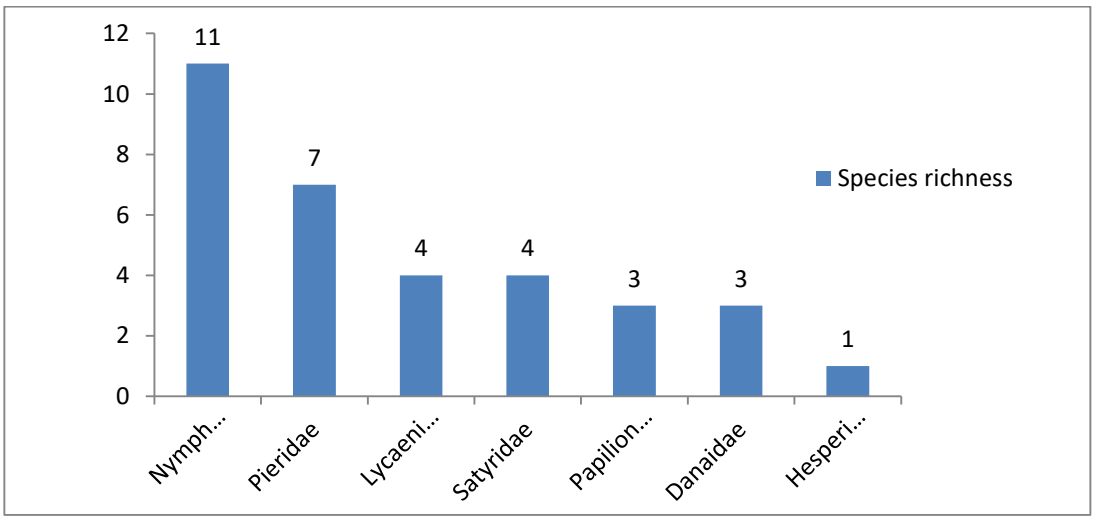

Fig. 2: Family wise composition of butterfly recorded in the study area.

Butterfly listing and species status

Based on local status, one species was found rare, 15 species were common and 17 species were very common for the study area. One of the species of family Pieridae - *Pieris canidia indica* was the species having highest abundance and was recorded throughout the study period from all seasons.

Previously, distribution of butterflies in Nepal was categorized into four regions i.e. W (West), C (Central), K (Kathmandu Valley) and E (East). Table 1 also shows the distribution pattern of recorded butterfly species in different parts of Nepal. All recorded species were distributed throughout Nepal.

Table 1

Butterflies recorded during study period with their abundance (Abd.), local status and distribution.

Family	Common name	Scientific name	Abd.	Local status	Distribution
Hespiridae	Straight Swift	*Parnara guttata mangala*	9	C	WCEK
Papilionidae	Lime Swallowtail	*Papilio demoleus*	10	VC	WCEK
	Common Mormon	*Papilio polytes*	18	VC	WCEK
	Common Bluebottle	*Graphium cloanthus cloanthus*	9	C	WCEK
Pieridae	Mottled Emigrant	*Catopsilia pyranthe*	36	VC	WCEK
	Common Emigrant	*Catopsilia pomona pomona*	17	VC	WCEK
	Common Brimstone	*Gonepteryx rhamni*	14	VC	WCEK
	Hill Jezebel	*Delias belladonna*	5	C	WCEK
	Common Grass yellow	*Terias hecabe*	15	VC	WCEK
	Large Cabbage White	*Pieris brassicanepalensis*	10	VC	WCEK
	Indian Cabbage White	*Pieris canidia indica*	44	VC	WCEK
Lycaenidae	Yamfly	*Loxura atymnus*	17	VC	WCEK
	Peablue	*Lampides boeticus*	17	VC	WCEK
	Common Red Flash	*Rapala airbus*	6	C	WCEK
	Cornelian	*Deudorix epijarbus*	9	C	WCEK
	Indian Fritillary	*Argyreus hyperbius*	8	C	WCEK
Nymphalidae	Rustic	*Cupha erymanthis lottis*	9	C	WCEK
	Vagrant	*Cupha vagrans*	7	C	WCEK
	Chocolate Pancy	*Precis almana almana*	9	C	WCEK
	Yellow Pancy	*Precis hierta hierta*	3	R	WCEK
	Peacock Pansy	*Precis almaa*	11	VC	WCEK
	Lemon Pansy	*Precis lemonias*	9	C	WCEK
	Common Sailer	*Neptishylas kamrupa*	5	C	WCEK
	Great Egg fly	*Hypolimnas bolina*	8	C	WCEK
	Indian Tortoiseshell	*Aglias cashmirensis aesis*	16	VC	WCEK
	Indian Red Admiral	*Venessa indica*	7	C	WCEK
Satyridae	Jungle Brown	*Orsotrioena medus*	38	VC	WCEK
	Banded Tree Brown	*Lethe confusa consusa*	7	C	WCEK
	Common Evening	*Melanitis leda*	18	VC	WCEK

Danidae	Brown				
	Common Bush Brown	*Mycelesis perseus*	12	VC	WCEK
	Common Tiger	*Danaus genutia*	10	VC	WCEK
	Plain Tiger	*Danaus chrysippus chrysippus*	7	C	WCEK
	Glassy Tiger	*Parantica aglea*	11	VC	WCEK

Butterfly diversity and evenness

The Shannon-Winner diversity index (H) was found to be 3.299 with Pielou's species evenness (J) of 0.943. The Shannon-Wiener index (H) and Pielou's species evenness (J) were found to be highest in post monsoon season followed by monsoon, pre-monsoon and winter seasons. The species richness and abundance of butterfly species followed same seasonal pattern.

Table 2

Biodiversity indices for butterfly fauna in Kakrebihar forest area in different seasons.

Ecological Indices	Pre monsoon	Monsoon	Post monsoon	Winter	Total
Total abundance	100	119	143	69	431
Shannon-Wiener diversity index (*H*)	2.994	3.22	3.349	2.851	3.299
Species evenness (J)	0.919	0.949	0.958	0.909	0.943
Species richness (S)	26	30	33	23	33

Discussion

We listed 33 butterfly species belonging to 7 families. Family Nymphalidae has good ecological adoption and dispersal ability (Alder et al., 1996; Ghimire, 2001 and Thapa, 2008) which may be the cause of high species abundance of family Nymphalidae in our study. The finding of this study also coincides with the findings from different parts of the world (Prajapati et al., 2000; Hamer et al., 2005; Bhusal and Khanal, 2008; Chalise, 2010 and Khan et al., 2011).

Most of the butterfly species recorded during the study period in the Kakrebihar forest were very common followed by common and single species was rare. In addition, recorded butterfly species were those which have distribution throughout the country. This indicates that the forest is home for nationally common butterfly species not for specific one. The rare status of one butterfly species indicates that the butterfly fauna are facing threats of extinction from the Kakrebihar forest which may be due to mainly anthropogenic.

The good diversity of butterfly fauna in Kakrebihar forest may be supported by the presence of some open areas (Patel and Pandya, 2014). We recorded high butterfly diversity in autumn due to availability of larval food plants and nectar rich flower sources for adult butterflies (Kumar et al., 2016). This finding is similar with the findings of different studies (Gowada et al., 2011; Arya et al., 2014 and Ghosh and Saha, 2016). However, some researcher revealed the dominant butterfly

population during summer (Kunte, 1997 and Sengupta et al., 2014).

Conclusion and recommendation

Butterfly diversity is high in Kakrebihar forest area and it's the home for common butterfly species. The low abundance of some butterfly species indicates that they are facing threats of extinction.

During survey periods, we have observed anthropogenic disturbances in Kakrebihar forest area due to exploitation of forest products and human encroachment. The tourist activities and pick nick spots have other problems for the biodiversity conservation in this area. Hence, we would like to suggest to the concerned agencies to initiate conservation practices and programs for biodiversity conservation including butterfly fauna as they have aesthetic and ecological value.

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References

Arya, M.K., Dayakrishna , & Chaudhary, R. (2014). Species richness and diversity of Butterflies in and around Kumaun University, Nainital, Uttarakhand, India. *Journal of Entomology and Zoology Studies*, 2(3): 153-159.

Alder, G.H., & Dudley, R. (1996). Biogeography of Milkweed of Milk butterflies Nymphalidae, Danaidae and mimetic patterns on tropical pacific archipelagos. *Biological Journal of Linnean Society*, 57: 317-326.

Bhusal, D.R., & Khanal, B. (2008). Seasonal and altitudinal diversity of butterflies in eastern Siwalik of Nepal. *Journal of Natural History Museum*, 23: 82-87.

Bourn, N.A.D., & Thomas, J.A. (2002). The challenge of conserving butterflies at range margins in Europe. *Biology Conservation*, 104: 285-292.

Chalise, P. (2010). Biodiversity of butterflies in Badikhel VDC, Lalitpur. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

DeVries, P.J. (1988). Stratification of fruit-feeding Nymphalid butterflies in a Costa Rican rainforest. *Journal of Research on the Lepidoptera*, 26: 98-108.

Ghimire, U.R. (2001). The diversity of butterfly fauna at Champadevi, Kirtipur Municipality, Kathmandu district. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

Ghorai, N., & Sengupta, P. 2014. Altitudinal Distribution of Papilionidae Butterflies along with Their Larval Food Plants in the East Himalayan Landscape of West Bengal, India. *Journal of Biosciences and Medicines*, 2: 1-8.

Ghosh, S., & Saha, S. 2016. Seasonal diversity of butterflies with reference to habitat heterogeneity, larval host plants and nectar plants at Taki, North 24 Parganas, West Bengal, India. *World Scientific News*, 50: 197-238.

Gowada, R., Kumar, V., Pramod, A.F., & Hosetti, B.B. (2011). Butterfly diversity, seasonality and status in Lakkavalli range of Bhadra Wildlife sanctuary, Karnataka, India. *World journal of Science and Technology*, 1(11): 67-72.

Hamer, K.C., Hill, J.K., Mustaffa, N., Benedick, S., Sherratt, T.N., Chey, V.K.,& Maryati, M. (2005). Temporal variation in abundance and diversity of butterflies in Bornean rain forests: opposite impacts of logging recorded in different seasons. *Journal of Tropical Ecology*, 21: 417-425.

KC, S. (2020). Some new distribution records of hesperiid butterflies in Nepal. *Bionotes*, 22(3), 190–194.

Khan, Z.H., Raina, F.H., Dar, M.A., & Ramamurthy, V.V. (2011). Diversity and distribution of butterflies from Kahmir Himalays. *Journal of Insect Science*, 24 (1): 45-55.

Khanal, B., & Smith, C. (1997). Butterflies of Kathmandu valley. TAC Press, Bangkok, Thailand, 5 pp.

Kunte, K. J. (1997). Seasonal patterns in butterfly abundance and species diversity in four tropical habitats in northern Western Ghats. *Journal of Bioscience*, 22(5): 593-603.

Kumar, P., Devi, R., & Muttu, V.K. (2016). Diversity and abundance of butterfly fauna (Insecta: Lepidoptera) of Subalpine area of Chanshal Valley of District Shimla (Himachal Pradesh). *Journal of Entomology and Zoology Studies*, 4(4): 243-247.

Patel, A.P., & Pandya, N.R. (2014). Assessment of termoral & spatial variation in species richness and diversity of butterfly host plants. International *Journal of Plant, Animal and Environmental Sciences*, 4(3): 235-245.

Prajapati, B., Shrestha, U., & Tamrakar A.S. (2000). Diversity of butterfly in Daman area of Makawanpur district, Central Nepal. *Nepal Journal of Science and Technology*, 2: 71-76.

Sengupta, P., Banerjee, K., & Ghorai, N. (2014). Seasonal diversity of butterflies and their larval food plants in the surroundings of upper Neora valley national park, A sub-tropical broad leanved hill forest in the eastern Himlayan landscape, West Bengal, India. *Journal of Threatned Taxa*, 6(1): 5327-5342

Simonson S.E., Opler, P., & Stohlgren, T.J. (2001). Rapid assessment of butterfly diversity in a montane landscape. *Biodiversity and Conservation*, 10: 1369-1386.

Smith, C. (1994). Butterflies of Nepal (Central Himalaya): 2nd ed. Craftsman Press, Bangkok (Thailand), 12 and 13 pp.

Smith, C. (2010). Lepidoptera of Nepal. Himalayan Nature, 5 pp.

Smith, C. (2011). An Illustrated Checklist of Nepal's butterfly. Craftsman Press, Bangkok (Thailand), 3 pp.

Sundufu, A.J., & Dumbuya, R. (2008). Habitat Preference of Butterflies in the Bumbana forest, Northern Sierr Leone. *Journal of Insect Science*, 64(8): 1-17.

Thapa, G. (2008). Diversity of butterflies in the Thankot and Syuchatar VDCs of Kathmandu District. M. Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Weiss, S.B., Murphy, D.D., & White R.R. (1988). Sun, slope and Butterflies: Topographic determinants of habitat quality for *Euphydryas editha*. *The Journal of Ecological Society America*, 69(5):1486:1496.

APPENDIX

Appendix 1: Photographs of some butterfly species recorded during study periods:

Fig. *Parnara guttata margala*

Fig. *Papiolio polytes*

Fig. *Pieris canadia indica*

Fig. *Hypolimnas bolina jacintha*

Fig. *Rapala tarbus*

Fig. *Vagrans egista*

Fig. *Cupha erymanthis lotis*

Fig. Precis almanac almanac

Fig. *Precis lemonias*

Fig. *Danaus chrysippus chrysippus*