



To study diversity of butterflies from Baramati Tehsil of Maharashtra

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Abstract

Butterflies play crucial roles in ecosystems, serving as vital components of the ecological chain. The objective of the present study was to assess butterfly diversity in Baramati Tehsil. Throughout the investigation, a total of 58 species of butterflies belonging to five families were recorded. The results revealed that Nymphalidae was the dominant family with 24 species constituting 41.38% of the total individuals of butterflies recorded, followed by Pieridae with 14 species, Lycaenidae with 13 species, Papilionidae with 6 species and Hesperidae with 1. The abundance of butterflies in the region can be attributed to the presence of well-established vegetation and greenery, which provide suitable food sources, habitats, and breeding zones. This study provides baseline data for further research on butterflies, including their restoration, management strategies, and sustenance in the tehsil region.

Keywords: Butterfly diversity, Lepidoptera, Baramati tehsil

Introduction

Insects constitute more than 50% of the planet's species diversity (May, 1992) [17]. Healthy biological communities depend on insects as pollinators, seed dispersers, herbivores, predators and prey (Tiple *et al.*, 2009) [24]. They are extremely important component of the bio-indicators of the World (Kunte, 2000 & 1997) [12, 13]. Within the ecological communities, insects comprise a large proportion of the biomass and are critical conduits of energy through the system (Tiple *et al.*, 2009) [24]. One of such insect being butterflies, which happen to be most extensively studied insect group in the world (Daniel *et al.*, 2018) [4]. Since early 18th century about 19,238 species of butterflies have been documented worldwide (Heppner, 1998) [8]. India hosts about 1,501 species of butterflies (Mohapatra *et al.*, 2013) [15]. This figure is not constant because of the continuous addition of new butterflies and also due to ongoing disagreements between taxonomists over the status of many species (Tiple *et al.*, 2009) [24].

Butterflies belong to order Lepidoptera coming under the Phylum Arthropoda and the class Insecta. The order Lepidoptera is divided into two suborders, heterocera (Moths) and Rhopalocera (Butterfly). Butterflies are classified into two superfamilies viz., Hesperioidea and Papilionoidea. Hesperioidea consists of a single family of Hesperidae (Skippers), whereas Papilionoidea consists rest of the butterfly families viz., Papilionidae (Swallowtails), Pieridae (Whites and Sulphurs), Nymphalidae (Brush-footed butterflies) and Lycaenidae (Blues) (Daniel *et al.*, 2018) [4]. Butterflies have the typical four-stage nonentity life cycle. They lay eggs on the food on which their larvae known as caterpillars grow, occasionally veritably fleetly, and when completely developed pupate in a chrysalis. When metamorphosis is complete, the pupal skin splits, the adult nonentity climbs out and, after its bodies have expanded and dried, it flies off. (Arya *et al.*, 2014) [1].

Butterfly diversity exhibits remarkable spatial variation, influenced by factors such as climate, habitat type and geographical features. Tropical regions, characterized by high temperatures and abundant rainfall, harbour the

greatest butterfly diversity (Haddad *et al.*, 2021) [9]. Temperate regions exhibit lower diversity but often support unique species adapted to cooler climates (Thomas *et al.*, 2004) [25]. Habitat loss and fragmentation emerge as primary drivers threatening butterfly populations worldwide (Öckinger *et al.*, 2010) [20]. Urbanization, agricultural expansion, and deforestation contribute to habitat degradation, restricting the availability of suitable breeding grounds and host plants (Haddad *et al.*, 2015) [10]. Their dependence on specific host plants for foliage during the caterpillar stage underscores their role in maintaining plant diversity and ecosystem health (Nimbalkar *et al.*, 2011) [19]. Changes in temperature, precipitation patterns, and land use directly impact butterfly populations, manifesting in shifts in species distributions, phenology, and abundance (Parmesan, 2006) [21] thus providing early warnings of ecological disturbances and facilitates targeted conservation interventions. Furthermore, butterflies are essential components of the food chain, serving as prey for various birds, reptiles, spiders, and predatory insects (Elanchezhyan *et al.*, 2017) [7]. Their sensitivity to environmental changes makes them valuable bio indicator species, reacting swiftly to alterations in microclimate, temperature, solar radiation, and the availability of host plants for oviposition and larval development (Joshi *et al.*, 2021) [11].

Monitoring butterfly diversity, biology, and correct identification is crucial for their management and conservation, considering their roles as pollinators, crop pests, and bio indicators (Daniel *et al.*, 2018) [4]. Monitoring them offers valuable insights into broader environmental trends and ecosystem functioning. Citizen science initiatives, such as butterfly monitoring schemes, engage volunteers in systematic data collection, enabling large-scale assessments of butterfly diversity and distribution (Roy *et al.*, 2015) [23]. Long-term monitoring programs, such as the UK Butterfly Monitoring Scheme and the North American Butterfly Association's Butterfly Count, provide essential data for assessing population trends, identifying conservation priorities, and evaluating the effectiveness of management strategies (Pollard *et al.*, 1993) [22]. By tracking

changes in butterfly assemblages over time, researchers can detect ecological responses to environmental stressors and inform evidence-based conservation actions. In urban ecosystems, such monitoring serves as a valuable tool to mitigate human mismanagement and pollution across urbanized, industrial, rural, and managed areas (Nowotny *et al.*, 2003) ^[18]. Furthermore, studies on species diversity in urban ecosystems are crucial for understanding the effects of anthropocentric development and ensuring the integrity and sustainability of these ecosystems (Mukherjee *et al.*, 2015) ^[16].

Overall, the conservation of butterflies is imperative for sustaining ecosystem services crucial for human well-being (Mukherjee *et al.*, 2015) ^[16], highlighting their significance in ecology and conservation efforts (Watt *et al.*, 2003 ^[26] & Ehrlich *et al.*, 2004) ^[6]

Materials and Methods

Sampling Site

In the Pune region of Maharashtra state, India, Baramati stands as a city, a tehsil, and a municipal corporation. Situated approximately 250 kilometres from Mumbai and around 100 kilometres southeast of Pune, the metropolis is positioned at 18.15°N 74.58°E, with an elevation of 538 meters. Baramati's geographical location renders it conducive to a diverse array of plant species, making it an ideal setting for both natural and man-made habitat. The survey encompasses various collection sites around Baramati city, notably including the Botanical Garden of Tuljaram Chaturchand College, Railway Garden, Baramati Municipal Poonawala Garden, Gul Poonawala Park, and Nakshatra Garden.

Observation Techniques

The findings presented herein are derived from field surveys conducted between October 2023 and March 2024. Observations were systematically carried out with a minimum of four visits per month to the designated site, supplemented by occasional sightings. Surveys were exclusively conducted under favorable weather conditions, specifically during periods devoid of rain or strong winds.

Preferential observation times were established for Sundays, from 9 am to 11 am, when balmy weather and clear skies prevailed.

Photographs were meticulously captured using a digital camera, ensuring varied angles to procure comprehensive imagery of butterflies. Recorded observations encompassed butterfly activities such as basking and flight, as well as the assessment of species abundance across diverse habitats. Identification of observed species was accomplished post-survey, utilizing 'The Book of Indian Butterflies' authored by Isaac Kehimkar in 2008 ^[14], as a definitive reference.

Ethical considerations guided the avoidance of live specimen collection during the study period. Information pertaining to genera and species composition was meticulously tabulated and categorized based on the frequency of sightings in the field. Categories were defined as Very Common (VC), Common (C), Rare (R).

Result & Discussion

During this systematic survey, a total of 58 butterfly species belonging to 35 genera and 5 families were recorded from various sites. The Nymphalidae family exhibited the highest species richness, with 24 species (41.38%), followed by Pieridae with 14 species (24.14%), Lycaenidae with 13 species (22.41%), Papilionidae and Hesperidae with 6 (10.34%) and 1 (1.72%) species, respectively. Of these, 18 species (31.03%) were classified as very common occurring, 19 (32.76%) as common, and 21 (36.21%) as rare. Nymphalidae were always dominant in tropical region because most of the species from the family are polypagous, consequently able to survive in majority of habitats, additionally members of the nymphalidae family are also active fliers, and hence have edge over other species for resource hunting and possibly less predator interaction. Among recorded species, 3 species come under the Indian Wildlife (protection) Act 1972. Preference of butterflies for particular habitat is connected with the availability of host plant and nectar plants. Butterfly help in pollination of the plants by acting as a carrier of pollen from the flower that is visits and hence promoting environment.

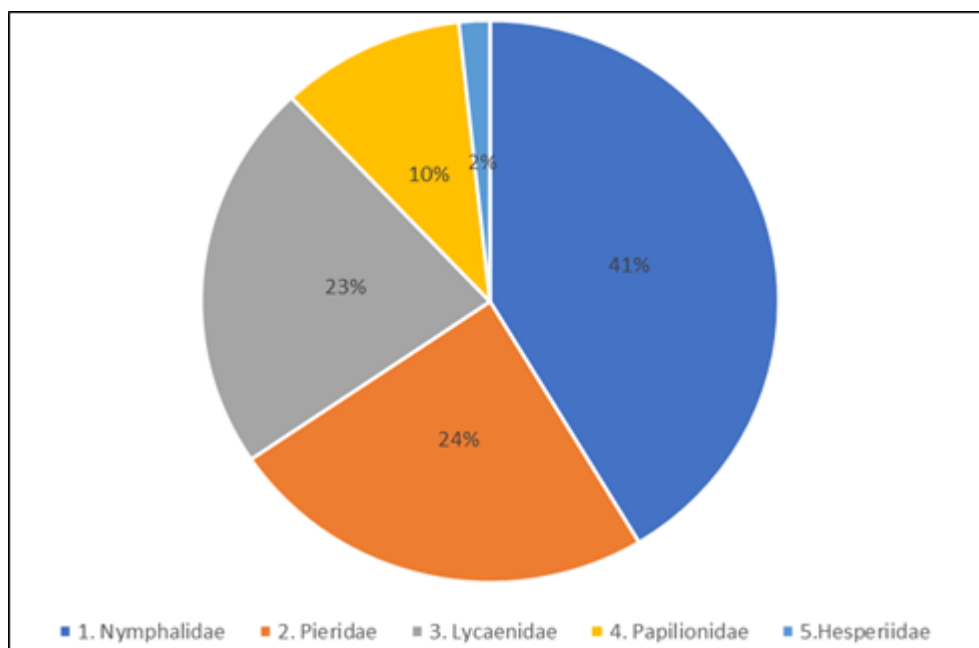















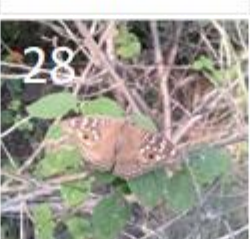































Fig 1: Family Wise Dominance of Butterfly species from Baramati, Pune (M.S) India.

Checklist of Butterflies from Baramati, Pune (M.S) India

	Common Name	Scientific Name	Abundance
<i>Family: Papilionidae</i>			
1.	Common Mormon (Female)	<i>Papilio polytes</i>	Very Common
2.	Tailed Jay	<i>Graphium Agememnon</i>	Very Common
3.	Common Mormon (Male)	<i>Papilio Polytes</i>	Common
4.	Blue Mormon	<i>Papilio Polymnestor</i>	Common
5.	Common Jay	<i>Graphium Doston</i>	Common
6.	Lime Butterfly	<i>Papilio demoleus</i>	Rare
<i>Family: Pieridae</i>			
7.	Spotless Grass Yellow	<i>Eurema Laet</i>	Common
8.	Pioneer White	<i>Belenois Aurota</i>	Very Common
9.	Plain Orange Tip	<i>Calotis eucharis</i>	Common
10.	Indian Little Orange Tip	<i>Colotis Etrida</i>	Common
11.	Common Grass Yellow	<i>Eurema Hecabe</i>	Very Common
12.	Common Gull	<i>Cepora Nerissa</i>	Common
13.	Indian Cabbage White	<i>Pieris Canidia</i>	Common
14.	Mottled Emigrant	<i>Catopsilia Pyranthe</i>	Very Common
15.	--	<i>Catopsilia spp.</i>	Very Common
16.	Common Emigrant	<i>Catopsilia pomana</i>	Very Common
17.	White Orange Tip	<i>Ixias marianne.</i>	Rare
18.	Crimson Tip	<i>Colotis Danae</i>	Rare
19.	Small grass Yellow	<i>Eurema brigitta</i>	Rare
20.	One spot Grass Yellow	<i>Eurema andersoni</i>	Very Common
<i>Family: Nymphalidae</i>			
21.	Great eggfly	<i>Hypolimnas bolina</i>	Very Common
22.	Common Sailor	<i>Neptis hylas</i>	Rare
23.	Evening Brown	<i>Melanitis leda</i>	Rare
24.	Stripped Grayling	<i>Hipparchia fidia</i>	Rare
25.	Painted Lady	<i>Vanessa cardui</i>	Common
26.	Dark Evening Brown	<i>Melanitis phedima</i>	Common
27.	Common Crow	<i>Euploea core</i>	Rare
28.	Lemon Pansy	<i>Junonia lemonias</i>	Very Common
29.	Long Bush Brown	<i>Mycalesis visala</i>	Rare
30.	Tawny Coster	<i>Acraea terpsicore</i>	Common
31.	Dark Brand Bush Brown	<i>Mycalesis mineus</i>	Rare
32.	Danaid EggFly	<i>Hypolimnas misippus</i>	Common
33.	Plain Tiger	<i>Danaus chrysippus</i>	Very Common
34.	Sahyadri Baby Five Ring	<i>Ypthima tabella</i>	Rare
35.	Spotted Joker	<i>Byblia ilithyia</i>	Rare
36.	Peacock Pansy	<i>Junonia almana</i>	Very Common
37.	Blue Pansy	<i>Junonia orithya</i>	Very Common
38.	Common Four Ring	<i>Ypthima huebneri</i>	Common
39.	Common Three Ring	<i>Ypthima pandocus</i>	Rare
40.	Common Leopard	<i>Phalanta phalantha</i>	Common
41.	Glassy Tiger	<i>Parantica aglea</i>	Rare
42.	High Brown Fritillary	<i>Fabriciana adippe</i>	Rare
43.	Blue Tiger	<i>Tirumala limniace</i>	Rare
44.	Dingy Bush Brown	<i>Mycalesis perseus</i>	Rare
<i>Family: Lycaenidae</i>			
45.	Tiny Grass Blue	<i>Zizula Hylax</i>	Very Common
46.	Zebra Blue	<i>Leptotes Plinius</i>	Common
47.	Indian Pierrot	<i>Tarucus Indica</i>	Common
48.	Grass Jewel	<i>Freyeria trochylus</i>	Very Common
49.	Common Pierrot	<i>Castalius Rosimon</i>	Common
50.	Cycad Blue	<i>Luthrodes Pandava</i>	Rare
51.	Forget Me Not	<i>Catochrysops Strabo</i>	Rare
52.	Gram Blue	<i>Euchrysops Cnejus</i>	Very Common
53.	Striped Pierrot	<i>Tarucus Nara</i>	Common
54.	Common Grass Blue	<i>Zizina Labradus</i>	Very Common
55.	Black Spotted Grass Jewel	<i>Freyeria Putli</i>	Common
56.	Orange Spotted Grass Jewel	<i>Freyeria Trochylus</i>	Very Common
57.	Red Pierrot	<i>Talicauda Nyseus</i>	Rare
<i>Family: Hesperidae</i>			
58.	Dark Palm Dart,	<i>Telicota spp</i>	Rare

Butterfly Species Documented at Baramati, Pune (M.S) India

				
<i>Papilio polytes</i>	<i>Graphium Agememnon</i>	<i>Papilio Polytes</i>	<i>Papilio Polymnester</i>	<i>Graphium Dason</i>
				
<i>Papilio Demoleus</i>	<i>Eurema Laeta</i>	<i>Belenois Aurota</i>	<i>Calotis eucharis</i>	<i>Colotis Etrida</i>
				
<i>Eurema Hecabe</i>	<i>Cepora Nerissa</i>	<i>Pieris Canidia</i>	<i>Catopsilia Pyraonthe</i>	<i>Catopsilia spp.</i>
				
<i>Catopsilia pomana</i>	<i>Ixias marianne</i>	<i>Colotis Danae</i>	<i>Eurema brigitta</i>	<i>Eurema andersoni</i>
				
<i>Hypolimnas bolina</i>	<i>Neptis hylas</i>	<i>Melanitis leda</i>	<i>Hipparchia fidia</i>	<i>Vanessa cardui</i>
				
<i>Melanitis phedima</i>	<i>Euploea core</i>	<i>Junonia lemonias</i>	<i>Mycalesis visala</i>	<i>Acraea terpsicore</i>

				
<i>Mycalasis mineus</i>	<i>Hypolimnas misippus</i>	<i>Danaus chrysippus</i>	<i>Ypthima tabella</i>	<i>Byblia ilithyia</i>
				
<i>Junonia almana</i>	<i>Junonia orithya</i>	<i>Ypthima huebneri</i>	<i>Ypthima pandocus</i>	<i>Parantica aglea</i>
				
<i>Phalanta phalanta</i>	<i>Fabriciana adippe</i>	<i>Tirumala limniace</i>	<i>Mycalasis perseus</i>	<i>Zizula Hylax</i>
				
<i>Leptotes Plinius</i>	<i>Tarucus Indica</i>	<i>Freyeria trochylus</i>	<i>Castalius Rosimon</i>	<i>Luthrodes Pandava</i>
				
<i>Catochrysops Strabo</i>	<i>Euchrysops Cnejus</i>	<i>Tarucus Nara</i>	<i>Zizina Labradus</i>	<i>Freyeria Putli</i>
				
<i>Freyeria Trochylus</i>	<i>Talica Nysus</i>	<i>Telicota Spp.</i>		

Conclusion

This study provides foundational data on butterfly species diversity in the Baramati region of Maharashtra, India. Our research indicates that butterflies are thriving across a range of habitats, from grasslands to the outskirts of urban areas, showcasing their adaptability and role as indicators of environmental health.

The findings emphasize the critical need to conserve diverse habitats to support butterfly populations. While certain species have shown resilience to moderate human activities, others are more vulnerable, calling for focused conservation measures. Preserving current green spaces and reintroducing native plant species are essential for maintaining butterfly populations. We advocate for the adoption of butterfly-friendly practices in agriculture and urban development, such as minimizing pesticide usage and incorporating suitable habitats within developed areas. Safeguarding local water resources is equally important for maintaining ecosystem health.

Future studies should focus on understanding seasonal patterns, the relationship between species and their habitats, and the effects of climate change on butterfly populations in Baramati. This research highlights the importance of a comprehensive conservation approach, combining scientific research, community involvement, and sustainable practices to protect these vital pollinators and the broader ecosystem they support.

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