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A COMPARATIVE STUDY OF BUTTERFLY DIVERSITY IN THREE SELECTED SITES IN GHODEGAON, MAHARASHTRA, INDIA.

Kiran Pardhi[1] and Pratik Havale[2]
1,2 Assistant Professor
Department of Zoology
Arts, Science and Commerce College,
Mokhada Dist. Palghar, Maharashtra, India.

***Abstract* :** A present survey was carried out at three selected sites in the Ghodegaon region of Maharashtra, India, for a period of eight months, from September 2021 to May 2022. A total of 41 species of butterflies were recorded during the study period, belonging to six families. The Nymphalidae family was dominant among the six families, with 20 (48%) species observed during this survey. Common castor (*Ariadne merione*), Common grass yellow (*Eurema hecabe*), and Red Pierrot (*Talicada nyseus*) are the most dominant butterfly species, followed by Gram Blue (*Euchrysops cnejus*), Common Sailer (*Neptis hylas*), and Common Crow (*Euploea core*). Danaid eggfly (*Hypolimnas misippus*) species are protected under the Wildlife (Protection) Amendment Act, 1972, observed in all three selected sites. The study area is rich in butterfly diversity, with a high Simpson Index of Diversity (0.9). The site Dhakale shows the maximum number of butterflies (126) followed by Thakarwadi (Kolwadi/kotamdara) (113), and the Sal site shows the minimum (97) number of individuals. The present survey helps to the documentation and systematic classification of butterfly fauna for future study.

Index Terms - Butterfly, Fauna, Wildlife, Diversity.

I.INTRODUCTION

The Western Ghat is one of the most popular hotspots in India, and the Ghodegaon region is a part of the Western Ghat. Butterflies fall under the group of insects and phylum Arthropoda. They are exhibited in different colors and patterns. Some butterflies act as charismatic species or flagship species (Gowda et al., 2011). Butterflies play an important role in maintaining the food chain and in pollination (Dwari et al., 2017). The presence of these creatures indicates that the ecosystem is in good condition. Butterflies are good biological indicators of habitat and environmental health (Larsen, 1988; Kocher and Williams, 2000; Sawchik and Dufrence, 2005). Even a small change in their habitat also disturbed their occurrence, and hence, these insects work as ecological indicators (Chakravarthy et al., 1997). They consist of a total of six families, namely Nymphalidae, Papilionidae, Pieridae, Hesperidae, Lycaenidae, and Libytheidae.

Nearly half the earth was occupied by insects (May, 1992). Depending on the season, the occurrence of butterfly species is also variable (Kunte, 1997). There was no detailed record available on butterfly species diversity in the Ghodegaon region of Maharashtra. The present work helped to prepare a checklist of butterfly species and diversity found at three selected sites.

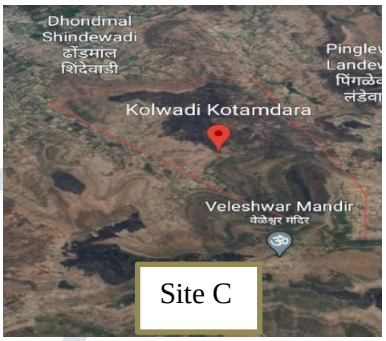
II. MATERIALS AND METHODS

2.1 Study area

Site A: Dhakale – 18.99122877,73.84289572

Site B: Sal – 19.02874567,73.793921319.

Site C: Thakarwadi (Kolwadi/Kotamdara) – 19.00338541,73.84238919



Google earth map of Selected Study Area.

The Western Ghat includes Maharashtra, and the Ghodegaon region lies between these hotspots. This location is situated 67 km to the north of the district headquarters in Pune and 120 km from the state capital, Mumbai. The latitude for the Ghodegaon region is 19.34 and the longitude is 74.88. The climate of the study area is characterized by hot summers, with a maximum temperature of 42°C from May to June and an average of 15°C in January. On average, the area receives an annual rainfall of 622 to 950 mm. Three sampling sites were selected in the study area, which include Dhakale, Sal and Thakarwadi (Kolwadi/Kotamdara).

2.2 Sampling

The field surveys on butterflies were carried out in the study area four times a week for a period of eight months, from September to May 2022. Butterflies will be observed in the study area from 8 a.m. to 11 a.m. and from 3 p.m. to 6 p.m. by random observations while walking through the three selected sites. In the field, photographs and a video of the butterflies were taken with the help of a mobile phone, the Redmi Note 7S.

2.3 Identification

For identification purposes, standard keys are used adopted by (Kehimkar, 2008; Kunte, 2000; Wynter-Blyth, 1957; Varshney and Smetacek, 2015). The most popular field guide, Butterflies of Western Ghats, is used for identification (Raju Kasambe, 2018). Sometimes we visit the Butterfly of India website.

2.4 Data analysis

The butterflies observed in three selected sites were listed in tabulated format. Analysis was done by using different formulas.

a. Simpson index of diversity mathematical formula-

$(D)= 1- [\Sigma ni(ni-1) / N(N-1)]$

Where, Σ = sum of (Total)

ni = Number of individuals of each different species

N = Total number of individuals of all species

b. Shannon index of diversity mathematical formula-

$(H') = -[\Sigma(ni/N \times \ln(ni/N)]$

Where, Σ = sum of (Total)
ni = Number of individuals of each different species
N = Total number of individuals of all species

c. Simpson's Reciprocal Index mathematical formula-

$DI = N (N-1)/ \sum n (n-1)$

Where, DI = Simpson reciprocal diversity index (note: D is the really 1/D for Simpson's Diversity)
N = Total number of individuals of all species
N = Number of individuals of a particular species.

III. RESULTS AND DISCUSSION

Table 1 indicates that a total of 41 species of butterflies were assessed during a period of eight months. A total of 336 individuals belonging to the six families were observed in three selected areas. The Nymphalidae family shows the highest number of species (20), while the Riodinidae and Hesperiidae families indicate the lowest number of species (1). Danaid eggfly species are protected under the Wildlife (Protection) Amendment Act, 1972, and are observed in all three selected sites. The Dhakale site shows the maximum number of butterflies (126).

The present survey indicates that the family Nymphalidae has a total of 20 species, comprising 48% of the total butterfly species, i.e., it is a dominant family. While the Riodinidae and Hesperiidae families show only a single species, each comprising 2% of the composition, a similar survey was carried out by Kamal Dhakane et al. (2020) that recorded a total of 51 species of butterflies belonging to the five families by random observation in the Ghodegaon region, Maharashtra, India. The observations show that the Nymphalidae were the richest family, including 47.05%, followed by the Pieridae and Lycaenidae, with 17.65% in both families and the lowest 3.92% observed in the Hesperiidae family.

The site, which is rich in nectar-bearing and host plants, shows high species richness. Also, those sites show less human activity, greater number of butterfly species are observed. Nectar-bearing plants are responsible for the occurrence of many butterfly species (Tiple et al., 2007). The maximum number of secondary vegetation with less predation shows good butterfly diversity. This survey is quite helpful for the documentation and conservation of biological diversity.

Table 1. Checklist of butterfly species observed in three selected sites.

Sr. No.	Family	Common Name	Scientific Name	Number of Individuals			Total No. Butterflies
				Site A	Site B	Site C	
1	Nymphalidae	Plain tiger	*Danaus chrysippus*	03	04	02	09
2		Glassy tiger	*Parantica aglea*	04	02	-	06
3		Blue tiger	*Tirumala limniace*	05	04	02	11
4		Stripped tiger	*Danaus genutia*	01	02	-	03
5		Common crow	*Euploea core*	05	04	06	15
6		Danaid eggfly	*Hypolimnas misippus*	02	01	03	06
7		Blue pansy	*Junonia orithya*	01	-	02	03
8		Lemon pansy	*Junonia lemonias*	02	03	01	06
9		Peacock pansy	*Junonia almanac*	-	02	01	03
10		Chocolate pansy	*Junonia iphita*	02	03	04	09
11		Great eggfly	*Hypolimnas bolina*	03	04	04	11
12		Common leopard	*Phalanta phalantha*	-	02	01	03
13		Common Castor	*Ariadne merione*	12	08	14	34
14		Common Bush brown	*Mycalesis perseus*	-	02	01	03
15		Common evening brown	*Melanitis leda*	03	02	01	06
16		Common five ring	*Ypthima baldus*	02	02	01	05
17		Common nawab	*Polyura athamas*	-	01	02	03
18		Common Baron	*Euthalia aconthea*	01	02	01	04
19		Painted lady	*Vanessa cardui*	01	02	02	05
20		Common Sailer	*Neptis hylas*	08	04	06	18
21	Papilionidae	Blue Mormon	*Papilio polymnestor*	02	01	03	06
22		Lime butterfly	*Papilio demoleus*	01	-	02	03
23		Tailed jay	*Graphium agamemnon*	02	01	03	06
24		Common Mormon	*Papilio polytes*	02	01	01	04
25	Pieridae	Common Wanderer	*Pareronia valeria*	02	-	03	05
26		Common jezebel	*Delias eucharis*	02	01	02	05
27		Mottled emigrant	*Catopsilia pyranthe*	03	04	02	09
28		Common emigrant	*Catopsilia pomona*	05	04	04	13
29		Common grass yellow	*Eurema hecabe*	12	09	09	30
30		Psyche	*Leptosia nina*	01	-	01	02
31	Lycaenidae	Red Pierrot	*Talicada nyseus*	13	04	06	23
32		Common Pierrot	*Castalius rosimon*	03	01	01	05
33		Zebra blue	*Tarucus Plinius*	02	01	03	06
34		Common Cerulean	*Jamides celeno*	03	01	02	06
35		Dark Cerulean	*Jamides bochus*	02	03	02	07
36		Indian Sunbeam	*Curetis thetis*	01	-	02	03
37		Common Red Flash	*Rapala airbus*	-	02	01	03
38		Gram Blue	*Euchrysops cnejus*	08	04	06	18
39		Pea Blue	*Lampides boeticus*	01	03	01	05
40	Riodinidae	Plum judy	*Abisara echerius*	03	01	02	06
41	Hesperiidae	Small Branded Swift	*Pelopidas mathias*	03	02	03	08
Total				**126**	**97**	**113**	**336**

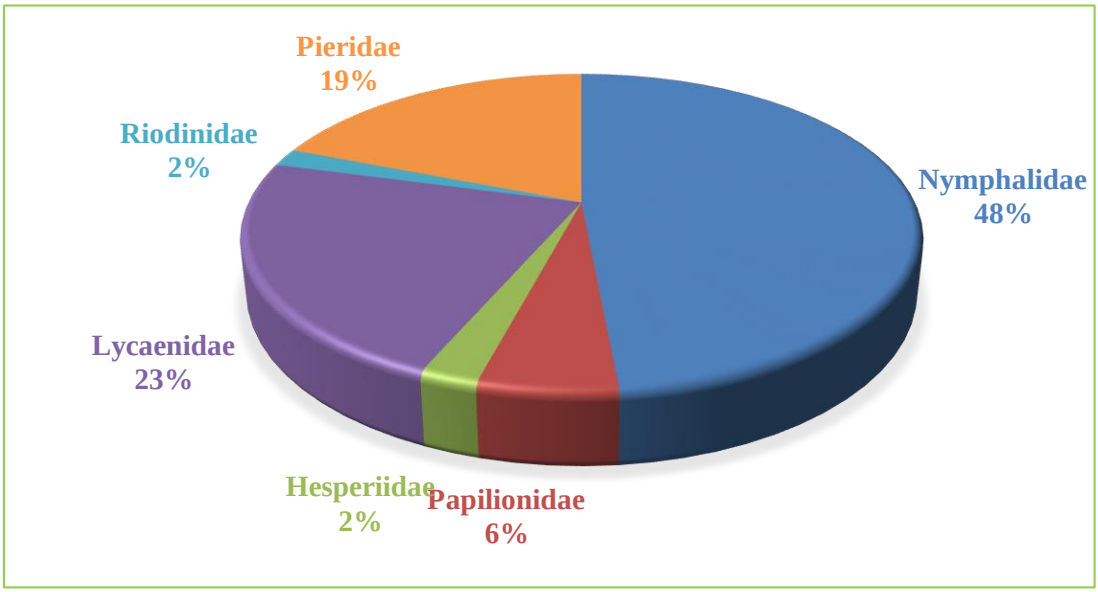


Fig.1 - Family wise percentage composition of butterfly species.

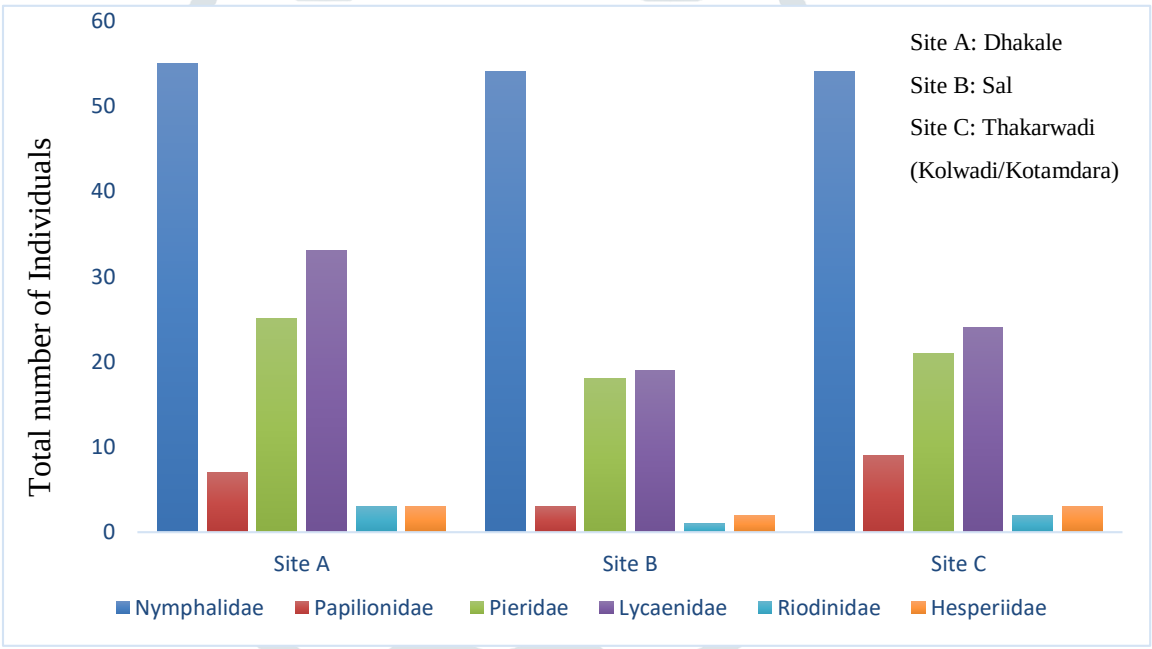
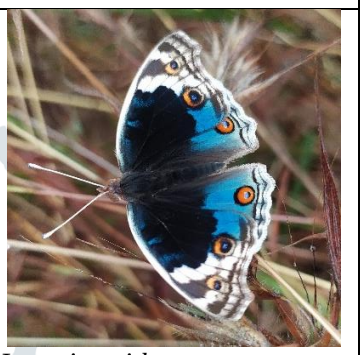


Fig.2 - Total number of individual populations of butterfly in three selected sites.

Table.2 Photo plate

 *Danaus chrysippus*	 *Parantica aglea*	 *Tirumala limniace*
 *Euploea core*	 *Hypolimnas misippus*	 *Junonia orithya*
 *Junonia iphita*	 *Hypolimnas bolina*	 *Phalanta phalantha*
 *Mycalesis perseus*	 *Melanitis leda*	 *Neptis hylas*

 *Papilio demoleus*	 *Graphium agamemnon*	 *Papilio polytes*
 *Delias eucharis*	 *Eurema hecabe*	 *Talicada nyseus*
 *Tarucus plinius*	 *Tarucus plinius*	 *Vanessa cardui*
 *Lampides boeticus*	 *Euthalia aconthea*	 *Rapala airbus*

 *Ypthima baldus*	 *Jamides celeno*	 *Catopsilia Pomona*
 *Junonia almana*	 *Leptosia nina*	 *Abisara echerius*
 *Danaus genutia*	 *Junonia lemonias*	 *Ariadne merione*
 *Papilio polymnestor*	 *Pareronia valeria*	 *Castalius rosimon*

Catopsilia pyranthe

Euchrysops cnejus

Pelopidas mathias

Curetis thetis

Polyura athamas

Table. 3 - Number of butterflies, Simpson Index of Diversity, Simpson's Reciprocal Index and Shannon diversity index in three selected sites.

Sites	Selected Sites Names	Number of Butterflies	Simpson Index of Diversity	Simpson's Reciprocal Index	Shannon diversity index
A	Dhakale	126	0.96	23.37	3.27
B	Sal	97	0.97	33.02	3.39
C	Thakarwadi (Kolwadi/kotamdara)	113	0.96	26.93	3.38

IV. CONCLUSION

Different floral diversity plays an important role in the life cycle of a butterfly. Selected areas are rich in various flora. Hence, all three selected sites are rich in butterfly species. The present survey indicates that a total of 41 species of butterflies belonging to the six families were recorded. The highest species were observed in the family Nymphalidae, followed by Lycaenidae, Pieridae, and Papilionidae, and the lowest species were observed in the families Riodinidae and Hesperiidae, respectively. Also, the Dhakale site shows the highest number of individuals.
Hence, there is a scope for documentation and systematic classification of butterfly species for detailed future study.

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Websites use for identification

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ii) Butterflies of India- https://www.ifoundbutterflies.org/

iii) Butterfly conservation - https://butterfly-conservation.org/butterflies/identify-a-butterfly?page=1