**An updated checklist of butterflies of district Gaya, Bihar**

**Abstract**

Butterflies play an essential role in the ecosystem, serving as pollinators, food sources, and effective indicators of environmental shifts. This study primarily concentrates on recognizing butterfly species and their diversity in the Bhagalpur district of Bihar, India. A total of 48 species of butterflies were noted during the survey. Of these, 102 species were recorded for the first time from Gaya. A total of 36 species were documented from the Nymphalidae family. The species most frequently found in the target area included *Ariadne ariadne*, *Danaus chrysippus*, *Euploea core*, *Junonia almana*, *Junonia iphita*, *Leptosia nina nina*, *Melanitis leda*, *Papilio demoleus*, and *Ypthima huebneri*. Nonetheless, a small number of species like *Cigaritis vulcanus*, *Curetis acuta*, and *Spialia galba* were infrequently encountered. The highest diversity was seen in winter, while the lowest diversity occurred in summer.

**Keywords:** Butterfly, Species, Gaya and Diversity.

**Introduction**

Butterflies (Lepidoptera: Rhopalocera) are strikingly coloured insects, and their hues result from pigments found in their scales. They serve a vital function in ecosystems, functioning as pollinators, food providers, and signals of the ecosystem's health. A large number of butterflies typically signifies a more thriving ecosystem. Butterflies aid in ecosystem restoration by providing pollination and serving as a food source. Higher butterfly populations might suggest greater plant variety and the presence of other pollinator species in restored regions (Dobson, 2012). Butterflies serve as effective indicators of climatic, seasonal, and ecological shifts and assist in creating conservation strategies. Butterflies are crucial to the ecosystem due to their coevolutionary relationship with plants, as their existence is interconnected (Ghazanfar et al., 2016). They are vulnerable to environmental influences like temperature, humidity, precipitation, solar radiation, air temperature, wind speed, and the presence of larval host plants (Ribeiro and Freitas, 2012).

Extensive research has focused on taxonomy, diversity, relative abundance, reproductive biology, and seasonal behaviours of butterflies across various states in India (Paul, 1981; Kunte, 1997; 2000; 2006; Sethy et al., 2014; Gajbe, 2016; Kumar et al., 2016; Dey et al., 2017; Kanagaraj and Kathirvely, 2018) and in Bihar (Sharma, 2017; Bharat, 2023; Masroor, 2022a; 2022b; 2022c 2022d; masroor, 2024a; 2024b). However, there are scanty reports on butterfly taxonomy and diversity in Bihar (Sharma and Kumar, 2017; Somala et al., 2020).

**Material and methods**

For almost two years, the butterflies were surveyed using (reference???) random techniques (only random survey conducted??? Specify it…). Every week, from early in the morning until late in the afternoon, their numbers were arbitrary and kept within 25 feet. The survey's path was predetermined and precise in terms of timing and movement. The study was often carried out under favourable weather conditions; wet, overcast, stormy, and hot weather conditions were disregarded. A digital camera was used to snap pictures of butterflies in their natural environments. The relevant literature (Wynter-Blyth, 1997; Kehimkar, 2008; Guptha et al., 2012; Smetacek, 2017) served as the basis for the species identification. The Sites selected for study were focused on enriched vegetation and less human activity area (Site1- Bodhgaya, Site 2- Islamganj, Site 3- Paimar village, Site 4- Naili)

**Results and Discussion**

The current research identified 102 butterfly species across 5 families and 71 genera throughout the study duration (Table:1, Graph:1). In Gaya Nymphalidae represents 35% of total recorded species followed by Lycaenidae 24%, Pieridae 18%, Hesperiidae 12% and Papilionidae 11%. While according to sites, in site 1 Nymphalidae recorded highest diversity of 35 species followed by Lycaenidae 25, Pieridae 18, Hesperiidae 12 and Papilionidae 11 species. In Site 2 Nymphalidae recorded highest diversity of 23 species followed by Lycaenidae 16, Pieridae 15, Hesperiidae 9 and Papilionidae 9 species. Site 3 Nymphalidae recorded highest diversity of 21 species followed by Lycaenidae 15, Pieridae 10, Hesperiidae 11 and Papilionidae 7 species. While site 4 Nymphalidae recorded highest diversity of 31 species followed by Lycaenidae 24, Pieridae 16, Hesperiidae 10 and Papilionidae 9 species. Site 1 represents 101 species followed by site 4 recorded 90 species, site 2 recorded 72 and site 3 recorded 64 species. Observation records show a healthy diversity of butterfly species need more enriched flora and the sites having less plant diversity represents less species diversity in Gaya district.

**Conclusion**

This study represents a dedicated attempt to record and propose effective methods for enhancing butterfly diversity in Gaya district. The current situation shows that the post-monsoon and winter periods were the most beneficial for butterfly activities in the region. Further studies on this community and their relationship with favoured plants can provide us with enhanced insights into their conservation and management around these irrigation reservoirs.

**References**

Bingham, C. T. (1905). Butterflies In The fauna of British India (Ceylon and Burma). Taylor and Franc. Red Lion Court, Fleet Street, London, EC-4. I.

Bingham, C. T. (1917). Butterflies In The fauna of British India (Ceylon and Burma). Taylor and Francis, Red Lion Court, Fleet Street, London, EC-4. II.

Bharat, B. and Ahmad, M.E. 2023. Study of diversity of butterflies in Bhagalpur District of Bihar in India. Ann. Entomol. 41, 115–123. (<https://doi.org/10.59467/AE.2023.41.115>)

Dobson, F. 2012. Butterflies act as Wildlife Indicators, Warning us of Ecosystem Changes. Environmental News Network.

Gajbe, P. U. 2016. Diversity of Butterflies in Karhandla Region of Umred -Karhandla Wildlife Sanctuary, Maharashtra, India. *Journal on New Biological Reports*, JNBR 5(1): 35-40.

Gilbert, L.E. and Singer, M.C. 1975. Butterfly Ecology. A. Rev. Eco! Syst*. 6:365-391.* Gunathilagaraj K, T.N.A. Perumal, K. Jayaram and M. Ganesh Kumar,1998. Some South Indian Butterflies.Nilgiri Wildlife and EnvironmentAssociation, Tamil Nadu. 40-198.

Ghazanfar, M., Malik, M. F., Hussain, M., Iqbal, R. and Younas, M. 2016. Butterflies and their contribution in ecosystem: A review. J. Entomol. Zool. Stud. 4, 115–118.

Kehimkar, I. 2008. The Book of Indian Butterflies, Vol. 5, Bombay Natural History Society, Mumbai, pp. 497–450.

Kumar, R. & G. Sharma (2021). An updated checklist of butterflies of Rajgir Wildlife Sanctuary, Bihar. Bugs R All #195, In: *Zoo’s Print* 36(5): 15–22.

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

Kunte, K. (2000). Butterflies of Peninsular India. Indian Academy of Sciences, Universities Press, India, 254pp.

Kunte, K. (2006). India - A Life scape, Butterflies of Peninsular India. Universities Press (India) Private Ltd. Hyderabad, India, 254pp.

Masroor, M. D., Z. Masrror, R. Kumar & Deen, S. N. P. Y. (2022). Records of two butterflies Silverstreak Blue and Bamboo Treebrown from Magadh, Bihar. Bugs R All #256, In: Zoo’s Print 37(10): 22–24.

Masroor, M. D., Masrror, Z., & Deen, S. N. P. Y. (2022). New distributional records of Monkey puzzle butterfly Rathinda amor (Fabricius, 1775) from Magadh division, Bihar. Species, 2022, 23(71), 108-111.

Masroor, M. D., Masrror, Z., Kumar, A. (2022). Species diversity of butterflies in Gaya district (Bihar), India. Insect Environment, 25 (1), 22-28. DOI: 10.55278/QUDW1537

Masroor, M. D., Masrror, Z., Nayeem MD.R., Ranjan, A., Deen, S. P. Y. (2024). First record of *Telchinia issoria* Hubner, 1819 (Lepidoptera: Nymphalidae) from Bihar. Species, 25: e14s1645, 1-3.

Masroor, M. D., Masrror, Z., and Deen, S. N. P. Y. (2024). First record of *Pontia daplidice* Moorei Rober, 1907 (Lepidoptera: Pieridae) from Bihar, India. Bionotes, 26 (1), 38-39.

 Masroor, M. D., Masrror, Z., and Kumar, R. (2022). First record of Spotted Palmfly *Elymnias malelas* (Insecta: Lepidoptera: Nymphalidae) from Bihar. Bionotes, 24 (1&2), 110-111.

Paul, S.R. (1981). Flora of Rajgir Hill, Bihar. *Journal of the Bombay Natural History Society* 78: 16–37. <http://www.biodiversitylibrary.org/page/48228551>

Ribeiro, D. B. and Freitas, A. V. (2012). The effect of reduced-impact logging on fruit-feeding butterflies in Central Amazon, Brazil. J. Insect Conserv. 16, 733–744.

Sharma, G. and Kumar, R. 2017. Butterfly diversity of Pant Wildlife Sanctuary, Rajgir (Bihar), India. Bioglobia, 4, 39–46.

Smetacek, P. A. (2017). Naturalist’s Guide to the Butterflies of India, Vol. 2, Prakash Books, Delhi, pp. 10–302.

Somala, K., Yadav K. M., Sai Reddy, M. S. and Yashaswini, G. (2020). Study on the diversity and abundance of butterfly fauna in Pusa, Bihar. J. Ecol. Environ. Sci. 2, 429–434.

Wynter-Blyth, M. A. 1997. Butterflies of Indian Region, Vol. 1, Bombay Natural History Society, Mumbai, pp. 443–450.

[**https://www.inaturalist.org/projects/butterflies-and-moths-of-bihar?tab=species**](https://www.inaturalist.org/projects/butterflies-and-moths-of-bihar?tab=species)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Serial no.**  | **Common name**  | **Scientific name**  | **Site 1**  | **Site 2**  | **Site 3**  | **Site 4**  |
|  | **Family: Hesperiidae** |   |   |   |   |   |
| **1** | Indian Palm Bob | *Saustus grenius* (Fabricius,1798) | \* | \* | \* | \* |
| **2** | Small Branded Swift | *Pelopidas mathias* (Fabricius, 1798) | \* | \_ | \_ | \* |
| **3** | Common Red Eye | *Matapa aria* (Moore, 1866) | \* | \* | \* | \* |
| **4** | Paint Brush Swift | *Baoris farri* (Moore, 1878) | \* | \* | \* | \_ |
| **5** | Grass Demon | *Udaspes folus* (Cramer, 1775) | \* | \* | \* | \* |
| **6** | Contiguous Swift | *Polytremis lubricans* (Herrich-Schaffer,1869) | \* | \_ | \* | \_ |
| **7** | Rice Swift | *Barbo cinnara* (Wallace,1866) | \* | \* | \* | \* |
| **8** | Dark Palm Dart | *Telicota bambusae* (Moore, 1878) | \* | \* | \* | \* |
| **9** | Asian Grizzled Skipper | *Spialia galba* (Fabricius, 1793) | \* | \* | \* | \* |
| **10** | Common Palm Dart | *Telicota colon* (Fabricius, 1775) | \* | \* | \* | \* |
| **11** | Common Banded Awl | *Hasora chromus* (Cramer, [1780]) | \* | \* | \* | \* |
| **12** | Brown Awl | *Badamia exclamationis* (Fabricius, 1775) | \* | \_ | \* | \* |
|  | **Family: Papilionidae** |   |   |   |   |   |
| **13** | Common Mormon | *Papilio polytes* (Linnaeus, 1758) | \* | \* | \* | \* |
| **14** | Indian Common Mormon | *Papilio polytes romulus* Cramer, [1775] | \* | \* | \_ | \_ |
| **15** | Lime Butterfly | *Papilio demolus* (Linnaeus, 1758) | \* | \* | \* | \* |
| **16** | Common Jay | *Graphium doson* (C. & R. Fedler, 1864) | \* | \* | \* | \* |
| **17** | Tailed Jay | *Graphium agramemnon* (Linnaeus, 1758) | \* | \* | \* | \* |
| **18** | Common Rose | *Pachliopta aristolochiae* (Fabricius,1775) | \* | \* | \_ | \* |
| **19** | Common Mime | *Papilio clytia* Linnaeus, 1758 | \* | \_ | \* | \* |
| **20** | Blue Mormon | *Papilio polymnestor* (Cramer, 1775) | \* | \_ | \* | \* |
| **21** | Crimson Rose | *Pachliopta hector* (Linnaeus, 1758) | \* | \* | \_ | \* |
| **22** | Common Bluebottle | *Graphium sarpedon* (Linnaeus, 1758) | \* | \* | \* | \_ |
| **23** | Chain Swordtail | *Graphium aristeus* (Stoll, [1780]) | \* | \* | \_ | \* |
|  | **Family: Nymphalidae** |   |   |   |   |   |
| **24** | Gray Pansy | *Junonia atlites* (Linnaeus, 1763) | \* | \* | \* | \* |
| **25** | Peacock Pansy | *Junonia almana* (Linnaeus, 1758) | \* | \* | \* | \* |
| **26** | Chocolate Pansy | *Junonia iphita* (Cramer, 1779) | \* | \* | \* | \* |
| **27** | Lemon Pansy | *Junonia lemonias* (Linnaeus, 1758) | \* | \* | \* | \* |
| **28** | Yellow Pansy | *Junonia hierta* (Fabricius, 1798) | \* | \_ | \_ | \* |
| **29** | Blue Pansy |  *Junonia orithya* (Linnaeus,1758) | \* | \* | \_ | \* |
| **30** | Plain Tiger | *Danus chrysippus* (Linnaeus, 1758) | \* | \* | \* | \* |
| **31** | Striped Tiger | *Danus genutia* (Cramer, 1779) | \* | \* |   | \* |
| **32** | Blue Tiger | *Trimula limniace* (Cramer,1775) | \* | \_ | \* | \* |
| **33** | Common Baron | *Euthalia aconthea* (Cramer, 1777) | \* | \* | \* | \* |
| **34** | Gaudy Baron  | *Euthalia lubentina* (Cramer, 1777) | \* | \_ | \_ | \* |
| **35** | Common Leopard | *Phalanta phalanta* (Drury, 1773) | \* | \* | \* | \* |
| **36** | Common Crow | *Euuploea core* (Cramer, 1780) | \* | \* | \* | \* |
| **37** | Common Evening Brown | *Melantis leda* (Linnaeus, 1758) | \* | \* | \* | \* |
| **38** | Dark Evening Brown | *Melantis phedima* (Cramer, [1780]) | \* | \* | \_ | \* |
| **39** | Common Three-ring | *Ypthima asterope* (Klug, 1832) | \* | \_ | \* | \* |
| **40** | Common Four-ring | *Ypthima huebneri* Kirby, 1871 | \* | \* | \_ | \* |
| **41** | Common Bush Brown | *Mycalesis perseus* (Fabricius,1775) | \* | \* | \* | \* |
| **42** | Dark-branded Bushbrown | *Mycalesis mineus* (Linnaeus, 1758) | \* | \_ | \_ | \* |
| **43** | Commander | *Moduza procris* (Cramer, 1777) | \* | \* | \* | \* |
| **44** | Great Eggfly | *Hypolimnas bolina* (Linnaeus, 1758) | \* | \* | \* | \* |
| **45** | Danaid Eggfly | *Hypolimnas misippus* (Linnaeus, 1764) | \* | \* | \* | \* |
| **46** | Common Castor | *Ariadne merione* (Cramer, 1777) | \* | \* | \* | \* |
| **47** | Tawny Castor | *Acraea terpsicore* (Fabricius,1793) | \* | \* | \* | \* |
| **48** | Angled Castor | *Ariadne ariadne* (Linnaeus, 1763) | \* | \_ | \* | \_ |
| **49** | Himalayan Yellow Coster | *Acraea issoria issoria* (Hubner, [1819]) | \* | \_ | \_ | \_ |
| **50** | Common Sailor | *Neptis hylas* (Linnaeus, 1758) | \* | \* | \* | \* |
| **51** | Short-banded Sailer | *Phaedyma columella* (Cramer, [1780]) | \* | \* | \_ | \* |
| **52** | Common Palmfly | *Elymnias hypermnestra* (Linnaeus,1763) | \* | \* | \* | \* |
| **53** | Baronet | *Symphaedra nais* Forster, 1771 | \* | \_ | \_ | \* |
| **54** | Bamboo Tree Brown | *Lethe europa* (Fabricius, 1787) | \* | \_ | \_ | \* |
| **55** | Glassy Tiger | *Parantica aglea* (Stoll, [1782]) | \* | \* | \_ | \* |
| **56** | Bengal Spotted Palmfly | *Elymnias malelas malelas* (Hewitson, 1863) | \* | \_ | \_ | \_ |
| **57** | White-line Bushbrown  | *Telinga malsara* (Moore, 1857) | \* | \_ | \* | \_ |
| **58** | Great Evening Brown | *Melantis zitenius* (Herbst, 1796) | \* | \* | \_ | \* |
| **59** | Indian Nawab | *Charaxes bharata* C. & R. Fedler, [1867] | \* | \_ | \_ | \* |
|  | **Family: Pieridae** |   |   |   |   |   |
| **60** | Mottled Emigrant | *Catopsilia pyranthe* (Linnaeus,1758) | \* | \* | \_ | \* |
| **61** | Common Emigrant | *Catopsilia pomana* (Fabricius, 1775) | \* | \* | \* | \* |
| **62** | Oriental Mottled Emigrant | *Catopsilia pyranthe pyranthe* (Linnaeus, 1758) | \* | \_ | \* | \_ |
| **63** | Yellow Orange Tip | *Ixias pyrene* Linnaeus, 1764 | \* | \* | \* | \* |
| **64** | White Orange Tip | *Ixias marianne*(Cramer,1779) | \* | \* | \_ | \* |
| **65** | Common Jezebel | *Delias eucharis* (Drury,1773) | \* | \* | \* | \* |
| **66** | Common Wanderer | *Pareronia hippia* (Cramer,1776) | \* | \* | \_ | \* |
| **67** | Common Grass Yellow | *Eurema hesabe* (Linnaeus,1758) | \* | \* | \* | \* |
| **68** | Spotless Grass Yellow | *Eurema laeta* (Boisduval,1836) | \* | \_ | \_ | \* |
| **69** | Leser Gull | *Cepora nadia* (Lucas, 1852) | \* | \* | \_ | \_ |
| **70** | Common Gull | *Cepora nerissa* (Fabricius,1775) | \* | \* | \* | \* |
| **71** | Indian cabbage white | *Pieris canidia* (Sparrman, 1768) | \* | \* | \_ | \* |
| **72** | Small Grass Yellow | *Eurema brigitta* (Stoll, [1780]) | \* | \* | \* | \* |
| **73** | Psyche | *Leptosia nina*(Fabricius,1793) | \* | \* | \* | \* |
| **74** | Cabbage Butterfly | *Pieris rapae* (Linnaeus, 1758) | \* | \* | \_ | \* |
| **75** | Three-spot Grass Yellow | *Eurema blanda* (Boisduval, 1836) | \* | \* | \_ | \* |
| **76** | Pioneer | *Belenois aurota* (Fabricius, 1793) | \* | \* | \* | \* |
| **77** | Pale Clouded Yellow  | *Colias erate* (Esper, 1805) | \* | \_ | \_ | \* |
|  |  **Family: Lycaenidae** |   |   |   |   |   |
| **78** | Common Pierrot | *Castalius rosimon* (Fabricius,1775) | \* | \* | \* | \* |
| **79** | Common Silverline | *Cigaritis vulcanus* (Fabricius,1775) | \* | \_ | \_ | \* |
| **80** | Plains Cupid | *Chilades pandava* (Horsefield,1829) | \* | \* | \* | \* |
| **81** | Slate Flash | *Rapala manea* (Hewitson,1863) | \* | \* | \* | \* |
| **82** | Dark Grass Blue | *Zizeeria karsamdara* (Moore,1865) | \* | \* | \* | \* |
| **83** | Lesser Grass Blue | *Zizina otis* (Fabricius,1787) | \* | \* | \* | \* |
| **84** | Rounded Pierrot | *Tarucus nara* (Kollar,1884) | \* | \* | \* | \* |
| **85** | Common Guava Blue | *Virachola isocrates* (Fabricius,1793) | \* | \* | \_ | \* |
| **86** | Lime Blue | *Chilades lajus* (Stoll, [1780]) | \* | \* | \* | \* |
| **87** | Gram Blue | *Euchysops cnejus* (Fabricius,1798) | \* | \* | \* | \* |
| **88** | African Babul Blue | *Azanus jesous* (Guerin-Meneville,1849) | \* | \_ | \* | \* |
| **89** | Pea Blue | *Lampidus boeticus* (Linnaeus,1767) | \* | \* | \* | \* |
| **90** | Apefly | *Spalgis epeus* (Westwood, 1851) | \* | \_ | \_ | \* |
| **91** | India sunbeam | *Curetis thetis* (Drury, [1773]) | \* | \* | \_ | \* |
| **92** | Saronis Sunbeam | *Curetis saronis* Moore,1877 | \* | \_ | \* | \* |
| **93** | Spotted Pierrot | *Taucus callinara* Butler,1886 | \* | \* | \* | \* |
| **94** | Margined Hedge Blue | *Celatoxia marginata* (de Niceville, [1884]) | \* | \_ | \_ | \* |
| **95** | Zebra Blue | *Leptosia plinius* (Fabricius,1793) | \* | \* | \* | \* |
| **96** | Lankan Oak Blue | *Arhopala amantes* (Hewitson, 1862) | \* | \_ | \_ | \* |
| **97** | Forget Me Not | *Ctochrysops strabo* Fbricius, 1793 | \* | \* | \* | \* |
| **98** | Pale Grass Blue | *Pseudozizeeria maha* (Kollar, [1844]) | \* | \_ | \_ | \* |
| **99** | Common Red Flash  | *Rapala iarbus* (Fabricius, 1787) | \* | \* | \_ | \* |
| **100** | Peacock Royal  | *Tjuria jehana* Moore, [1884] | \* | \_ | \* | \_ |
| **101** | Silverstreak Blue  | *Iraota timoleon* Stoll, 1790 | \* | \* | \_ | \* |
| **102** | Monkey Puzzle  | *Rathinda amor* (Fabricius, 1775) | \* | \_ | \_ | \* |

**Table: 1. Table representing the butterfly species belongs to five families documented during study in four selected sites located in Gaya district.**

**Graph: 1. Histogram showing the percentage and number of species in five families of butterfly in four selected sites of Gaya district.**