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Studies on the biodiversity of some families of butterflies (Lepidoptera: Rhopalocera) at Kanke, Ranchi, Jharkhand, India

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Abstract- Present study was an attempt to investigate the biodiversity of the butterflies (Lepidoptera: Rhopalocera) at Kanke, Ranchi, Jharkhand in the year 2019 to 2021. The seasonal collections were made at the interval of 15 days. The objective of this work was to understand the status of species richness and diversity of the butterflies, mainly during the COVID-19 lockdown. Total 702 individuals of butterflies belonging to 21 species under the three families Nymphalidae, Pieridae and Papilionidae with their host plants were reported. Nymphalidae was the most dominant family. The diversity was calculated using Shannon Weiner Index (H). The calculated values of Shannon Weiner diversity index (H) was found to be highest (3.012) during the year 2021. These values indicate that the area of study contains good butterfly diversity and it might play a role in the biodiversity conservation.

Key words: Lepidoptera: Rhopalocera, Nymphalidae, Pieridae, Papilionidae, Shannon Weiner Index, Kanke, Ranchi

INTRODUCTION

Most abundant animal types belong to the class Insecta of phylum Arthropoda.¹ In this class, the order Lepidoptera is considered to be the second largest and highly diverse². It comprises butterflies and moths.³⁻⁵ Butterflies are studied more than any other insect because they are easily accessible and can be captured and identified. Moths play a role as pest on many economically important plants.⁶ Both of them serve as pollinators. So, they have great economic importance.⁷ Studies on the animals have been performed⁸⁻¹⁰ mainly for its abundance, species richness, relationship with vegetation and abiotic factors. They show behaviour of mimicry, migration and seasonality that make them different from the others. Butterflies are the most attractive creatures in the world

of insects due to their diverse and beautiful colour. So they have aesthetic value, as well. The diverse habitat and climate of India is responsible for the different colour, size, and species of butterflies. They are recognized as a potent ecological indicator because of their sensitivity towards changes in habitat, climate, and weather¹¹⁻¹³ and also as an important component of food chain. They can be good study material for the analysis of genetics, coevolution and insect - plant relationship.¹⁴ As the abiotic factors like ecological factors and host plants directly influence the larva and adult of them and so influence their diversity.

Aim and objective of this work was to collect the butterflies from study areas of Ranchi to record the ecological factors at the same place, to calculate the diversity of the collected butterflies and then correlate with the seasonal variations and host plants, because

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butterflies directly depend on food plants.¹⁵ The study of the diversity of butterflies mainly took place during the COVID-19 period when the anthropogenic disturbances were less, because of the lock down.¹⁶ Morrison-Godfrey (1950)¹⁷ reported about 121 species and 134 sub-species from Ranchi and Hazaribag. Rapid urbanization and destruction of natural habitat for the commercial and residential purpose at Ranchi can be a potential threat to the biodiversity of butterflies. The present study was designed to study the effect of ecological factors and host plants on the population dynamics and diversity of the insects. The collection work was made during the years 2019-2021.

MATERIALS & METHODS

Collection, Identification and Preservation of samples:-

Collection of butterflies from Kanke, Ranchi in the state of Jharkhand was done. Its geo-coordinate is 23° 26' 4.3764' N (latitude) and 85° 19' 14.5272' E (longitude). The collection was accomplished through flying net technique. One individual of each species was preserved for reference and rest were released. Counting was made through quadrat method. For the preservation, butterflies were killed using ethyl acetate in an airtight killing jar. Stretching of wings and proper pinning was done as per prescribed format. Identification was done with the help of available literature, (<https://www.ifoundbutterflies.org>)¹⁸ and by comparing with the zoological keys and reference collection available at the Zoological Survey of India and National Centre for Biological Science¹⁹. After a few days of spreading, the dried specimens were shifted from the spreading board to the wooden box by removing the pins and preserving them with the labelling. The collection work was divided into three seasons – Pre-monsoon (January to April), Monsoon (May to August) and Post-monsoon (September to December).

Tabulation of Data: -

Data analysis:- It was completed with the help of MS-Excel and PAST software. Shannon-Weiner Diversity Index (1948)²⁰ and Simpson's Dominance Index

$$H' = -\sum P_i \ln P_i \quad \text{and} \quad H = -\sum [(p_i) \times \ln(p_i)]$$

Where, P_i = species diversity index.

N = total number of species.

Table 1: Yearly report of the environmental factors like ambient temperature, relative humidity and rainfall at Kanke site. The ambient temperature was between 22°C to more than 24°C while relative humidity was calculated between 76% to more than 77 % and the rainfall was 3mm to more than 5mm.

Year	Ambient temp.(°C)	R.H. (%)	Rainfall (mm)
2019	24.75 ± 5.15	76.04 ± 3.13	5.64 ± 18.75
2020	22.10 ± 6.08	77.14 ± 5.08	4.38 ± 13.36
2021	24.61 ± 5.04	77.29 ± 1.75	3.19 ± 12.80

Plant diversity at the site: A rich diversity of plants belonging to trees, shrubs and herbs was found in the collection area of Kanke. Agro-horticulture areas were also found nearby to the site. *Asclepias curassavica* (Kaura-Dodi), *Calotropis gigantea* (Safed Ak), *C. Procera* (Madar, Ak), *Cryptolepis dubia* (Karanta) *Bambusa bambos* (bans), *Andropogon* (beard grass), *Cymbopogon* (Lemon grass), *Apluda*, *Eleusine* (grass), *Ficus reliogiosa* (Peepul), *Oryza sativa* (Paddy, Rice), *Panicum maximum* (Guinea Grass), *Zea* (maize), *Sinningia speciosa* (Gloxinia), *Hygrophila auriculata* (gokanta), *Nelsonia canescens* (blue pussy leaf), *Ricinus communis* (Castor Seed Plant), *Tragia cannabina* (Ground creeper), *Tragia involucrate* (Indian Stinging Nettle), *Barleria* (vajradanti), *Celtis timorensis* (stinkwood) *Ficus benghalensis* (Banyan), *Ficus glomerata* (Country fig, Goolar), *Ficus indica* (cactus pear) *Holarrhena antidysenterica* (Kura, Kurchi, Dudhi), *Ichnocarpus frutescens* (Kali Dudhi), *Nerium oleander* (Oleander), *Bombax ceiba* (red silk cotton tree) *Leguminosae* (Beans), *Hibiscus rosasinensis* (china rose), *Jasminum officinale* (jasmine) and others.

RESULTS & DISCUSSION

Total 702 butterflies' sightings of 21 species were recorded during the collection period. The species compositions with their taxonomic position, family wise presented in Table 2.

Species Composition

The present study covers a smaller area. Among three families, butterflies of family Nymphalidae were prevalent than two other families. During the compilation done in the year 2019-21 in Kanke, Ranchi, 13 species of butterflies belonging to Nymphalidae family, four species each of Pieridae, and Papilionidae family were found (Table-1). The thirteen species of Nymphalidae family were *Danaus chrysippus chrysippus* (NYM001), *Melanitis phedima bela* (NYM002) *Junonia almana*

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(NYM003), *Callerebia scandao pima* (NYM004), *Ariadne merione merione* (NYM005), *Melanitis phedima varaha* (NYM006), *Junonia atlites atlites* (NYM007) *Rohana parisatis parisatis* (NYM008) *Danaus genutia genutia* (NYM009) *Euploea core core* (NYM010), *Neptis hylas nicobarica* (NYM011), *Lasippa viraja viraja* (NYM012), and *Acraea terpsicore* (NYM013). Four species of butterflies of the family Pieridae were *Eurema andersonii* (PIE001), *Delias eucharis* (PIE002), *Catopsilia pomona* (PIE003), and *Belenois aurota aurota* (PIE004). Four species of butterflies of the family Papillionidae were *Graphium macareus indicus* (PAP001), *Papilio polytes* (PAP002), *Papili odemolus demolus* (PAP003), and *Pachliopta aristolochiae*

aristolochiae (PAP004). As far as butterflies are concerned, 61.9% belonged to Nymphalidae followed by 19.05% of both Pieridae and Papillionidae families. The similar trend was reported by Verma (2009)²¹ and Joshi & Arya (2007)²².

Maximum types of butterflies were belonging to the most common family Nymphalidae. Joshi & Arya (2007)²² has reported that its dominance was found equally in both higher and lower altitude areas. Verma (2009)²¹ has also reported presence of butterflies (NYM001, NYM003, NYM005, NYM007, NYM010, NYM011, PIE002, PIE003, and PAP002) at Dalma Wildlife Sanctuary, Jharkhand found in consonance with the results of author.

Table 2: - List of butterflies collected from Kanke, Ranchi during 2019 – 2021.

Sl. no	Name Of The Butterfly Species	Sample Code	Common Name	Family
1	<i>Danaus chrysippus chrysippus</i> (Linn.)	NYM001	Plain Tiger	Nymphalidae
2	<i>Melanitis phedima bela</i> (Carmer)	NYM002	Dark Evening Brown	Nymphalidae
3	<i>Junonia almana</i> (Linn.)	NYM003	PeacockPansy	Nymphalidae
4	<i>Callerebia scandao pima</i> (Kollar)	NYM004	Pallid Argus	Nymphalidae
5	<i>Ariadne merione merione</i> (Carmer)	NYM005	Dakhan Common Caster	Nymphalidae
6	<i>Melanitis phedima varaha</i> (Carmer)	NYM006	Dark Evening Brown	Nymphalidae
7	<i>Junonia atlites atlites</i> (Linn.)	NYM007	Grey Pansy	Nymphalidae
8	<i>Rohana parisatis parisatis</i> (Westwood)	NYM008	Black Prince	Nymphalidae
9	<i>Danaus genutia genutia</i> (Carmer)	NYM009	Oriental Plain Tiger	Nymphalidae
10	<i>Euploea core core</i> (Carmer)	NYM010	Indian Common Crow	Nymphalidae
11	<i>Neptis hylas nicobarica</i> (Linn.)	NYM011	Common Sailor	Nymphalidae
12	<i>Lasippa viraja viraja</i> (Moore)	NYM012	Yellow jack Sailor	Nymphalidae
13	<i>Acraea terpsicore</i> (Linn.)	NYM013	Indian Tawny caster	Nymphalidae
14	<i>Eurema andersonii</i> (Moore)	PIE001	One Spot Grass Yellow	Pieridae
15	<i>Delias eucharis</i> (Drury)	PIE002	Common Jezebel	Pieridae
16	<i>Catopsilia pomona</i> (Fabricius)	PIE003	Lemon Emigrant	Pieridae
17	<i>Belenois aurota aurota</i> (Fabricius)	PIE004	Pioneer White	Pieridae
18	<i>Graphium macareus indicus</i> (Godart)	PAP001	Lessor Zebra	Papillionidae
19	<i>Papilio polytes</i> (Linn.)	PAP002	Indian Common Mormon	Papillionidae
20	<i>Papilio demolus demolus</i> (Linn.)	PAP003	Oriental Lime swallowtail	Papillionidae
21	<i>Pachliopta aristolochiae aristolochiae</i> (Fabricius)	PAP004	Common Rose	Papillionidae

Table 3: A chart containing year wise collection list of individual species and their families and the Shannon Weiner diversity index values.

Year	Family	Total number of species	Total number of individuals	Diversity index (H')
2019	Nymphalidae	13	87	
	Pieridae	04	40	
	Papillionidae	04	26	
	Total (A)	21	153	2.940
2020	Nymphalidae	13	190	
	Pieridae	04	51	
	Papillionidae	04	33	
	Total (B)	21	274	2.993
2021	Nymphalidae	13	195	
	Pieridae	04	54	
	Papillionidae	04	33	
	Total (C)	21	282	3.012
	Grand Total (A+B+C)		709	

Species Diversity

Shannon-Weiner diversity index of the collected butterflies were calculated year wise. In the year 2019, 2020 and 2021 it was 2.940, 2.993, and 3.012 respectively (Table 3). The results show that the biodiversity of collected samples increased yearly. It was highest in the year 2021 while lowest in 2019. This trend is reported as a new finding by the author because it was not similar to the diversity index cited by Verma (2009)²¹.

Species Richness

In the year 2019, *Ariadne merione merione* (NYM005) and *Belenois aurota aurota* (PIE004) were abundantly collected while in the year 2020, *Ariadne merione merione* (NYM005) was abundant. But in the year 2021, *Danaus chrysippus chrysippus* (NYM001), *Melanitis phedima bela* (NYM002), *Ariadne merione merione* (NYM005), *Neptis hylas nicobarica* (NYM011), *Belenois aurota aurota* (PIE004) were abundant (Table 3). It indicated that *Ariadne merione merione* (NYM005) was abundantly found in all three years while in 2021 the dominance of some other species was also reported.

The result of species richness of the Ranchi in and around was found in inconsequence with the results of Morse *et al.* (1988)²³, Ahmad (2017)²⁴, Kumari *et al.* (2021)²⁵.

CONCLUSION

Total 702 butterflies' sightings of 21 species were tabulated during the collection period. The diversity was found to be good in all three years. COVID-19 lockdown may have helped their diversity in year 2020 and 2021 because of less fabricated disturbances. Further researches are needed to develop more correlation with the situation and diversity as well as species richness of butterflies in Kanke, Ranchi, Jharkhand.

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LIMITATION

The study area was small so, results may not be significantly similar in a bigger collection area. It depends on further researches.

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