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A Study of Butterfly Diversity in Nandgaon Village and Gulmohar Park in Khed Tehsil District of Ratnagiri (M.S.) India

Ayesha A. Rauf Murudkar[1] and Nanda Bhupal Jagtap[2]
Department of Zoology
Dapoli Urban Bank Senior Science College, Dapoli, Ratnagiri[1,2]

Abstract:*A study about diversities of butterfly was carried out in Khed taluka Ratnagiri district of Maharashtra, India. These two sites were used in the study area for the surveys of butterflies namely "Nadgaon Village and Gulmohar park", a total of 36 individuals and 35 species of butterflies belong to 5 families and were recorded during the study period.Nymphalidae was the richest amongst families that comprised (15 and 42%) of the total species of butterfly recorded in the study area which was followed by Lycaenidae (10 and 28%), Pieridae (5 and 14%) Papilioninae (5 and 14%) and Riodinidae family were the lowest (1 and 3%) respectively. Amongst the species of butterflies Which were observed in the study area, 4 of them were abundantly and 2 species were common while 8 numbers of the species of butterflies were rare. In addition to that 7 numbers of the species of butterfly were occasionally found.The study area is rich in butterfly and its diversity. However further research could be conducted to obtain more details and documentation on butterfly diversity for the conservation and butterfly park.*

Keywords: A study on butterfly diversity in Khed, District Ratnagiri (MS), India

I. INTRODUCTION

Butterflies' build-up a large group of insects known as the order Lepidoptera in phylum Arthropod. The is derived from the Greek word lepido meaning "scale" and ptera meaning "wings" which alsorefers to a prominent feature of adult butterflies (the tiny scales that cover the wings). Butterflies are wonderfully diverse in shape, size and colour.They can be found anywhere around the world except the Poles. There are about 200,000 known species of Lepidoptera, of which about 10% are butterflies.Based on their anatomy, they are classified into six families: the Pieridae, commonly known as "whites" and sulphurs; the Papilionidae, or swallowtails; the Nymphalidae, includingthemorphos, the owl butterfly and the long wings; the Hesperidae, or skippers; the Libytheidae, or snout butterflies; and the small Lycaenidae. Butterflies are good indicators of climatic conditions, seasonal and ecological changes, they can also serve in formulating strategies for conservation.However, they have largely been ignored by conservation biologists and policy makers as well.Hence butterflies play a vital role in ecosystem and co-evolutionary relationship between them and plants as well as their lives are interlinked (Ghazanfaret al.,2016).

Kunteet al. (2012) showed that India harboured total Number of 1504 butterfly species which meant 8.74% of the world's butterflies and 285 species found in southern India.The Indian peninsula and Western Ghats have 351 and 334 species respectively. The order represents a mega diverse radiation of almost exclusively phytophagous insects probably correlated with the great diversification of flowering plants since the Cretaceous (Menkenet al.,2012). Butterflies they provide many vital economically important services within terrestrial ecosystem (such as nutrients recycling, soil formation, food resources and pollination). Pahariet al. (2018) revealed on the study of butterfly diversity in Haldia industrial zone that shows few numbers of butterfly species, less diversity and evenness indices when compared with the adjacent rural belt. And also recommend that industrialized areas are harmful places to the butterflies.

Leon-Corteset al. (2019) reported that the most diverse species of butterfly in the study area were belonging to Nymphalidae family with (31) species followed by Hesperidae (12), Pieridae (19) and Lycaenidae (16) respectively. One of the groups of animals with diverse species richness is insects which represent over 50% of terrestrial

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biodiversity. Butterflies, unlike most of other groups of insects, are popular, well documented, and easy to recognize. Butterflies they are well adapted to the landscape and react quickly to any alteration in their habitat as a result of human-induced activities such as farmland intensification and intensive logging (Moraet al.,2011). Climatic change affects the diversity of species and is expected to exacerbate the ecosystems (Scott and Lemieux, 2005).The changes in parameters of temperature, rainfall patterns, and extreme weather conditions such as heat waves, prolonged drought or excessive rainfall, have to be taken into consideration.

Depletion of nectar and desiccation of host plants cause direct mortality and induce migratory behaviour. Butterflies, being exothermal, are highly sensitive to climatic variation and a short generation time which makes them an appropriate model organism to study. Vu (2009) described that forest edges have greater diversity of butterflies and more exposure to the open forest. Stream in the forest area play a vital role for the conservation of butterfly diversity, unlike bamboo forest that have less diverse of the butterfly species (Vu and Vu, 2011). There is a need for the documentation of butterfly species from Prayagraj district, under the issues of environmental change from the seasonal variations. Hence, the present study was undertaken to provide baseline information on the checklist of butterflies and their diversity in the study area.

Butterflies are said to be the “insects of the sun” with their catchy colour and beautiful charisma. They have been admired for centuries for their physical beauty and behavioural display.Approximately, 17,200 species of butterflies throughout the world and 1,504 species from the Indian subcontinent are renowned species among the insects, butterflies occupy a vital position in the ecosystem and their occurrence and diversity is considered too well for the health of any given terrestrial biotope.Butterflies are also good indicators of environmental changes as they are sensitive to habitat in degradation and climate change. Some workers have subsequently worked on the composition, richness, diversity and distribution of butterflies in different parts of the world.The distribution of butterflies depends upon the availability of their host plants.Since 18th Century different studies have been made and many researchers have been done on various species. In (1998) it has been documented that 19,238 butterfly species throughout the world are unique and important for the environment. Over the past century, many researchers have significantly contributed to the field of butterfly ecology within the various ecosystems in India (Bingham, 1905, 1907; Williams).

II. Materials And Methods

Khed is a town with a municipal council in the Ratnagiri district of Maharashtra state, India. Situated in between the Mumbai - Goa Highway, NH 66, it is surrounded by a number of villages. Khed is the headquarters of Khed taluka which connects the district administration with the village administration. Khed is located at 17.72°N 73.38°E. It has an average elevation of 25 metres (82 feet). Alphonso mangoes are grown in the area around the town. Khed lies between Kashedi Ghat and Bhoste Ghat. The region surrounding the town is mostly mountainous. The Jagbudi River is a large river located in the area. Raghuveer ghat is mainly use for picnic spots.

We selected Nadgaon and Gulmohar Park Mahad Naka khed as a study area. Nandgaon is a Village in Khed Taluka in Ratnagiri District of Maharashtra State, India. It belongs to Konkan region. It belongs to Konkan Division. It is located 93 KM towards North from District headquarters Ratnagiri. 18 KM from State capital Mumbai. Khed is surrounded by Dapoli Taluka towards west, Chiplun Taluka towards South, Poladpur Taluka towards North, Guhagar Taluka towards South.+Chiplun, Mahabaleswar, Mahad, Wai are the nearby Cities to Nandgaon. Gulmohar Park is a small area in Mahad Naka in Khed Taluka in Ratnagiri District of Maharashtra State, India.

III.Study Area And Sampling Site

The present study was carried out in Taluka Khed Ratnagiri district of Maharashtra, India. The study area is situated between the North latitude 17.72°N and at the longitude 73.38°E and it is located in the western coast of India. The climate of the study area is characterized by Winter with the maximum temperature of 20°C during October to February with an average of 40°C in May. It has subtropical to tropical climate with extremes of summer and winter. On an average, the area receives an annual rainfall of 3,188 mm.

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IV. Survey Method

The field surveys on butterflies were carried out in the studymerely for three times a week for the period of five months from October to February, 2021 to 2022.Butterflies were accessed in the study area from 9am to 11am in the morning by random observations during walking through the two selected sites based on habitats present in the study area. In the field, photographs of the butterflies were taken for the aid of camera for the purpose of identification.

V. Species of Butterfly And Its Identification

The photographs of butterflies were used for the identification of the species of butterfly. Colour patterns, sizes and shapes as well as their designs were taken into consideration for the identification of the species with the help of entomologist expert and relevant available literature as well as photographs described by (Sunil et al., 2016) and (Kumar et al., 2016).

VI. Statistical Data Analysis

Identified species of butterfly observed in the study area were analysed by using Simpson index of diversity formula adopted by (Sunil et al., 2016) and (Ashok, 2017).

The Simpson index of diversity mathematical formula is giving as follows: $(D) = \frac{1-\sum n(n-1)}{N(N-1)}$

Where:

1-D = Simpson Index of Diversity
Σ = Sum of (Total)
n = The number of individuals of each different species
N = The total number of individuals of all the species

VII. Result And Discussion

Checklist of the species of butterfly in the study area

The checklist of the species of butterflies observed in the study area is presented in (Table 1 & 2). The results showed that a total of 316 individuals and 35 species of butterfly belong to 5 families were recorded in the study area. Nymphalidae was the richest family in the study area that comprised (15 and 42%) species of butterfly followed by Lycaenidae with (10 and 28%) species, Papilionidae (5 and 14%), Pieridae (5 and 14%) and Riodinidae were the lowest family with (1 and 3%) species as indicated in (Fig.1& 2).

Table1: Checklist of the species of butterfly recorded in the study area

Sr. No.	Common Name	Scientific Name	Family
1	Common Windmill	Byasa Polyeuctes	Papilioninae
2	Common Yellow swallowtail	Papilio machaon	
3	Malabar Banded Peacock	Papilio buddha	
4	Common mormon	Papilio polytes	
5	Common bluebottle	Graphium sarpedon	
6	Common Grass Yellow	Eurema hecabe	Pieridae
7	One-Spot Grass Yellow	Eurema andersoni	
8	Yellow Orange Tip	Ixias pyrene	
9	Common Emigrant	Catopsilia pomona	
10	Common Albatross	Appias albina	
11	Double Banded Judy	Abisara bifasciata	Riodinidae
12	Zebra blue	Tarucus plinius	Lycaenidae
13	Dark Grass Blue	Zizeeria karsandra	
14	Tiny Grass Blue	Zizula hylax	

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15	Hedge Cupid	Bothrinia chennelli	
16	Indian Cupid	Everes lacturnus	
17	Plains Cupid	Chilades pandava	
18	Cerulean	Jamides celeno	
19	Apefly	Spalgis epius	
20	Common Pierrot	Castalius rosimon	
21	Red Pierrot	Talicada nyseus	
22	Chocolate Pansy	Junonia iphita	Nymphalidae
23	Tawny Coster	Acraea terpsicre	
24	Common Fourring	Ypthima huebneri	
25	Common Three Ring	Ypthima huebneri	
26	Blue Tiger	Tirumala limniace	
27	Glassy tiger	Parantica aglea	
28	Common Crow	Euploea core	
29	Sailer	Neptis Sappho	
30	Short-Banded Sailer	Phaedyma columella	
31	Peacock Pansy	Junonia almana	
32	Common Tiger	Danaus genutia	
33	Plain Tiger	Danaus chrysippus	
34	Blue Pansy	Junonia orithya	
35	Common Sailor	Neptis hylas	
36	Grey Pansy	Junonia atlites	

Table 2: Photographs of the species of butterfly observed in the study area

Common Windmill 	Common Yellow swallowtail 	Malabar Banded Peacock 
Common Mormon 	Common bluebottle 	Common Grass Yellow 
One-Spot Grass Yellow	Yellow Orange Tip	Common Emigrant

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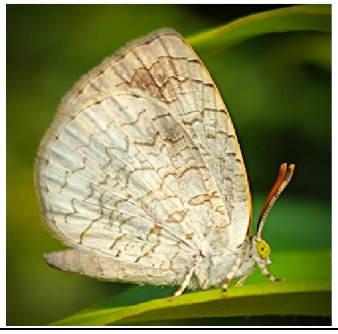
Dark Grass Blue	Tiny Grass Blue	Hedge Cupid
		
Indian Cupid	Plains Cupid	Cerulean
		
Apefly	Common Pierrot	Red Pierrot
		
Chocolate Pansy	Tawny Coster	Common Fourring

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Common Three Ring	Blue Tiger	Glassy Tiger
		
Common Crow	Sailor	Short-Banded Sailor
		
Peacock Pansy	Common Tiger	Plain Tiger
		
Blue Pansy	Common Sailor	Grey Pansy

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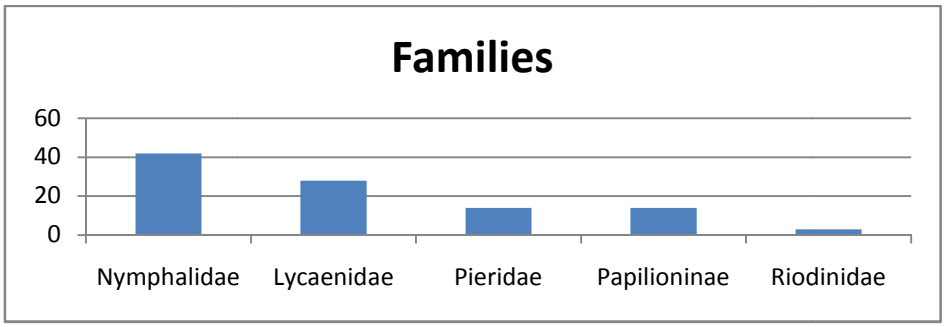

Figure 1: Number of the species of butterfly in a family wise composition in the study area

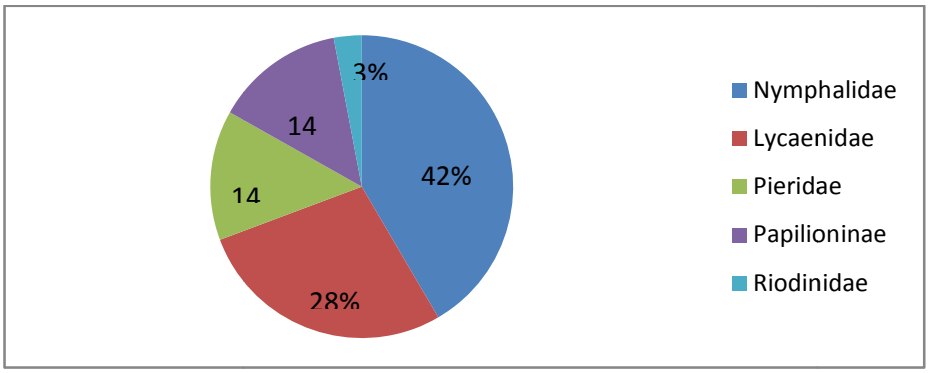

Figure2: Family wise percentage composition of the species of butterfly in the study area

VIII. Species of Butterflies And Its Diversities in the Research Area

The diversity of the species of butterfly which were observed in the study area is presented in (Table 3). The result showed that the highest number of butterflies and Simpson index of diversity was observed in Gulmohar Park site followed by Nadgaon sites showing respectively.

Table3: Number of butterflies and Simpson Index of Diversity in the study area

Sr. No.	Site	Number of butterflies	Simpson Index of Diversity
1.	Gulmohar Park	126	0.9
2.	Nadgaon	118	0.6

1. Gulmohar Park:

Gulmohar Park situated in Mahad, Naka, Khed , Ratnagiri ,Maharashtra India. It is named after presence of Gulmohar trees in it. It is situated at the bank of 'River Jagbudi'. There are two hospitals named as 'Dharya Hospital' and 'Rahim Hospital'.

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Figure3: Gulmohar Park

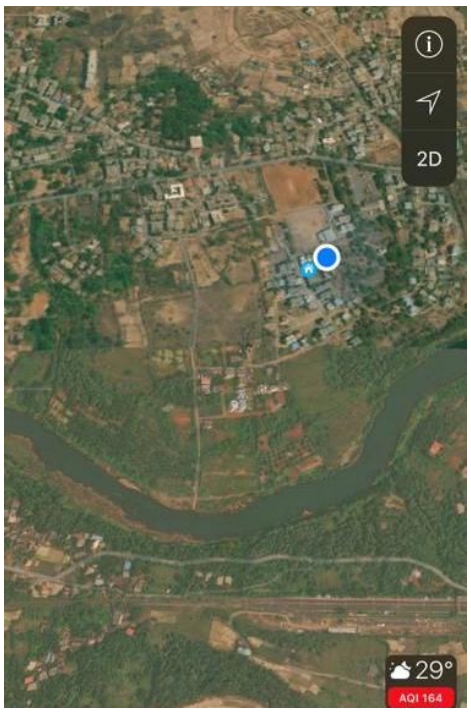

Figure4: Gulmohar Park Map

2. Nadgaon:

Nandgaon is a Village in Khed Taluka in Ratnagiri District of Maharashtra State, India. It belongs to Konkan region. This is a small village that was selected for study because in this village is full of greenery. It covers the large shore area of Jagbudi river as it passes through Nadgaon.

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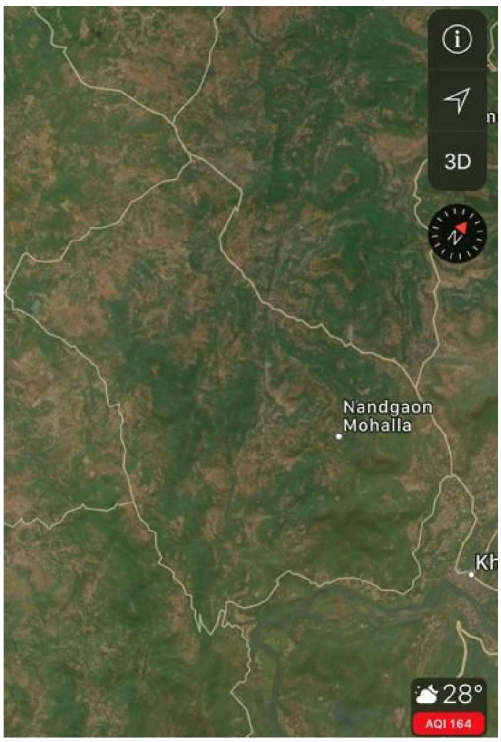

Figure5: Nadgaon Map

Figure6: Nadgaon Village

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Figure7: Jagbudi River in Nadgaon Village

IX. DISCUSSION

Checklist of the Species of Butterfly

The percentage of the species of butterfly among the other families, which may be due to adaptation and habitat preference of the species. Similar studies reported by Singh and Chib (2014) on a preliminary checklist of butterflies that recorded 125 species of butterfly from78 genera belong to 5 families.

Nymphalidae family was one of the highest in the study area. Also, this finding is in close agreement with the findings of Charn (2015) who listed 54species of butterflies which belonged to 7 families from the forest strip of Punjab. Nymphalidae family dominated during the study period with the highest number of the species of butterfly. In addition, the result is supported by Bubeshet al. (2012) who observed 50 species of butterfly belong to 5 families. Nymphalidae and Lycaenidae families were the highest number of the species of butterfly in the study area. The result of this study conceded with the findings of Sayeswara (2018) who was recorded higher percentage of the species of butterfly from Nymphalidae family with 44.4%, followed by Papilionidae of 22.2%, Lycaenidae having 8.33% and Hesperidae was the least percentage of the species of butterfly in the study area. Another relevant study reported by Sauravet al. (2017) who was found that the Lycaenidae family having the maximum percentage of the species of butterfly with 34.9%, followed by Nymphalidae of 28.3%, Hesperidae19.81%, Pieridae 9.43%, Papilionidae 6.6% and Riodinidae 0.94% respectively. This finding agrees with that of koneri and Nangoy (2019) who observed the status of Sangihe Island butterflies and recorded maximum number of the species of butterfly from Nymphalidae family constituted with 53.81%, followed by Papilionidae of 22.67%, Pieridae with15.57%, Lycaenidae having 7.31% and Hesperidae with only 0.64% in the study area. Further, the results are in strong agreement with Sethyet al. (2014) who also reported that Nymphalidae represent the dominant family in the study area with 42.5%, followed by Papilionidae of 21.2%, Lycaenidae 15.1%, Pieridae14.1% and Hesperidae with 7.1%.

Diversity of the Species of Butterfly

The best Simpson record of variety was seen in Gulmohar Park site among different locales, showing that the study area is more assorted of the types of butterflies. Notwithstanding, the most extreme number person of butterflies recorded may prompt the best variety of the types of butterflies in the study area. Past examinations detailed by Ashok (2017) who was recorded high variety of the types of butterflies from five living spaces of Jhansi. Narayan bagh was the most noteworthy variety (0.7440) and the least variety was seen from Jhansi Gwalior (0.6916) in the review region. What's more, Savarimuthuet al. (2012) additionally expressed that the most extreme Simpson list of variety was seen in

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the long stretch of April from stream bank (0.9743) trailed by crop region (0.9819) then, at that point, woodland region (0.9661) during the review time frame. Among the types of butterflies saw in the review region, 4 of them were plentifully (Danaus chrysippus, Danaus genutia, Catopsilia pomona, Acreae violae) and 2 species were normal (Eurema andersoni, Chilades pandava) while 8 number of the types of butterflies were more uncommon (Euploea center, Tirumala limniace, Eurema hecabe, Delias eucharis, Appias pale skinned person, Graphium doson, Zizeeria karsandra, Papilio demoleus).

Seven quantities of the types of butterflies were tracked down sometimes in the review region (Pseudozizeeria maha, Hypolimnas misippus, Venessa cynthia, Anaphaeis aurota, Phalanta phalantha, Neptis hylas, Papilio polytes) as displayed in (Index 4, 5 and 6). The vegetation and territory types in the review region may be justification behind the above normal events of the types of butterflies. Every single site had different natural surroundings design. Moreover, the destinations were found with gardens, plantations, farmland, scene and agroforestry/woods nursery region and so on the outcomes are as per the discoveries of Kanagaraj and Kathirvely (2018) who recorded and sorted different types of butterflies as extremely normal (6), normal (28), more uncommon (16) and interesting (2) individually. Additionally, comparable perception was made by Bora and Meitei (2014) who figure out variety of butterflies in Assam College grounds and noticed exceptionally normal (20), normal (34), phenomenal (29), intriguing (9) and extremely interesting (4) of the types of butterflies in the review region.

X. CONCLUSION

In view of the outcomes got from the review on butterfly and its variety in the review region, Nymphalidae family was greatest in numbers and in rate among every one of the groups of butterflies. Aside from this the Gulmohar Park was seen as most elevated among different destinations as far as individual quantities of butterflies and Simpson record of variety.

Along these lines, it is reasoned that the review region is wealthy in butterfly variety and thus, further examination could be directed to get subtleties and documentation on butterfly variety for the protection and butterfly parks.

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