ISSN (Print) 0975-685X
ISSN (Online) 0975-864X

J. Appl. Biosci., 52(1): 71-77, June, 2026
doi no. 10.61081/joab/52v1i109

ORIGINAL RESEARCH

A Study on Butterfly Diversity in the Sagar District of the Bundelkhand Region, Central India

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Abstract

Butterflies are widely recognized as important bioindicators and charismatic species for biodiversity conservation and environmental monitoring. The present study investigates the diversity, seasonal variation, and distribution patterns of butterflies in Sagar, Madhya Pradesh, India, with the aim of providing baseline data for ecological assessment and conservation planning. Surveys were conducted across multiple study sites, including university campus, urban localities, and semi-natural habitats, over five months from January to May 2026. The study documented 34 butterfly species belonging to five families and associated with 23 nectar plant species. Nymphalidae was the most dominant family (41.2%), reflecting considerable butterfly diversity in the study area. The study revealed significant seasonal fluctuation, with the highest abundance and diversity observed during the monsoon and post-monsoon period, while comparatively lower diversity was recorded in winter months. Family-wise distribution showed dominance of certain groups, reflecting habitat suitability and resource availability. The findings emphasize the ecological importance of maintaining habitat heterogeneity and plant diversity to support butterfly populations. This study provides essential insights into butterfly biodiversity in Sagar and highlights its relevance for future conservation strategies and sustainable urban and regional planning.

Keywords: Butterfly, Biodiversity, Seasonal variation, Host plant, Conservation.

INTRODUCTION

Butterflies, belonging to the order Lepidoptera under the class Insecta, are ecologically significant components of terrestrial ecosystems and serve as sensitive indicators of environmental quality (Chakravarty *et al*., 1997). Owing to their dependence on specific host plants for larval development and nectar resources for adult sustenance, their diversity and distribution closely reflect vegetation structure and habitat heterogeneity. The present study focuses on the butterfly biodiversity of Sagar in Madhya Pradesh, encompassing five distinct sites University Campus, Civil Lines, Makronia Battalion, Pili Kothi, and Patheriya Jat representing a gradient of urban, semi-urban, and peri-urban habitats. These areas differ in floral composition, anthropogenic disturbance, and microclimatic conditions, thereby offering a suitable framework to examine spatial variations in butterfly assemblages.

Globally, butterflies are represented by more than 28,000 species, with a large proportion occurring in tropical and subtropical regions. India, recognized as one of the mega-diverse countries, harbors a rich butterfly fauna with over 1300 recorded species distributed across various ecosystems (Das, *et al.,* 2023). Butterflies are broadly classified into several families, including Papilionidae (swallowtails),

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Pieridae(whites and yellows), Nymphalidae (brush-footed butterflies), Lycaenidae (blues), and Hesperiidae (skippers) (Heppner, 1998; Kehimkar, 2008). These families exhibit diverse ecological adaptation patterns. The occurrence and dominance of particular families in a region often reflect habitat characteristics, vegetation types, and climatic conditions.

The study was conducted over five months from January to May, covering late winter to pre-monsoon seasons, which are critical for butterfly activity due to progressive changes in temperature, humidity, and flowering patterns. Seasonal availability of herbs and shrubs, including nectar-rich species such as *Lantana camara*, plays a pivotal role in determining butterfly abundance and movement. Feeding ecology is particularly important in butterflies, as larval and adult stages utilize different food resources, making them highly responsive to even minor ecological disturbances (May, 1992). Rapid urbanization and habitat modification in Sagar have the potential to influence species composition, abundance, and distribution patterns (Nasir *et al*., 2014; Mukherjee *et al.,* 2015).

Therefore, documenting butterfly diversity across these selected sites is essential for understanding local ecological dynamics and for developing conservation strategies. Such studies not only provide baseline data on species richness and seasonal variation but also contribute to biodiversity monitoring and environmental impact assessment (Pollard, 1977; Pollard *et al.*, 1975; Pawar & Deshpande, 2017). The findings are expected to highlight the relationship between butterfly diversity and vegetation patterns, thereby emphasizing the importance of habitat conservation in maintaining ecological balance within the region.

MATERIALS AND METHODS

The present study on butterfly biodiversity was carried out in Sagar, located in Madhya Pradesh. Five sites were selected for investigation: University Campus, Civil Lines, Makronia Battalion, Pili Kothi, and Patheriya Jat. These sites represent a gradient of habitats ranging from urban to semi-urban and peri-urban areas, with noticeable variation in vegetation composition, host plant availability, and anthropogenic disturbance.

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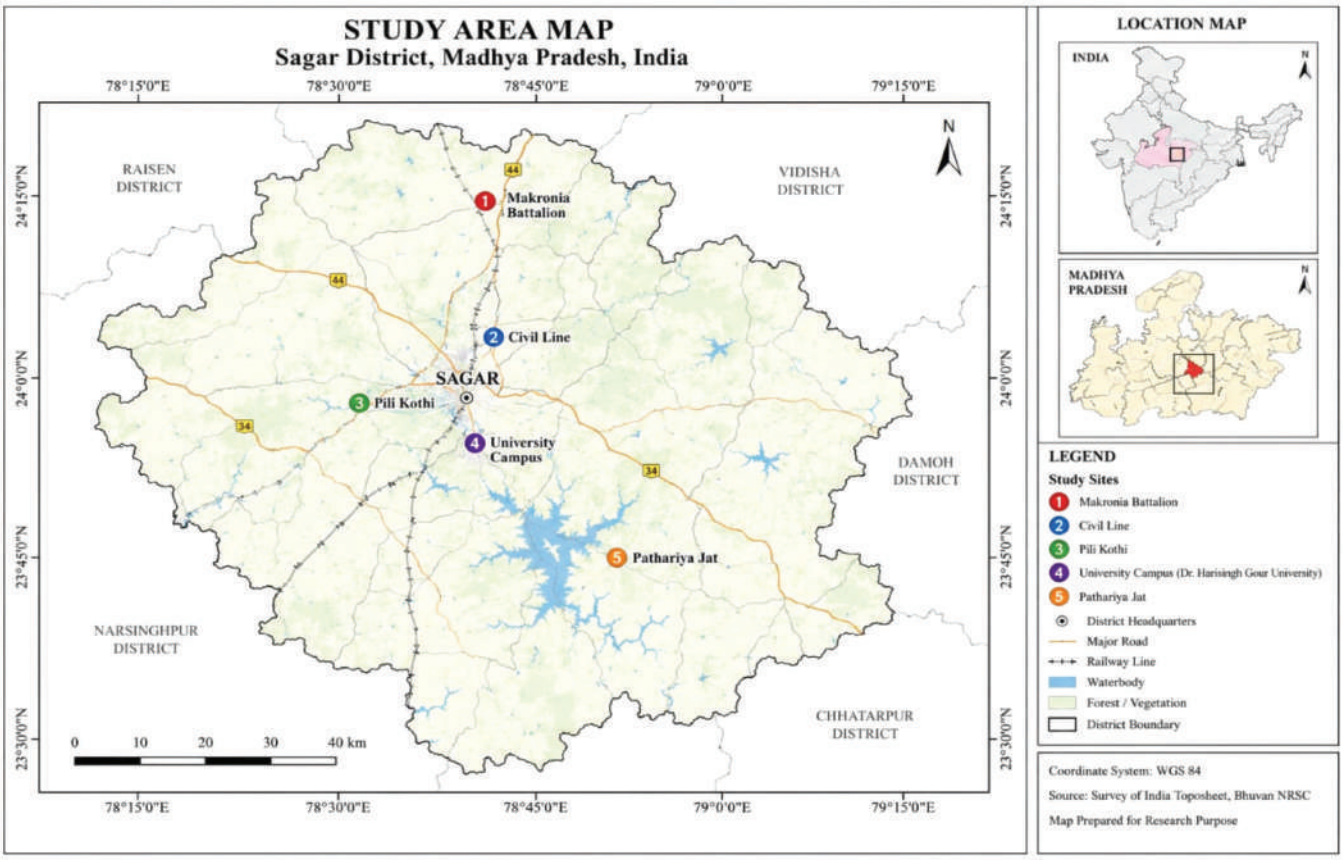

Figure 1: Map of the study areas in Sagar District, Madhya Pradesh, India.

Table 1: List of butterflies recorded from Sagar, Madhya Pradesh, India during January 2026 to May 2026.

S. No.	Family	Common Name	Scientific Name	Short form
1.	Papilionidae	Common jay	*Graphium doson* (Felder & Felder, 1864)	GDO
2.	Papilionidae	Common Mormon	*Papilio polytes* (Linnaeus, 1758)	PPO
3.	Papilionidae	Lime Butterfly	*Papilio demoleus* (Linnaeus, 1758)	PDE
4.	Pieridae	Three spot Grass Yellow	*Eurema blanda* (Biosduval, 1836)	EBL
5.	Pieridae	Common Grass Yellow	*Eurema hecabe* (Linnaeus, 1758)	EHE
6.	Pieridae	Common Emigrant	*Catopsilia pyranthe* (Linnaeus, 1758)	CPY
7.	Pieridae	Lemon Emigrant	*Catopsilia Pomona* (Linnaeus, 1758)	CPO
8.	Pieridae	Common Wanderer	*Pareronia valeria* (Cramer, 1775)	PVA
9.	Pieridae	Indian Wanderer	*Pareronia hippia* (Cramer, 1775)	PHI
10.	Pieridae	Cabbage White	*Pieris rapae* (Linnaeus, 1758)	PRA
11.	Pieridae	Common Gull	*Cepora Nerissa* (Fabricius, 1775)	CNE
12.	Nymphalidae	Blue Tiger	*Tirumala limniace* (Cramer, 1775)	TLI
13.	Nymphalidae	Striped Tiger	*Danaus genutia* (Cramer, 1775)	DGE
14.	Nymphalidae	Plain Tiger	*Danaus chrysippus* (Linnaeus, 1758)	DCH
15.	Nymphalidae	Common Crow	*Euploea core* (Cramer, 1775)	ECO
16.	Nymphalidae	Common Evening Brown	*Melanitis leda* (Linnaeus, 1758)	MLE
17.	Nymphalidae	Tawny Coster	*Acrea violae* (Fabricius, 1775)	AVI
18.	Nymphalidae	Common Castor	*Ariadne merione* (Cramer, 1777)	AME
19.	Nymphalidae	Peacock Pansy	*Junonia almana* (Linnaeus, 1758)	JAL
20.	Nymphalidae	Grey Pansy	*Junonia atlites* (Linnaeus, 1758)	JAT
21.	Nymphalidae	Chocolate Pansy	*Junonia iphita* (Linnaeus, 1758)	JIP
22.	Nymphalidae	Blue Pansy	*Junonia orithya* (Linnaeus, 1758)	JOR
23.	Nymphalidae	Lemon Pansy	*Junonia lemonias* (Linnaeus, 1758)	JLE
24.	Nymphalidae	Great Egg fly	*Hypolimnas bolina* (Linnaeus, 1758)	HBO
25.	Nymphalidae	Danaid Eggfly	*Hypolimnas missipus* (Linnaeus, 1758)	HMI
26.	Lycaenidae	Common Pierrot	*Castalius rosimon* (Fabricius, 1775)	CRO
27.	Lycaenidae	Red Pierrot	*Talicada nyseus* (Guerin-Meneville, 1843)	TNY
28.	Lycaenidae	Forget-me-not	*Catochrysops strabo* (Fabricius, 1793)	CST
29.	Lycaenidae	Pale Grass Blue	*Pseudozizeeria maha* (Kollar, 1844)	PMA
30.	Lycaenidae	Grass Blue	*Zizeeria karsandra* (Moore, 1865)	ZKA
31.	Lycaenidae	Holly Blue butterfly	*Celastrina argiolus* (Linnaeus, 1758)	CAR
32.	Lycaenidae	Common Cerulean	*Jamides celeno* (Cramer, 1775)	JCE
33.	Hesperiidae	Brown Awl	*Badamia exclamationis* (Fabricius, 1775)	BEX
34.	Hesperiidae	Indian Skipper	*Spialia galba* (Fabricius, 1775)	SGA

Table 2: Major Nectar Plants Visited by Butterflies During the Study Period (January–May 2025).

S. No.	Scientific Name	Common Name	Plant Type	Flower Colour
1	*Lantana camara*	Lantana	Shrub	Orange, Pink, Yellow
2	*Tridax procumbens*	Coat Buttons	Herb	White with Yellow Centre
3	*Sphagneticola trilobata*	Singapore Daisy	Creeping Herb	Yellow
4	*Jatropha integerrima*	Spicy Jatropha	Shrub	Red
5	*Jatropha curcas*	Physic Nut	Shrub	Yellow Green
6	*Gazania rigens*	Gazania	Herb	Yellow, Orange
7	*Pelargonium* spp.	Geranium	Herb	Pink, Red, White
8	*Hygrophila auriculata*	Marsh Barbel	Herb	Purple-Violet
9	*Pluchea indica*	Indian Fleabane	Shrub	Pink-Purple
10	*Bougainvillea spectabilis*	Paper Flower	Climber	Pink, Purple, White
11	*Gloriosa superba*	Glory Lily	Climber	Red and Yellow
12	*Punica granatum*	Pomegranate	Shrub/Tree	Orange-Red
13	*Citrus limon*	Lemon	Tree	White
14	*Ixora coccinea*	Jungle Geranium	Shrub	Red
15	*Catharanthus roseus*	Madagascar Periwinkle	Herb	Pink, White
16	*Tagetes erecta*	African Marigold	Herb	Yellow, Orange
17	*Zinnia elegans*	Zinnia	Herb	Various Colours
18	*Cosmos sulphureus*	Yellow Cosmos	Herb	Yellow, Orange
19	*Helianthus annuus*	Sunflower	Herb	Yellow
20	*Ocimum tenuiflorum*	Holy Basil	Herb	White-Purple
21	*Nerium oleander*	Oleander	Shrub	Pink, White
22	*Tecoma stans*	Yellow Bells	Shrub/Small Tree	Yellow
23	*Cassia fistula*	Golden Shower Tree	Tree	Bright Yellow

Table 3: Diversity Indices of Butterfly Assemblage Recorded from Sagar District.

Parameter	Formula	Value	Interpretation
Total Species Richness (S)	Number of species recorded	34	Moderate species richness
Number of Families	Count of families	5	Five butterfly families recorded
Shannon Diversity Index (H′)	$H' = -\Sigma(pi \ln pi)$	1.412	Moderate diversity
Simpson Diversity Index (D)	$D = \Sigma pi^2$	0.279	Moderate dominance
Simpson's Diversity (1 − D)	$1 - D$	0.721	Fairly high diversity
Dominant Family	Highest relative proportion	Nymphalidae (41.18%)	Most species-rich family

Field surveys were conducted over five months from January to May 2026. Observations were made regularly at each site, with visits scheduled during daytime hours between 07:00 am and 01:00 pm, when butterfly activity is generally high due to favourable light and temperature conditions. The selected time frame allowed for adequate documentation of species active during both morning and late forenoon periods.

Butterfly sampling and observation were carried out without the use of transect-based methods. Instead, active search and opportunistic sampling techniques were employed across all study sites (Pollard & Yates, 1993). Specimens were captured using an insect net for closer examination and identification, then released back into their natural habitat to minimize ecological disturbance. Photographic documentation was performed using a digital camera to support identification and record-keeping.

Species identification was conducted using preliminary photographic support; species were confirmed using standard taxonomic keys (Kehimkar, 2008; Evans, 1932). Final identification and confirmation of species were based on morphological characteristics and standard taxonomic keys of the order Lepidoptera. A checklist was prepared, including both common names and scientific names of all recorded species.

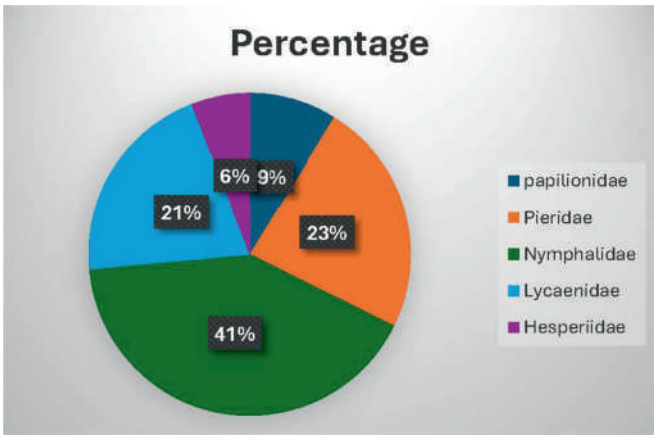

Chart 1: Pie chart showing the percentage composition of butterfly families in the Sagar District, Madhya Pradesh.

Geographical coordinates of each study site were recorded using a Global Positioning System (GPS) to ensure spatial accuracy. Observations on habitat type, vegetation, and availability of nectar and host plants were also noted during each field visit. The compiled data were systematically organized to assess species diversity, distribution, and relative abundance across the selected sites during the study period.

The butterfly diversity data were analyzed using the following biodiversity indices to assess family-wise composition and species diversity.

1. **Relative Abundance:**

$$P_i = \frac{n_i}{N}$$

Where, Pi = Relative abundance of a family, ni = Number of species in a family

N = Total number of species recorded (34)

Percentage Composition:

$$\%\ Species = \frac{n_i}{N} \times 100$$

2. **Shannon Diversity Index (H'):** The Shannon–Wiener Diversity Index (H′) was used to evaluate species diversity (Shannon & Weaver, 1949).

$$H' = -\sum(P_i \ln P_i)$$

3. **Simpson Diversity Index (D):** Species dominance within the butterfly assemblage was determined using Simpson's Diversity Index (Simpson, 1949).

$$D = \sum P_i^2$$

4. **Simpson's Diversity/Simpson's Index of Diversity (1-D):** To assess overall diversity, Simpson's Diversity (1 − D) was also calculated.

Figure 2: Butterfly species recorded in Sagar District, Bundelkhand Region, Central India.1) *Graphium doson,* 2) *Papilio polytes,* 3) *Papilio demoleus,* 4) *Eurema blanda,* 5) *Eurema hecabe,* 6) *Catopsilia pyranthe,* 7) *Catopsilia Pomona,* 8) *Pareronia valeria,* 9) *Pareronia hippia,* 10) *Pieris rapae,* 11) *Cepora Nerissa,* 12) *Tirumala limniace,* 13) *Danaus genutia,* 14) *Danaus chrysippus,* 15) *Euploea core,* 16) *Melanitis leda,* 17) *Acrea violae,* 18) *Ariadne merione,* 19) *Junonia almanac,* 20) *Junonia atlites,* 21) *Junonia iphita,* 22) *Junonia orithya,* 23) *Junonia lemonias,* 24) *Hypolimnas bolina,* 25) *Hypolimnas missipus,* 26) *Castalius rosimon,* 27) *Talicada nyseus,* 28) *Catochrysops Strabo,* 29) *Pseudozizeeria maha,* 30) *Zizeeria karsandra,* 31) *Celastrina argiolus,* 32) *Jamides celeno,* 33) *Badamia exclamationis,* 34) *Spialia galba*

RESULTS

We recorded 34 butterfly species belonging to five families (Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperiidae; Table 1; Figure 2), 23 species of nectar plants, along with flower colour and plant type, over the duration of the study period (Table 2). Based on the family-wise abundance data, the Shannon Diversity Index (H′ = 1.412), Simpson Diversity Index (D = 0.279), and Simpson's Diversity (1 − D = 0.721) were calculated (Table 3). These values indicate moderate butterfly diversity with fairly high species richness in the study area.

Family-wise analysis revealed that Nymphalidae was the most dominant family, comprising 14 species (41.18%) of the total recorded butterflies. Pieridae was the second most dominant family with 8 species (23.53%), followed by Lycaenidae with 7 species (20.59%). Papilionidae and Hesperiidae were represented by 3 species (8.82%) and 2 species (5.88%), respectively.

The diversity analysis showed a Shannon–Wiener diversity index (H′) of 1.41, indicating a moderate level of butterfly diversity in the study area. The Simpson's diversity (1 − D) was calculated as 0.721, suggesting relatively high diversity and a fairly even distribution of species among the recorded families. The predominance of Nymphalidae may be attributed to its broad ecological adaptability, diverse larval host plant associations, and ability to thrive in a wide range of habitats.

These findings indicate that the study area provides suitable environmental conditions for butterfly survival and supports a diverse butterfly community. The availability of host plants, nectar resources, and favorable microhabitats may have contributed to the observed diversity and distribution patterns.

DISCUSSION AND CONCLUSION

The present study on butterfly diversity was conducted at five selected sites of Sagar district, Madhya Pradesh, namely University Campus, Civil Lines, Makronia Battalion, Pili Kothi, and Patheriya Jat, during the period from January to May 2026. Field observations were carried out between 7:00 AM and 1:00 PM, corresponding to the peak activity period of butterflies under favorable environmental conditions. During the study, a total of 34 butterfly species belonging to five families were recorded. The observed species richness indicates that the study area supports a moderately diverse butterfly community despite the relatively short duration of sampling.

Among the recorded families, Nymphalidae was the dominant family, contributing 41.18% of the total species richness, followed by Pieridae (23.53%), Lycaenidae (20.59%), Papilionidae (8.82%), and Hesperiidae (5.88%). The predominance of Nymphalidae may be attributed to its broad ecological adaptability, wide host plant range, and ability to thrive under diverse habitat conditions.

The Shannon–Wiener diversity index (H′ = 1.41) indicated a moderate level of butterfly diversity, whereas the Simpson's Index of Diversity (1 − D = 0.721) suggested relatively high diversity and a "low dominance of individual species." The diversity observed during the study may be associated with the availability of 23 nectar plant species, which provided essential food resources for adult butterflies.

Variation in species richness among the study sites was likely influenced by differences in vegetation composition, floral abundance, habitat heterogeneity, and anthropogenic disturbances. Sites with greater vegetation cover and flowering plant diversity supported higher butterfly abundance than highly urbanized locations. Seasonal observations revealed an increase in butterfly activity from January to April, followed by a slight decline in May, possibly due to increasing temperature and reduced moisture availability.

Overall, the findings indicate that the Sagar region supports a moderately diverse butterfly fauna and highlight the importance of conserving natural vegetation, nectar resources, and suitable habitats for maintaining butterfly diversity in urban and semi-natural landscapes.

ACKNOWLEDGEMENT

The authors are thankful to Prof. Shweta Yadav, Head, Department of Zoology, for providing the necessary facilities and support to carry out this study.

REFERENCES

Arora, G. S., Mehta, H. S., & Walia, V. K. (2009). *Handbook on butterflies of Himachal Pradesh*. Zoological Survey of India.

Battisti, A. (1988). Phytophagous insects in the energy flow of an artificial stand. *Redia, 71*(1), 139–160.

Bhatt, U. M., & Nagar, P. S. (2016). Diversity of butterflies in an arboretum of Gujarat, India. *Check List, 13*(2).

Chakravarthy, A. K., Rajagopal, D., & Jagannatha, R. (1997). Insects as bioindicators of conservation in the tropics. *Zoos' Print Journal, 12*, 21–25.

Das, G. N., et al. (2023). Geography and distribution of Indian butterflies. *Insects, 14*(6), 549.

Doherty, W. (1886). List of butterflies taken in Kashmir. *Journal of the Asiatic Society of Bengal, 55*(2–3), 103–140.

Evans, W. H. (1932). *The identification of Indian butterflies* (2nd ed.). Bombay Natural History Society.

Heppner, J. B. (1998). *Classification of Lepidoptera* (Part I: Introduction).

Iqbal, W., Malik, M. F., Hussain, M., Ashraf, H., Sarwar, M. K., Azam, I., & Umar, M. (2016). Butterfly diversity in district Gujarat, Punjab, Pakistan. *Journal of Biodiversity and Environmental Sciences, 9*(2), 235–243.

Jabal, J. (1978). A preliminary report on butterflies of Islamabad. *Biologia, 24*(2), 237–247.

Kehimkar, I. (2008). *The book of Indian butterflies*. Bombay Natural History Society & Oxford University Press.

Kehimkar, I. (2016). *Butterflies of India*. Bombay Natural History Society, Mumbai.

Kunte, K. (2000). *Butterflies of peninsular India*. Universities Press.

Kunte, K., Joglekar, A., Utkarsh, G., & Pramod, P. (1999). Patterns of butterfly diversity in the Western Ghats. *Current Science, 77*, 356–358.

Magurran, A. E. (2004). *Measuring biological diversity*. Blackwell Publishing.

May, P. G. (1992). Flower selection and the dynamics of lipid reserves in nectarivorous butterflies. *Ecology, 73*, 2181–2191.

Mukherjee, S., Banerjee, S., Saha, G. K., & Basu, P. (2015). Butterfly diversity in Kolkata, India: An appraisal for conservation management. *Journal of Asia-Pacific Biodiversity, 8*(3), 210–221.

Nair, A. V., Mitra, S. C., & Bandyopadhyay, S. (2014). Studies on diversity and abundance of butterflies in urban habitats. *Journal of Entomology and Zoology Studies, 2*(4), 129–134.

Pawar, P. A., & Deshpande, V. Y. (2017). Butterfly diversity of Satara Tehsil, Maharashtra. *IRA International Journal of Applied Sciences*.

Pollard, E. (1977). A method for assessing changes in the abundance of butterflies. *Biological Conservation, 12*, 115–153.

Pollard, E., Elias, D. O., Skelton, M. J., & Thomas, J. A. (1975). A method of assessing the abundance of butterflies. *Entomologist's Gazette, 26*, 79–88.

Ravendra, G., Vijaya Kumara, H. T., Pramod, A. F., & Hosetti, B. B. (2011). Butterfly diversity, seasonality and status in Lakkavalli range of Bhadra wildlife sanctuary. *Karnataka Journal of Science & Technology, 11*, 67–72.

Shannon, C. E., & Weaver, W. (1949). *The mathematical theory of communication*. University of Illinois Press.

Simpson, E. H. (1949). Measurement of diversity. *Nature, 163*(4148), 688. https://doi.org/10.1038/163688a0

Sreekumar, E. R., et al. (2018). Diversity and endemism of butterflies in the Western Ghats. *Journal of Threatened Taxa*.