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Butterflies - Diversity in Mayureshwar Wildlife Sanctuary of Baramati Tehsil in Pune district (India)

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Abstract

Different species of plants and habitats of Mayureshwar Wildlife Sanctuary attract wide variety of butterflies. A preliminary attempt on the diversity of butterflies was carried out in Mayureshwar Wildlife Sanctuary of Baramati Tehsil of Pune District (India) and its vicinity from June 2013 to May 2016 using transects lining method. The Mayureshwar Wildlife Sanctuary Campus is surrounded by lush green hillocks, natural lakes and the sugarcane farms. The total of 96 species of butterflies belonging to 68 genera and five families were recorded during the study period, of which 13 species were under the rare category (included 9 rare* and 4 very rare**). It was observed that the family Nymphalidae represented by 23 genera and 34 species was the most dominant followed by Lycaenidae (19 genera, 20 species), Hesperidae (13 genera, 15 species), Pieridae (9 genera, 14 species) and Papilionidae (4 genera, 13 species). The diversity of butterflies in Mayureshwar Sanctuary deserve appreciations and exert a significant influence.

Keywords: Lepidoptera, butterfly diversity, the eco-forests, Western Ghats, Mayureshwar

1. Introduction

Butterflies are insects in the order Lepidoptera, which also includes moths. Adult butterflies have large, often brightly coloured wings, and conspicuous, fluttering flight. The group comprises the large superfamily Papilionoidea, along with two smaller groups, the skippers (superfamily Hesperioidea) and the moth-butterflies (superfamily Hedyloidea). Butterfly fossils date to the Palaeocene, about 56 million years ago. Butterflies have the typical four-stage insect life cycle. Winged adults lay eggs on the food plant on which their larvae, known as caterpillars, will feed. The caterpillars grow, sometimes very rapidly, and when fully developed pupate in a chrysalis. When metamorphosis is complete, the pupal skin splits, the adult insect climbs out and, after its wings have expanded and dried, it flies off. Some butterflies, especially in the tropics, have several generations in a year, while others have a single generation, and a few in cold locations may take several years to pass through their whole life cycle. Butterflies are often polymorphic, and many species make use of camouflage, mimicry and aposematism to evade their predators. Some, like the monarch and the painted lady, migrate over long distances. Some butterflies have parasitoidal relationships with organisms including protozoans, flies, ants, and other invertebrates, and are predated by vertebrates. Some species are pests because in their larval stages they can damage domestic crops or trees; other species are agents of pollination of some plants, and caterpillars of a few butterflies (e.g., harvesters) eat harmful insects. Culturally, butterflies are a popular motif in the visual and literary arts. The *Oxford English Dictionary* derives the word straightforwardly from Old English *butorflēoge*, butter-fly; similar names in Old Dutch and Old High German show that the name is ancient. A possible source of the name is the bright yellow male of the brimstone *Gonepteryx rhamni*; another is that butterflies were on the wing in meadows during the spring and summer butter season while the grass was growing [33]. The earliest Lepidoptera fossils are of a small moth, *Archaeo lepis mane*, of Jurassic age, around 190 million years ago [12, 21]. Butterflies evolved from moths, so while the butterflies are monophyletic (forming a single clade), the moths are not. The oldest butterflies are from the Palaeocene MoClay or Fur Formation of Denmark. The oldest American butterfly is the Late Eocene *Prodryas persephone* from the Florissant Fossil Beds [35]. Traditionally, the butterflies have been divided into the superfamily Papilionoidea and the smaller groupings of the Hesperioidea (skippers)

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and the more moth-like Hedyloidea of America. Phylogenetic analysis suggests that the traditional Papilionoidea is paraphyletic with respect to the other two groups, so they should both be included to form a single butterfly group, the clade Rhopalocera^[22, 23].

The India is one of the richest in biological values, high in endemism and holds a large number of rare species that are now under serious threat. The North East region is among the 34 Hot Spots of the world, identified in India, the other being the Western Ghats. This region supports a rich butterfly fauna because of its average annual rainfall that often exceeds 2,000 mm, which is ideal for most flora and fauna. The International Union for Conservation of Nature and Natural Resources (IUCN) has certified northeastern India as one of the 'swallowtail-rich zones' under the Swallowtail Conservation Action Plan (1984). The scientific study and documentation of the Indian butterflies can be traced to the arrival of a Danish medical doctor Johann Gerhard Koenig in southern India, as early as in 1767. W.H. Evans^[18] provides an excellent scientific documentation of about 962 species/subspecies of butterflies belonging to five families from the Assam region alone. Doubleday^[16] seems to be the first person to study on butterflies in the state when he worked in northern Assam covering the areas of Sadia, Jorhat and Cachar followed by Moore^[36] who worked in Abor Hills and Mishmi Hills, including Sadia. The "Fauna of India, including Ceylon, Burma, Butterflies" occupied "celebrated work" of Bingham^[3]. It is renewed interest in butterflies of the Indian Region due to increased awareness among Indian citizens about butterflies, their biology and conservation issues. In a preliminary study on the butterflies of Regional Research Laboratory Campus, Jorhat, Assam^[7], a total of 70 species of butterflies belonging to 45 genera were recorded. Out of the five families, the family Nymphalidae was found to be dominant contributing 40 different species. Similar type of study carried out in Zoo-Cum-Botanical garden, Guwahati^[2] recorded 72 species belonging to 43 genera with family Nymphalidae 9 being dominant out of the five families. There is a record of 1005 individuals representing 59 species in 48 genera belonging to five families were recorded in Trishna Wildlife Sanctuary^[32]. Of these, 23 species belonged to the family Nymphalidae and accounted for 38.98% of the total species and 45.20% of the total number of individuals. A preliminary checklist was prepared in Jeypore-Dehing forest, eastern Assam^[20] describing 292 species including the sighting of two species – Snowy Angle (*Darpa pteris*) and Wavy Maplet Chersonesia (*Rahira rahrioides*). Butterflies are suitable for biodiversity studies, as the taxonomy, geographic distribution and status of many species are relatively well known.

The butterflies are good biological indicators of habitat quality as well as general health of environment^[26- 29], as many species are strictly seasonal and prefer only particular set of habitats^[28]. Butterflies may react to disturbance and change in habitat. They are acting as an ecological indicator^[4]. They may get severely affected by variations in the environment and changes in the structure of the forest, as they are closely dependent on plants^[9, 40]. Minor changes in the habitat of butterflies may lead to either migration or local extinction^[9, 28, 34]. Due to their dependence on the plants, butterfly diversity may reflect overall plant diversity in the given area^[38]. Thus, change in land use pattern may lead to landscape changes, which can reflect into change in butterfly diversity and distribution. As a result, butterflies can also be used as umbrella species (the species whose protection serves

to protect many co-occurring species) for conservation planning and management^[6].

Mayureshwar Sanctuary is mostly made of dry deciduous scrub forest of *Acacia catechu* (Khair), *Acacia* sp. (Hivar), *Dalbergia latifolia* (Sisoo), *Ziziphus mauritiana* (Ber), *Carissa opaca* (Karwand), *Alysicarpus bupleurifolius*, *Cyathocline purpurea*, *Eriocaulon diane*, *Merremia emarginata*, *Cucumis melo*, *Cyperus kyllingia*, *Striga densiflora*, *Mareilea minuta* trees and interspersed grasslands. It is also home to a variety of birds including, Indian roller, black-winged kite, grey hornbill, grey partridge, Eurasian collared dove, white-throated kingfisher, ashy-crowned sparrow lark, shrike, laughing dove, blue-cheeked bee-eater, Indian silverbill, eagle and babbler. The main animal species found in the refuge are the Indian Gazelle (Chinkara), Striped Hyena, Indian gray wolf, Indian Jackal, Indian fox and Indian Hare (black-naped hare)^[50, 52]. For the purpose to prepare a preliminary checklist and to determine the dominant taxa of butterflies based on their diversity status; the present study has been planned.

2. Material and Method

2.1 The Study Area: The "Mayureshwar Wildlife Sanctuary" is located in Tehsil Baramati in Pune district in Maharashtra, India (Fig. 1.a and 1.b)^[56]. There are ten biogeographic zones in India, which include: Trans Himalayan zone; Himalayan zone; Desert zone; Semiarid zone; Western ghat zone; Deccan plateau zone; Gangetic plain zone; North east zone; Coastal zone and Islands present near the shore line^[10]. Trans Himalayan zone. The "Mayureshwar Wildlife Sanctuary" is belonging to Deccan Plateau. Beyond the Ghats is Deccan Plateau, a semi-arid region lying in the rain shadow of the Western Ghats. This is the largest unit of the Peninsular Plateau of India. The highlands of the plateau are covered with different types of forests, which provide a large variety of forest products. the Deccan plateau includes the region lying south of the Satpura range.it extends up to the southern tip of peninsular India. Anai mudi is the highest peak of this region. The Deccan plateau is surrounded by the western and the eastern ghats. These ghats meet each other at the Nilgiri hills. The western ghats includes the Sahyadri, Nilgiris, Anamalai, and cardamom hills. Many rivers such as Mahanadi, Godavari, Krishna, and Kaveri originates from western ghats and flow toward the east. The eastern ghats are broken into small hill ranges by river coming from the western ghats.



Fig 1(a): Geographical Map of the Study Area (The "Mayureshwar Wildlife Sanctuary").

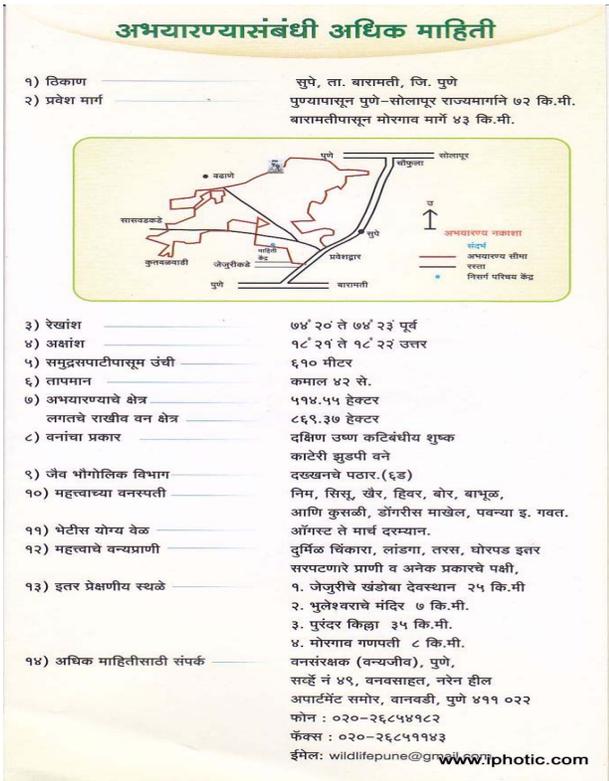
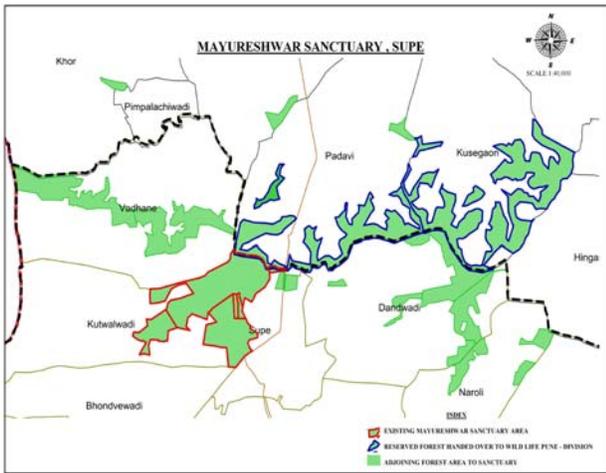


Fig 1 (b): Administrative map of Mayureshwar Wildlife Sanctuary. Few patches of Reserve Forest were handed over to Willdlife Division Pune to existing MWS, in year 2015 (Ready Source: <http://threatenedtaxa.org/index.php/JoTT/article/viewFile/2653/3578>)



The “Mayureswar Wildlife Sanctuary” is 74 km away from Pune; 35 km away from Daund; 41 km away from Baramati; 220 km away from Mumbai; 88 km away from Satara; 111 km away from Ahmednagar; 198 km away from Beed; 211 km away from Solapur; 265 km away from Nashik and 205 km away from Kolhapur. The “Mayureshwar Wildlife Sanctuary” is mostly made of dry deciduous scrub forest of *Acacia catechu* (Khair), *Acacia sp.* (Hivar), *Dalbergia latifolia* (Sisoo), *Ziziphus mauritiana* (Ber), *Carissa opaca* (Karwand), *Alysicarpus bupleurifolius*, *Cyathocline purpurea*, *Eriocaulon diane*, *Merremia emarginata*, *Cucumis melo*, *Cyperus kyllingia*, *Striga densiflora*, *Mareilea minuta* trees [50] and interspersed grasslands. This sanctuary is also home to a variety of birds including, Indian roller, black-winged kite, grey hornbill, grey partridge, Eurasian collared dove, white-

throated kingfisher, ashy-crowned sparrow lark, shrike, laughing dove, blue-cheeked bee-eater, Indian silverbill, eagle and babbler. The wild animal species found in the refuge include: Indian Gazelle (Chinkara), Striped Hyena, Indian gray wolf, Indian Jackal, Indian fox and Indian Hare (black-naped hare). The stunning landscapes and natural beauty is one more significant feature of the “Mayureshwar Wildlife Sanctuary”. This is a good place to see the Indian gazelle. Tourists are allowed to drive their vehicles inside the sanctuary as well as on foot. The forest department has two tents within the sanctuary area. Accommodation options available in the vicinity are in Supe, outside the sanctuary. One may also stay in the Hadapsar area in Pune and drive to the sanctuary in the morning or evening. The best time to visit is from late August to February when the weather is not very harsh. Summers are hot and humid and monsoon may have heavy rainfall. Dominant plant species recorded within the sanctuary include *Citrus spp.*, *Toddalia asiatica L.*, *Murraya spp.*, *Aegle marmelos L.*, *Mangifera indica L.*, *Polyalthia longifolia L.*, *Michelia spp.*, *Cinnamomum spp.*, *Annona spp.*, *Magnolia grandiflora L.*, *Litsea spp.*, *Aristolochia spp.*, *Ricinus communis L.*, *Derris scandens L.*, *Bambusa spp.*, *Cocos spp.*, *Calamus spp.*, *Cassia spp.*, *Andropogon spp.*, *Cymbopogon sp.*, *Setaria glauca L.*, *Terminalia spp.*, *Melastoma malabathricum L.*, *Dioscorea spp.*, *Ageratum conyzoides L.*, *Vallisneria spp.*, *Frerea spp.*, *Calotropis sp.*, *Ficus sp.*, *Neriumsp.*, *Dendrocalamus spp.*, *Panicum spp.*, *Sorghum spp.* This wide variety of plants supports a huge diversity of butterflies providing them an ideal breeding habitat [50, 52, 53, 54].

2.2 The Method of Study: Well known Survey Method was followed for the present attempt. The diversity studies are an important aspect of the butterfly ecology with major conservation implications. Various ecological determinants serve to control the diversity of butterfly community and are known for their value as an important ecological indicator group. The surveys were carried out at different spots of the area selected and its vicinity by point and line transect method [5] from June 2013 to May 2014. The same was repeated for the tenure of June 2014 to May 2015 and June 2015 to May 2016. This repetition was for the purpose to obtain consistency in the results. The field notes, photographs (camera: Nikon d5100) and the observations of butterflies were taken for the entire growing season during the day light hours. The species were noted along with the date, location of capture and any plant association. The other factors noted include the time of day using a twenty four hour clock and the weather conditions. At each location the same route of observations were followed each time to reduce the number of variables presents [41]. Host specific plants were recorded in each transect and identified through the preparation of herbarium.

2.3 The Taxonomic Study: The attempt has been made to use the latest nomenclature and common names as far as possible as per Evan [11, 18, 24, 49]. The status of individual butterfly species in the locality was noted through the parameter, “Relative Abundance”. This Relative Abundance or say status of individual species in locality was categorized within the forest reserve as “Very Rare” (VR) when recorded rarely; “Rare” (C) when recorded occasionally; “Uncommon” (UC) when recorded frequently; “Common” (C) when recorded regularly; “Very Common” (VC) when recorded regularly in large numbers.

2.4 Statistical Analysis: Two main statistical methodologies were used in data analysis: descriptive statistics, which summarizes data from a sample using indexes such as the mean or standard deviation, and inferential statistics, which draws conclusions from data that are subject to random variation (e.g., observational errors, sampling variation). Descriptive statistics are most often concerned with two sets of properties of a *distribution* (sample or population): *central tendency* (or *location*) seeks to characterize the distribution's central or typical value, while *dispersion* (or *variability*) characterizes the extent to which members of the distribution depart from its center and each other. Inferences on mathematical statistics are made under the framework of probability theory, which deals with the analysis of random phenomena.

A standard statistical procedure followed involves the test of the relationship between two statistical data sets, or a data set and a synthetic data drawn from idealized model. An hypothesis is proposed for the statistical relationship between the two data sets, and this is compared as an alternative to an idealized null hypothesis of no relationship between two data sets. Rejecting or disproving the null hypothesis is done using statistical tests that quantify the sense in total of which the null can be proven false, given the data that are used in the test. Working from a null hypothesis, two basic forms of error are recognized: Type I errors (null hypothesis is falsely rejected giving a "false positive") and Type II errors (null hypothesis fails to be rejected and an actual difference between populations is missed giving a "false negative"). Multiple problems have come to be associated with this framework: ranging from obtaining a sufficient sample size to specifying an adequate null hypothesis [37].

3. Results and Discussion

The butterflies are insects in the clade: Rhopalocera from the order: Lepidoptera, which also includes moths. Adult butterflies have large, often brightly colored wings, and conspicuous, fluttering flight and deserve appreciations. The group of butterflies comprises the large superfamily Papilionoidea, along with two smaller groups, the skippers (superfamily Hesperioidea) and the moth-butterflies (superfamily Hedyloidea). Butterfly fossils date to the Palaeocene, about 56 million years ago. Being insects, butterflies have the typical four-stage (Egg; larval instars; Pupa and adult) in life cycle. After mating, the female adults lay the eggs on the host plants. After the completion of embryonic development, the young ones hatch out. The young ones of butterflies are called either larval instars or caterpillars. The leaves of host plants serves as the food material for caterpillars. The caterpillars grow through the metamorphosis. They grow, sometimes very rapidly, and sometimes slowly (depend on the conditions of environment). After the completion of tenure of "Larval Stage", the mature caterpillars pupate in a chrysalis. The pupa is resting stage in the life cycle of butterflies. The skin (cuticle) of mature pupa get split and this results into emergence of adult butterfly. The adult butterflies climbs out, and after its wings have expanded and dried, they flies off. Number of life cycles of butterflies in a year varies according to the climatic conditions and type of

genus. Some of the butterflies, especially in the tropics, have several generations in a year. While others have a single generation, and a few in cold locations may take several years to pass through their whole life cycle. Butterflies are often polymorphic, and many species make use of camouflage, mimicry and aposematism to evade their predators. Some, like the monarch and the painted lady, migrate over long distances. Some butterflies have parasitoidal relationships with organisms including protozoans, flies, ants, and other invertebrates, and are predated by vertebrates. Some species are pests because in their larval stages they can damage domestic crops or trees; other species are agents of pollination of some plants, and caterpillars of a few butterflies (e.g., harvesters) eat harmful insects. Culturally, butterflies are a popular motif in the visual and literary arts.

The results on the study are explained away through the families of butterflies. The families of butterflies observed in the study include: Papilionadae; Hesperidae; Pieridae; Lycaenidae and Lymphalidae. In attempt of the systematic survey, a 96 species of butterfly belonging to 67 genera and five families were recorded from the different habitat types at the "Mayureshwar Wildlife Sanctuary" of Baramati Tehsil Dist. Pune (India) and its vicinity areas during the study period, June 2013 to May 2014; June 2014 to May 2015 and June 2015 to May 2016. Among the five families, family Nymphalidae represented by 22 genera and 34 species. This family: Nymphalidae was the most dominant in the study area. This was followed by family: Lycaenidae with 19 genera, 20 species; family: Hesperidae with 13 genera, 15 species; family: Pieridae with 9 genera, 14 species and family: Papilionidae with 4 genera, 13 species.

3.1 Family: Papilionadae (Table – 1 and Fig. 2)

The adult members of the butterfly family: Papilionidae are recognized by their common name: swallowtails. They are often have 'tails' on wings; caterpillar generates foul taste with osmeteriumorgan; pupa supported by silk girdle. Swallowtail butterflies are large, colorful butterflies of the family Papilionidae. Though the majority are tropical, members of the family inhabit every continent except Antarctica. This family: Papilionidae includes the largest butterflies in the world, the birdwing butterflies of the genus *Ornithoptera* [44]. The swallowtail butterflies have a number of distinctive features; for example, the papilionid caterpillar bears a repugnatorial organ called the osmeterium on its prothorax. The osmeterium normally remains hidden, but when threatened, the larva turns it outward through a transverse dorsal groove by inflating it with fluid [45]. The hind wings of swallowtail butterflies deserve most significant forked appearance. This appearance of forked wings of swallowtail butterflies can be seen when they resting with its wings spread. This appearance of hind wings availed them a common name "Swallowtail". The Latin word "Papilio" refers to the "butterfly". For the purpose to give specific epithets of the genus, Linnaeus applied the names of Greek heroes to the swallowtails. For instance, the type species: *Papilio machaon* honored Machaon, one of the sons of Asclepius, mentioned in the *Iliad* [47] (Table – 1 and Fig. 2).

Table 1: Butterflies of Family: Papilionidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District. Pune (India).

| S. No. | Common Name | Scientific Name | Food Plants preferred by Larval Stages | Relative Abundance |
|--------|-------------------|--|--|--------------------|
| 1. | Common Mormon | <i>Papilio polytes</i> L. | Citrus spp, Aegle marmelos, curry leaf plant | Very Common |
| 2. | Great Mormon | <i>Papilio memnon</i> L. | Cultivated lime and oranges, Murraya spp. | Common |
| 3. | Red Helen | <i>Papilio helenus</i> L. | Toddalia asiatica, all types of wild and cultivated Citrus plants | Uncommon |
| 4. | Yellow Helen | <i>Papilio nephelus</i> Westwood. | Toddalia asiatica, all types of wild and cultivated Citrus plants | Uncommon |
| 5. | Spangle | <i>Papilio protenor</i> Cramer. | Murraya spp., Citrus spp. | Rare |
| 6. | Common Lime | <i>Papilio demoleus</i> L. | Aegle marmelos, Murraya spp., Citrus spp., limes and lemons | Very Common |
| 7. | Common Bluebottle | <i>Graphium sarpedon</i> L. | Cinnamomum spp., Miliusa tomentosa, Polyalthia longifolia, Michelia doltoSPA | Common |
| 8. | Glossy Bluebottle | <i>Graphium cloanthus</i> Westwood. | Michelia spp., Miliusa spp., | Very Rare |
| 9. | Great Jay | <i>Graphium eurypylus</i> L. | Cinnamomum spp., Annona spp., Polyalthia longifolia | Rare |
| 10. | Common Jay | <i>Graphium doson</i> C. & R. Felder | Cinnamomum spp., Miliusa spp., Polyalthia longifolia, Magnolia grandiflora | Uncommon |
| 11. | Tailed Jay | <i>Graphium Agamemnon</i> L. | Annona spp., Polyalthia longifolia, Miliusa tomentosum, Michelia spp., Cinnamomum spp. | Uncommon |
| 12. | Common Mime | <i>Chilasa clytia</i> L. | Cinnamomum spp., Litsea spp | Uncommon |
| 13. | Common Rose | <i>Atrophaneura aristolochiae</i> Fabricius. | Aristolochia spp. | Rare |

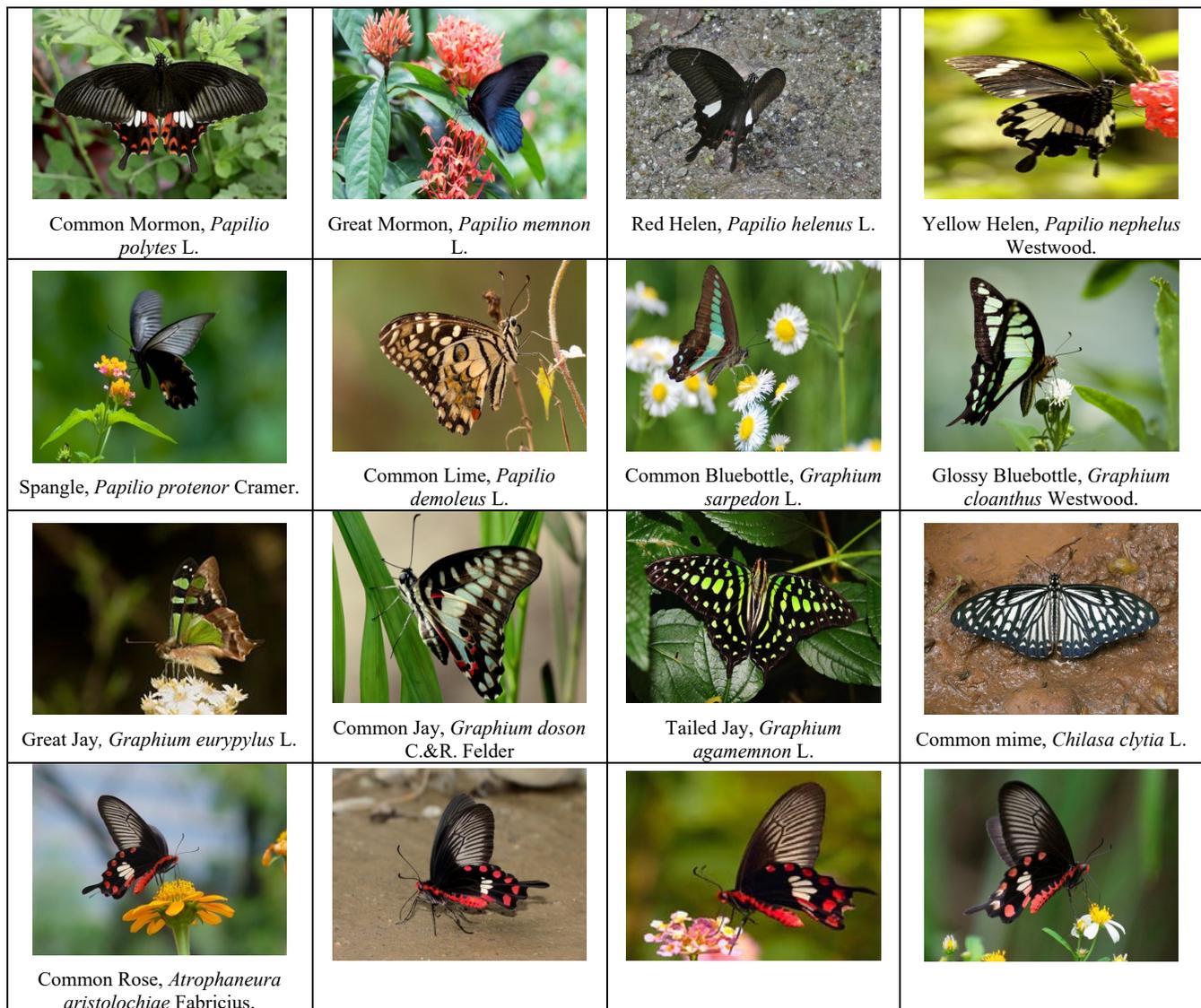


Fig 2: Butterflies of Family: Papilionidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil Dist. Pune (India).

3.2 Family: Hesperidae (Table – 2 and Fig. 3)

The members of family: Hesperidae are commonly called as “Skippers”. Taxonomically, they are placed in a superfamily: Hesperioidea, which is a sister-group of the Papilionoidea. The name “Skipper” may be for their quick, darting flight habits. The skipper butterflies have the antenna tip modified into a narrow hook like projection. More than 3500 species of skipper butterflies are recognized, and they occur worldwide, but with the greatest diversity in the Neotropical regions of Central America [99]. Traditionally, the Family: Hesperidae is placed in a monotypic superfamily: Hesperioidea, because they are morphologically distinct from other Rhopalocera (butterflies), which mostly belong to the typical butterfly

superfamily Papilionoidea. The third and rather small superfamily of butterflies is the moth-butterflies (Hedyloidea), which are restricted to the Neotropics. However, recent studies on “Phylogenetic Analyses” suggest the Papilionoidea are paraphyletic, and thus the subfamilies should be reorganized to reflect true cladistic relationships [22, 23]. Collectively, these three groups of butterflies share many characteristics, especially in the egg, larval, and pupal stages [1]. However, skipper butterflies have the antennae clubs hooked backward like a crochet hook, while the typical butterflies have club-like tips to their antennae, and moth-butterflies have feathered or pectinate (comb-shaped) antennae similar to moths (Table – 2 and Fig. 2).

Table 2: Butterflies of Family: Hesperidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

| S. No. | Common Name | Scientific Name | Food Plants preferred by Larval Stages | Relative Abundance |
|--------|---------------------|--|---|--------------------|
| 1. | Banded Orange Awlet | <i>Bibasis oedipodea</i> Swainson. | <i>Hiptage benghalensis</i> | Uncommon |
| 2. | Common Banded Awl | <i>Hasora chromus</i> Cramer. | <i>Ricinus communis</i> , <i>Derris scandens</i> . | Common |
| 3. | Common Awl | <i>Hasora badra</i> Moore | <i>Derris</i> spp. | Rare |
| 4. | Common Spotted Flat | <i>Calanorhinus leucocera</i> Kollar | <i>Ecbolium ligustrinum</i> , <i>Eranthemum</i> spp. | Uncommon |
| 5. | Fulvous Pied Flat | <i>Pseudocoladenia dan</i> Fabricius. | <i>Achyranthus aspera</i> L. | Common |
| 6. | Common Snow Flat | <i>Tagiades japedus</i> Stoll. | <i>Dioscorea oppositifolia</i> L. | Very Rare |
| 7. | Common Grass Dart | <i>Taractrocera maevius</i> Fabricius. | Grasses | Common |
| 8. | Dark Palm Dart | <i>Telicota ancilla</i> Herrich-S. | <i>Calamus</i> spp., <i>Cocos nucifera</i> L. | Common |
| 9. | Small Branded Swift | <i>Pelopidas mathias</i> Fabricius. | <i>Cymbopogon nardus</i> L., <i>Imperata cylindrical</i> L. | Common |
| 10. | Great Swift | <i>Pelopidas assamensis baramatiwali</i> Niceville (and Khyade). | | Uncommon |
| 11. | Chestnut Bob | <i>Iambrix salsala</i> Moore. | Grasses, <i>Bambusa</i> spp. | Common |
| 12. | Indian Palm Bob | <i>Suastus gremius</i> Fabricius | <i>Calamus</i> spp., <i>Cocos nucifera</i> | Common |
| 13. | Common Redeye | <i>Matapa aria</i> Moore. | <i>Bambusa</i> spp. | Common |
| 14. | Grass Demon | <i>Udaspes folus</i> Cramer. | <i>Zingiber</i> spp., <i>Curcuma</i> spp. | Uncommon |
| 15. | Chocolate Demon | <i>Ancistroides nigrita</i> Latreille. | <i>Zingiber</i> spp. | Common |



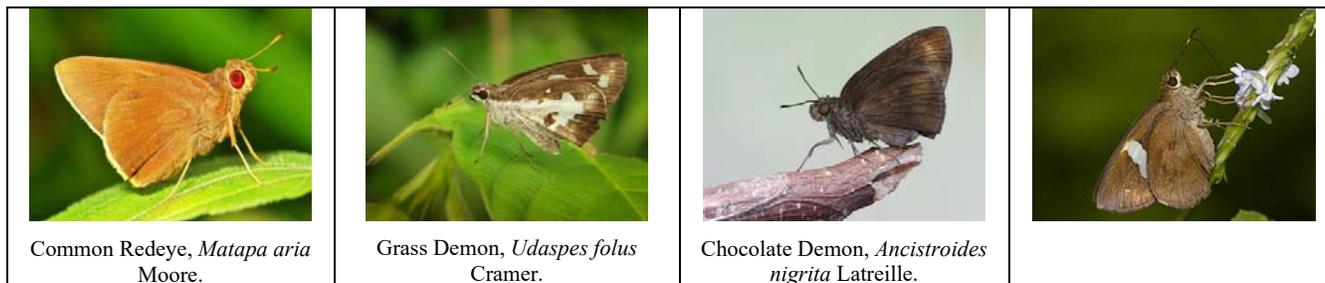


Fig 3: Butterflies of Family: Hesperidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

The skipper butterflies (Family : Hesperidae) also have generally stockier bodies and larger compound eyes than the other two groups, with stronger wing muscles in the plump thorax, in this resembling many moths more than the other two butterfly lineages do. But unlike, for example, the family: Arctiidae, their wings are usually small in proportion to their bodies. Some have larger wings, but only rarely as large in proportion to the body as in other butterflies. When at rest, skippers keep their wings usually angled upwards or spread out, and only rarely fold them up completely [1, 50]. The wings are usually well-rounded with more or less sharply-tipped forewings. There are some with prominent hindwing tails, and others have more angled wings; the skippers' basic wing shape varies not much by comparison to Papilionoidea however. Most have a fairly drab coloration of browns and greys; some are more boldly black-and-white. Yellow, red and blue hues are less often found, but some largely brown species are quite rich-colored too. Green colors and metallic iridescence are generally absent. Sexual dichromatism is present in some; males may have a blackish streak or patch of scent scales on their forewings. Many species of skipper butterflies look frustratingly alike. For instance, some species in the genera *Amblyscirtes*, *Erynnis* (duskywings) and *Hesperia* (branded skippers) cannot currently be distinguished in the field even by experts. The only reliable study method of telling them apart involves dissection and microscopic examination of the genitalia, which have characteristic structures that prevent mating except between conspecifics [1, 50].

3.3 Family: Pieridae (Table – 3 and Fig. 4)

The Pieridae are a large family of butterflies with about 76 genera containing about 1,100 species, mostly from tropical Africa and tropical Asia with some varieties in the more northern regions of North America [13]. Most pierid butterflies are white, yellow, or orange in coloration, often with black spots. The pigments that give the distinct coloring to these butterflies are derived from waste products in the body and are a characteristic of this family [14, 50]. The word "butterfly" is believed to have originated from a member of

this family, the brimstone, *Gonepteryx rhamni*, which was called the "butter-coloured fly" by early British naturalists. There is distinct sexual dimorphism. The larval instars (caterpillars) of a few of these species, such as *Pieris brassicae* and *Pieris rapae*, commonly seen in gardens. The larval instars (caterpillars) feed on brassicas, and therefore, they are notorious agricultural pests. Males of many species exhibit gregarious mud-puddling behavior when they may imbibe salts from moist soils [13, 50]. The butterfly members of family: Pieridae have the radial vein on the forewing with three or four branches and rarely with five branches. The forelegs are well developed in both sexes, unlike in the Nymphalidae, and the tarsal claws are bifid, unlike in the Papilionidae [4]. Like the butterflies of family: papilionidae, the Pieridae also have their pupae held at an angle by a silk girdle, but running at the first abdominal segment, unlike the thoracic girdle seen in the Papilionidae. The Pieridae are generally divided into these four subfamilies, which include:

- (A) **Dismorphiinae (six genera), mostly Neotropical:** This group includes several mimetic species. The host plants are in the family Fabaceae [1].
- (B) **Pierinae (55 genera), whites, yellows, and orange-tips:** many of these species are strongly migratory. Host plants for Pierinae belong to the plants of families: Capparidaceae, Brassicaceae, Santalaceae, and Loranthaceae.
- (C) **Coliadinae (14 genera), sulphurs or yellows:** many of these species are sexually dimorphic. Some, such as *Colias*, have wing patterns that are visible only under ultraviolet.
- (D) **Pseudopontiinae:** the sole species in this subfamily, *Pseudopontia paradoxa*, is endemic to West Africa.

According to the molecular phylogenetic study of Braby [4], sister group relationships among Pieridae subfamilies are ((Dismorphiinae + Pseudopontiinae) + (Coliadinae + Pierinae)).

Table 3: Butterflies of Family: Pieridae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil Dist. Pune (India).

| Serial No. | Common Name | Scientific Name | Food Plants preferred by Larval Stages | Relative Abundance |
|------------|----------------------|-------------------------------------|---|--------------------|
| 1. | Common Grass Yellow | <i>Eurema hecabe</i> Boisduval. | <i>Acacia</i> spp., <i>Cassia</i> spp. | Very Common |
| 2. | Three Spot Yellow | <i>Eurema blanda</i> Boisduval. | <i>Cassia</i> spp., <i>Delonix regia</i> L. | Common |
| 3. | Common Emigrant | <i>Catopsilia Pomona</i> Fabricius. | <i>Cassia</i> spp., <i>Bauhinia racemosa</i> L. | Very Common |
| 4. | Mottled Emigrant | <i>Catopsilia pyranthe</i> L. | <i>Cassia</i> spp. | Very Common |
| 5. | Small Orange Tip | <i>Colotis etrida</i> Boisduval. | <i>Maerua oblongifolia</i> L. | Uncommon |
| 6. | Great Orange Tip | <i>Hebomoia glaucippe</i> L. | <i>Capparis</i> spp. | Common |
| 7. | Striped Albatross | <i>Appias libythea</i> Fabricius. | <i>Capparis</i> spp. | Uncommon |
| 8. | Common Albatross | <i>Appias albino</i> Boisduval. | <i>Drypetes</i> spp. | Common |
| 9. | Chocolate Albatross | <i>Appias lyncida</i> Cramer. | <i>Capparis</i> spp. | Common |
| 10. | Indian Cabbage White | <i>Pieris canidia</i> Sparrman. | Cabbage, Mustard and other related plants | Very Common |

| | | | | |
|-----|------------------|-------------------------------------|--------------------------|-------------|
| 11. | Lesser Gull | <i>Cepora nadina</i> Lucas. | <i>Capparis</i> spp. | Common |
| 12. | Red-Base Jezebel | <i>Delias pasithoe</i> L. | <i>Dendrophthoe</i> spp. | Uncommon |
| 13. | Red-Spot Jazebe | <i>Delias descombesi</i> Boisduval. | | Rare |
| 14. | Psyche | <i>Leptosia nina</i> Fabricius. | <i>Capparis</i> spp. | Very Common |

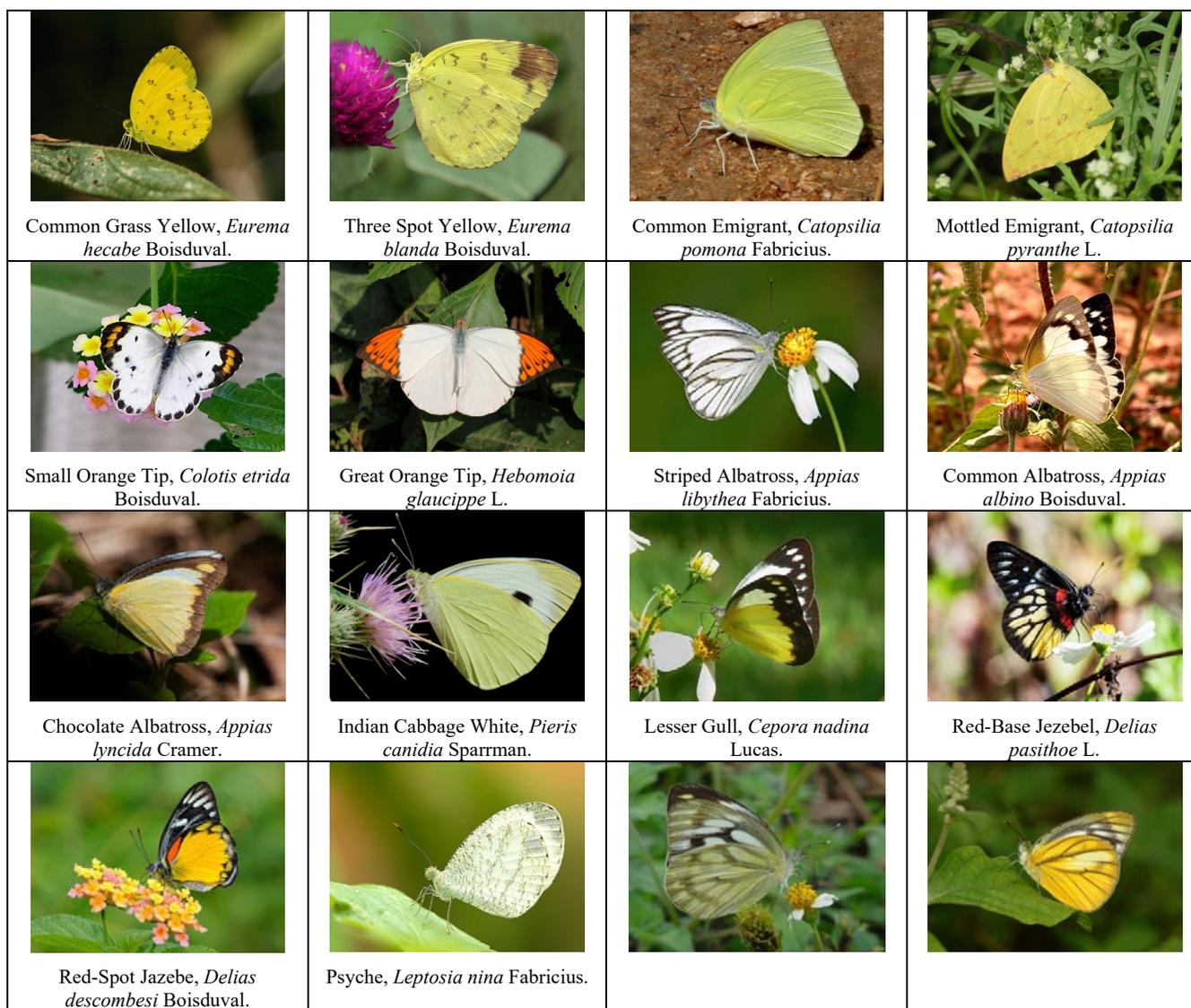


Fig 4: Butterflies of Family: Pieridae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

3.4 Family: Lycaenidae (Table – 4 and Fig. 5)

This family, Lycaenidae is the second-largest family of butterflies (behind Nymphalidae, brush-footed butterflies), with over 5,000 species worldwide (Fiedler, 1996). The members of family: Lycaenidae are also called gossamer-winged butterflies. They form about 30% population of the known butterfly species. The family is traditionally subdivided into the subfamilies of the blues (Polyommatainae), the coppers (Lycaeninae), the hairstreaks (Theclinae) and the harvesters (Miletinae); others include the Lipteninae, Liphyrinae, Curetinae and Poritiinae, but some authorities also include the family Riodinidae within the Lycaenidae [55]. The Adults are small, under 5 cm usually, and brightly coloured, sometimes with a metallic gloss. The Larval instars are often flattened rather than cylindrical, with glands that may produce secretions that attract and subdue ants. Their cuticles tend to be thickened. Some larvae are capable of producing vibrations and low sounds that are transmitted through the substrates they inhabit. The Larval instars use the

sounds to communicate with ants [39]. The adult individuals often have hairy antenna-like tails complete with black and white annulated appearance. Many species also have a spot at the base of the tail and some turn around upon landing to confuse potential predators from recognizing the true head orientation. This causes predators to approach from the true head end resulting in early visual detection (Robins, 1981). The lycaenid members are diverse in their food habits and apart from phytophagy. Some of the lycaenid members are entomophagous and feed on aphids, scale insects, and ant larvae. Some lycaenid members even exploit their association with ants by inducing ants to feed them by regurgitation, a process called trophallaxis. Not all Lycaenid butterflies need ants, but about 75% of species associate with ants [39], a relationship called myrmecophily. These associations can be mutualistic, parasitic, or predatory depending on the species. In some members of family: Lycaenidae, larvae are attended and protected by ants while feeding on the host plant, and the ants receive sugar-rich honeydew from them, throughout the

larval life, and in some species during the pupal stage. In some members of family: Lycaenidae, only the first few instars are spent on the plant, and the remainder of the larval instars lifespan is spent as a predator within the ant nest. It becomes a parasite, feeding on ant regurgitations, or a predator on the ant larvae [39]. The mature larval instar, that is to say caterpillar, pupate inside the ant's nest and the ants continue to look after the pupa. The pupa becomes silvery in it's last but few minutes of tenure. And then the adult emerges the wings of the butterfly inside the pupal case detach from it. The tenure for pupal life is about three to four weeks, inside the ant nest. The adult butterfly must crawl out of the ant nest before it can expand its wings. Several evolutionary

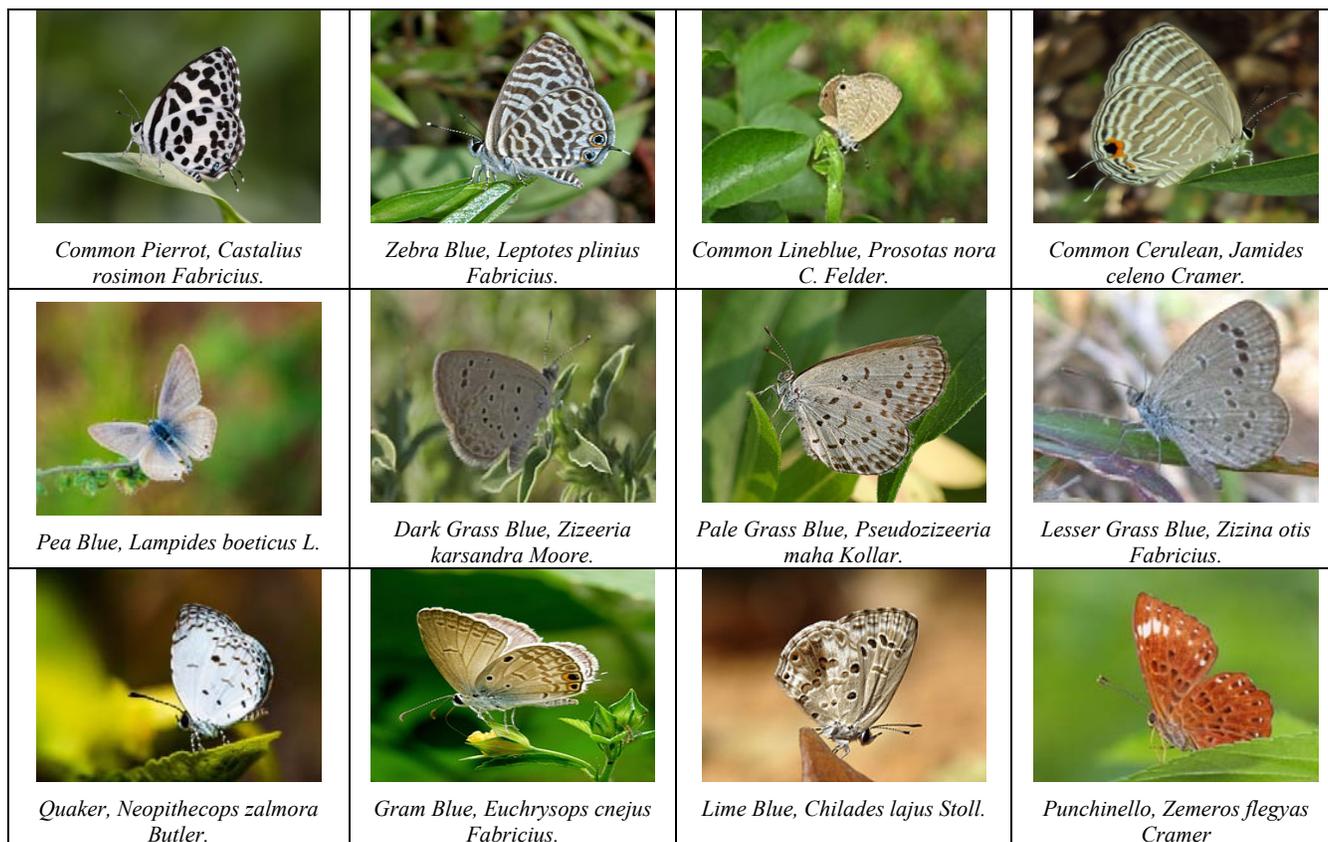
adaptations enable these associations. These adaptations include: small glands on the skin of the larval instars / caterpillars called "pore cupola organs". The larval instars / caterpillars of many species, except those of the Riodininae, have a gland on the seventh abdominal segment that produces honey dew and is called the "dorsal nectary gland" (also called "Newcomer's gland"). There is eversible organ called the "tentacular organ" present on the eighth abdominal segment (third segment of thorax in the Riodininae) and this is cylindrical and topped with a ring of spikes and emits chemical signals which are believed to help in communicating with ants.

Table 4: Butterflies of Family: Lycaenidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

| S. No. | Common Name | Scientific Name | Food Plants preferred by Larval Stages | Relative Abundance |
|--------|--------------------------|---|--|--------------------|
| 1. | Western Centaur Oakblue | <i>Arhopala pseudocentaurus</i> Doubleday | <i>Terminalia paniculata</i> L. | Uncommon |
| 2. | Yamfly | <i>Loxura atymnus</i> Stoll. | <i>Dioscorea</i> sp. | Uncommon |
| 3. | Common Imperial | <i>Cheritra freja</i> Fabricius. | <i>Cinnamomum</i> sp. | Common |
| 4. | Common Tit | <i>Hypolycaena erylus</i> Godart. | <i>Cinnamomum</i> sp. | Common |
| 5. | Copper Flash | <i>Rapala pheretima</i> Hewitson. | | Uncommon |
| 6. | Indian Red Flash | <i>Rapala airbus</i> Fabricius. | <i>Melastoma malabathricum</i> L. | Common |
| 7. | Long – Banded Silverline | <i>Spindasis lohita</i> Horsfield | <i>Dioscorea</i> spp., <i>Psidium guajava</i> L. | Uncommon |
| 8. | Common Ciliate Blue | <i>Anthene emolus</i> Godart. | <i>Terminalia paniculata</i> L. | Rare |
| 9. | Common Pierrot | <i>Castalius rosimon</i> Fabricius. | <i>Zizypus</i> sp. | Common |
| 10. | Zebra Blue | <i>Leptotes plinius</i> Fabricius | <i>Mimosa</i> sp. | Uncommon |
| 11. | Common Lineblue | <i>Prosotas nora</i> C. Felder. | <i>Acacia</i> sp., <i>Mimosa</i> spp. | Common |
| 12. | Common Cerulean | <i>Jamides celeno</i> Cramer. | <i>Xylia xylocarpa</i> L. | Common |
| 13. | Pea Blue | <i>Lampides boeticus</i> L. | <i>Pisum sativum</i> L. | Uncommon |
| 14. | Dark Grass Blue | <i>Zizeeria karsandra</i> Moore. | <i>Amaranthus spinosus</i> L., <i>Polygonum</i> spp. | Very Common |
| 15. | Pale Grass Blue | <i>Pseudozizeeria maha</i> Kollar. | <i>Oxalis corniculata</i> L. | Very Common |
| 16. | Lesser Grass Blue | <i>Zizina otis</i> Fabricius. | <i>Vicia</i> sp. | Very Common |
| 17. | Quaker | <i>Neopithecops zalmora</i> Butler. | | Common |
| 18. | Gram Blue | <i>Euchrysops cnejus</i> Fabricius. | <i>Acacia</i> spp., <i>Pisum sativum</i> L. | Common |
| 19. | Lime Blue | <i>Chilades lajus</i> Stoll. | <i>Citrus</i> sp. | Very Common |
| 20. | Punchinello | <i>Zemeros flegyas</i> Cramer | <i>Maesa</i> spp. | Common |

Fig 5: Butterflies of Family: Lycaenidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil Dist. Pune (India).





3.5 Family: Nymphalidae (Table – 5 and Fig. 6)

The Nymphalidae is the largest family of butterflies. It is with about 6,000 species distributed throughout most of the world. These butterflies are usually medium-sized to large butterflies. Most species of family: Nymphalidae have a reduced pair of forelegs and many hold their colourful wings flat when resting. The butterflies of family: Nymphalidae are also called brush-footed butterflies or four-footed butterflies, because they are known to stand on only four legs while the other two are curled up; in some species, these forelegs have a brush-like set of hairs which gives this family its other common name. Many species of family: Nymphalidae are brightly coloured and include popular species such as the emperors, monarch butterfly, admirals, tortoiseshells, and fritillaries. However, the under wings of the members of family: Nymphalidae are, in contrast, often dull and in some species look remarkably like dead leaves, or are much paler, producing a cryptic effect that helps the butterflies blend into their surroundings.

Rafinesque^[43] introduced the name Nymphalia as a subfamily name in diurnal Lepidoptera. Rafinesque did not include *Nymphalis* among the listed genera, but *Nymphalis* was unequivocally implied in the formation of the name (Code Article 11.7.1.1). The attribution of the Nymphalidae to Rafinesque has now been widely adopted^[48]. In the adult butterflies, the first pair of legs is small or

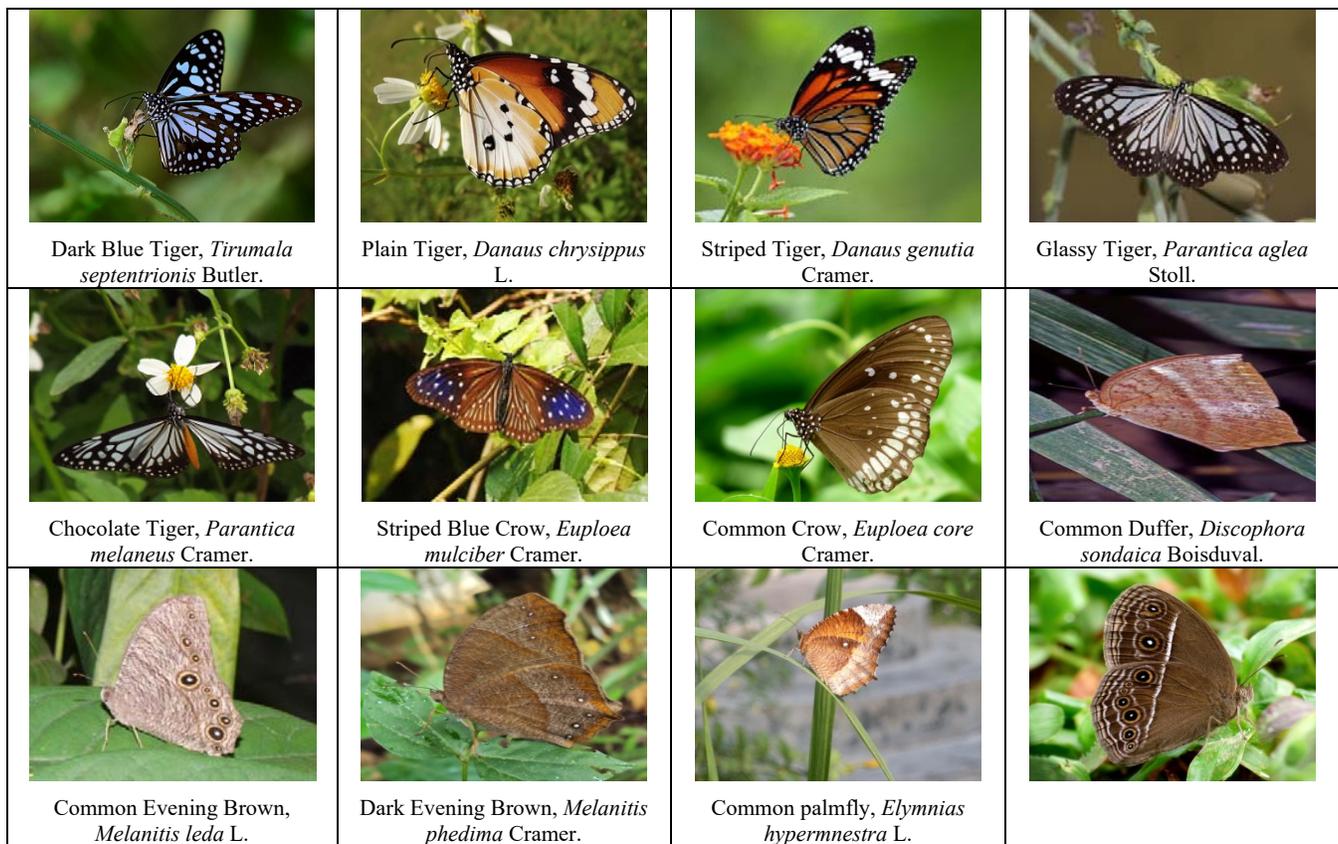
reduced^[51], giving the family the other names of four-footed or brush-footed butterflies. The caterpillars are hairy or spiky with projections on the head, and the chrysalids have shiny spots. The forewings have the submedial vein (vein 1) unbranched and in one subfamily forked near the base; the medial vein has three branches, veins 2, 3, and 4; veins 5 and 6 arise from the points of junction of the discocellulars; the subcostal vein and its continuation beyond the apex of cell, vein 7, has never more than four branches, veins 8–11; 8 and 9 always arise from vein 7, 10, and 11 sometimes from vein 7 but more often free, i.e., given off by the subcostal vein before apex of the cell^[3]. The hind wings have internal (1a) and precostal veins. The cell in both wings is closed or open, often closed in the fore, open in the hind wing. The dorsal margin of the hind wing is channelled to receive the abdomen in many of the forms^[3]. The antennae always have two grooves on the underside; the club is variable in shape. Throughout the family, the front pair of legs in the male, and with three exceptions (*Libythea*, *Pseudergolis*, and *Calinaga*) in the female also, is reduced in size and functionally impotent; in some, the atrophy of the forelegs is considerable, e.g., the Danainae and Satyrinae. In many of the forms of these subfamilies, the forelegs are kept pressed against the underside of the thorax, and are in the male often very inconspicuous^[3].

Table 5: Butterflies of Family: Nymphalidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

| Serial No. | Common Name | Scientific Name | Food Plants preferred by Larval Stages | Relative Abundance |
|------------|-------------------|---------------------------------------|---|--------------------|
| 1. | Dark Blue Tiger | <i>Tirumala septentrionis</i> Butler. | <i>Ageratum conyzoides</i> , <i>Vallis</i> spp. | Uncommon |
| 2. | Plain Tiger | <i>Danaus chrysippus</i> L. | <i>Frerea</i> spp., <i>Calotropis</i> sp. | Very Common |
| 3. | Striped Tiger | <i>Danaus genutia</i> Cramer. | | Uncommon |
| 4. | Glassy Tiger | <i>Parantica aglea</i> Stoll. | <i>Calotropis</i> sp. | |
| 5. | Chocolate Tiger | <i>Parantica melaneus</i> Cramer. | | Rare |
| 6. | Striped Blue Crow | <i>Euploea mulciber</i> Cramer. | <i>Ficus</i> sp. | Uncommon |

| | | | | |
|-----|----------------------|---------------------------------------|--|-------------|
| 7. | Common Crow | <i>Euploea core</i> Cramer. | <i>Ficus</i> sp., <i>Nerium</i> sp. | Common |
| 8. | Common Duffer | <i>Discophora sondaica</i> Boisduval. | <i>Dendrocalamus</i> sp. | Common |
| 9. | Common Evening Brown | <i>Melanitis leda</i> L. | <i>Panicum</i> spp., <i>Sorghum</i> spp. | Very Common |
| 10. | Dark Evening Brown | <i>Melanitis phedima</i> Cramer. | | Rare |
| 11. | Common palmfly | <i>Elymnias hypermnestra</i> L. | <i>Calamus</i> spp., <i>Areca</i> spp. | Very Common |
| 12. | Common Bushbrown | <i>Mycalesis perseus</i> Fabricius. | Grasses | Very Common |
| 13. | Dark-Brand Bushbrown | <i>Mycalesis mineus</i> L. | Grasses | Common |
| 14. | Common Fourring | <i>Ypthima huebneri</i> Kirby. | Grasses | Common |
| 15. | Common Fivering | <i>Ypthima baldus</i> Fabricius. | | Common |
| 16. | Vagrant | <i>Vagrans egista</i> Cramer. | | Uncommon |
| 17. | Common Leopard | <i>Phalanta phalantha</i> Drury. | <i>Flacourtia</i> spp. | Very Common |
| 18. | Commander | <i>Moduza procris</i> Cramer. | <i>Mussaenda frondosa</i> | Uncommon |
| 19. | Common Sergeant | <i>Athyma perius</i> L. | <i>Glochidion</i> sp. | Common |
| 20. | Colour Sergeant | <i>Athyma nefte</i> Cramer. | <i>Glochidion</i> sp. | Uncommon |
| 21. | Common Lascar | <i>Pantoporia hordonia</i> Stoll. | <i>Acacia</i> spp. | Uncommon |
| 22. | Common Sailer | <i>Neptis hylas</i> L. | <i>Bombax</i> sp. | Very Common |
| 23. | Short-Banded Sailer | <i>Phaedyma columella</i> Cramer. | <i>Dalbergia</i> sp. | Uncommon |
| 24. | Clipper | <i>Parthenos sylvia</i> Cramer. | | Very Rare |
| 25. | Common Baron | <i>Euthalia aconthea</i> Cramer. | <i>Mangifera indica</i> L. | Uncommon |
| 26. | Plain Earl | <i>Tanaecia jahnu</i> Moore. | | Rare |
| 27. | Archduke | <i>Lexias pardalis</i> Moore. | <i>Garcinia</i> sp. | Very Rare |
| 28. | Common Castor | <i>Ariadne merione</i> Cramer. | <i>Ricinus communis</i> | Common |
| 29. | Grey Pansy | <i>Junonia atlites</i> L. | <i>Barleria</i> sp. | Very Common |
| 30. | Peacock Pansy | <i>Junonia almanac</i> L. | <i>Barleria</i> sp. | Very Common |
| 31. | Yellow Pansy | <i>Junonia hierta</i> Fabricius. | <i>Barleria</i> sp. | Very Common |
| 32. | Lemon Pansy | <i>Junonia lemonias</i> L. | <i>Barleria</i> sp. | Common |
| 33. | Chocolate Pansy | <i>Junonia iphita</i> Cramer. | | Uncommon |
| 34. | Great Eggfly | <i>Hypolimnas bolina</i> L. | <i>Hibiscus</i> sp. | Common |

Fig 6: Butterflies of Family: Nymphalidae recorded at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).



| | | | |
|---|---|--|---|
|  |  |  |  |
| Dark-Brand Bushbrown, <i>Mycalis mineus</i> L. | Common Fourring, <i>Ypthima huebneri</i> Kirby. | Common Fivering, <i>Ypthima baldus</i> Fabricius. | Vagrant, <i>Vagrans egista</i> Cramer. |
|  |  |  |  |
| Common Leopard, <i>Phalanta phalantha</i> Drury. | Commander, <i>Moduza procris</i> Cramer. | Common Sergeant, <i>Athyma perius</i> L. | Colour Sergeant, <i>Athyma nefie</i> Cramer. |
|  |  |  |  |
| Common Lascar, <i>Pantoporia hordonia</i> Stoll. | Common Sailer, <i>Neptis hylas</i> L. | Short-Banded Sailer, <i>Phaedyma columella</i> Cramer. | Clipper, <i>Parthenos sylvia</i> Cramer. |
|  |  |  |  |
| Common Baron, <i>Euthalia aconthea</i> Cramer. | Plain Earl, <i>Tanaecia jahnu</i> Moore. | Archduke, <i>Lexias pardalis</i> Moore. | Common Castor butterfly, <i>Ariadne merione</i> L. |
|  |  |  |  |
| Grey Pansy, <i>Junonia atlites</i> L. | Peacock Pansy, <i>Junonia almanac</i> L. | Yellow Pansy, <i>Junonia hierta</i> Fabricius. | Lemon Pansy, <i>Junonia lemonias</i> L. |

Table 6: Composition of the five Butterfly Families along with their number of Genera and Species at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

| Family | Number of Genera | Percentage | Number of Species | Percentage |
|--------------|------------------|------------|-------------------|------------|
| Nymphalidae | 23 | 33.82 | 34 | 35.41 |
| Lycaenidae | 19 | 27.94 | 20 | 20.83 |
| Hesperiidae | 13 | 19.40 | 15 | 15.62 |
| Pieridae | 09 | 13.23 | 14 | 14.58 |
| Papilionidae | 04 | 05.88 | 13 | 13.40 |
| Total | 68 | | 96 | |

Table 7: List of 20 Dominant Taxa recorded along with their respective taxonomic families at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

| Butterfly Family | Biological (Scientific) Name of Dominant Species |
|------------------|--|
| Papilionidae | <i>Papilio polytes</i> L. <i>Papilio demoleus</i> L. |
| Pieridae | <i>Eurema hecabe</i> L. <i>Catopsilia Pomona</i> Fabricius. <i>Catopsilia pyranthe</i> L. <i>Pieris canidia</i> Sparrmann. <i>Leptosia nina</i> Fabricius. |
| Lycaenidae | <i>Zizeeria karsandra</i> Moore. <i>Pseudozizeeria maha</i> Kollar. <i>Zizina otis</i> Fabricius. <i>Chilades lajus</i> Stoll. |
| Nymphalidae | <i>Danaus chrysippus</i> L. <i>Melanitis leda</i> L. <i>Elymnias hypermnestra</i> L. <i>Mycalis perseus</i> Fabricius. <i>Phalanta phalantha</i> Drury. <i>Neptis hylas</i> L. <i>Junonia atlites</i> L. <i>Junonia almanac</i> L. <i>Junonia lemonias</i> L. <i>Junonia hierta</i> Fabricius. |

Table 8: List of Rare Taxa (included 9 Rare* and 4 Very Rare**) along with their respective taxonomic at Mayureshwar Wildlife Sanctuary of Baramati Tehsil District Pune (India).

| Butterfly Family | Biological (Scientific) Name of Rare Species |
|------------------|---|
| Papilionidae | <i>Papilio protenor</i> Cramer. * <i>Graphium cloanthus</i> Westwood. ** <i>Graphium eurypylus</i> L. * <i>Atrophaneura aristolochiae</i> Fabricius. * |
| Hesperiidae | <i>Hasora badra</i> Moore. * <i>Tagiades japedus</i> Stoll. ** |
| Pieridae | <i>Delias descombesi</i> Boisduval. * |
| Lycaenidae | <i>Anthene emolus</i> Godart. * |
| Nymphalidae | <i>Parantica melaneus</i> Cramer. * <i>Melanitis phedima</i> Cramer. * <i>Parthenos Sylvia</i> Cramer. ** <i>Tanaecia jahnu</i> Moore. * <i>Lexias pardalis</i> Moore. ** |

The present attempt provides an array of butterfly diversity of “Mayureshwar Wildlife Sanctuary” of Baramati Tehsil Dist. Pune (India) and its vicinity areas. Geographical location of any area, its climatic conditions and vegetative composition are essential requisites for supporting a rich diversity of butterflies. The exploration of species diversity, understanding the habitat ecology and behaviour culminate into a database for the study area is an imperative. The results of the study are explaining the structural complexity and vegetation diversity in different habitat type. This might be facilitating a definite set of microhabitats that might be suitable for a particular species. According to Klopfer and MacArthur^[25], in tropical forests species may reside not in the number of niches available, but in an increase in the similarity of coexisting species. The extent to which all these informal explanations apply is a matter of further study at micro-habitat level. As the area houses 96 species of butterflies distributed throughout the study area, it can be presumed to have a good diversity of butterflies. This may be attributed to the sprawling lawns and well nurtured gardens that provide a suitable nectar source throughout the varying seasons, and especially the eco-forests that serves a breeding habitat to the butterflies. Results suggesting that the family Nymphalidae with 22 genera and 34 species was the most dominant in the study area. Members of the Nymphalidae were always

dominant in the tropical region because most of the species are polyphagous in nature, consequently helping them to live in all the habitats. Additionally, many species of this family: Nymphalidae are strong, active fliers that might help them in searching for resources in large areas^[17, 27]. A high proportion of nymphalid species thus clearly indicates high host plant richness. The family: Papilionidae representing the swallowtails was recorded to be the least with 4 genera and 13 species. Loss of suitable habitat may be the reason for their decline in population. Further detailed studies should be taken out on this group of Systematic study and continuous observation suggests that the month of November and March were the best for the butterflies. During this seasons (November and March), variety of host plants grow across the vacant areas. During this period, butterfly activity is at its peak as there are plenty of food source available for their breeding cycles. The plants of the family Rutaceae, Annonaceae, Lauraceae, Magnoliaceae and Aristolochiaceae are found to be the dominant larval food plants of the family Papilionidae; for Nymphalidae (plants belonging to family Apocynaceae, Asclepiadaceae, Moraceae, Poaceae, Arecaceae, Flacourtiaceae, Rubiaceae, Euphorbiaceae, Mimosaceae, Malvaceae, Cucurbitaceae, Acanthaceae and Melastomataceae); for Pieridae (plants belonging to family Caesalpiniaceae, Mimosaceae, Fabaceae, Capparaceae, Euphorbiaceae, Cruciferae and Lorantaceae); for Lycaenidae (plants belonging to family Mimosaceae, Dioscoreaceae, Lauraceae, Rubiaceae, Melastomataceae, Myrtaceae, Caesalpiniaceae, Rhamnaceae, Zingiberaceae, Fabaceae, Oxalidaceae, Rutaceae and Myrsinaceae) and for Hesperidae (plants belonging to family Malpighiaceae, Euphorbiaceae, Fabaceae, Acanthaceae, Amaranthaceae, Poaceae, Arecaceae and Zingiberaceae) are dominant larval food plants. The specificity among butterflies and plants is always highly significant^[50]. Unlike honey bees, butterflies collect their nectar from flower. There is a crucial link between the plant pollination and butterfly population. This should be well understood. This may help to develop appropriate strategies for conservation of the biodiversity. The “Mayureshwar Wildlife Sanctuary” of Baramati Tehsil District Pune (India) is housing a rich butterfly diversity mainly attributed to the micro-habitats available within the eco-forest. Further studies should be planned by the administration of Wildlife Department and Academic Institutions. This may fortify the set up an eco-forest or to adopt any other conservation plans to support the wildlife of the area which can also be used to practically train the students, the bright future, regarding conservation issues and plans concerned. The “Mayureshwar Wildlife Sanctuary” of Baramati Tehsil Dist. Pune (India) deserve appreciations on the butterfly diversity and exert significant influence of forest dynamics.

4. Conclusion

The Mayureshwar Wildlife Sanctuary of Baramati Tehsil of Pune District (India) deserve appreciations with reference to various plant species, which are responsible to attract wide variety of butterflies. A preliminary attempt on the diversity of butterflies was carried out in Mayureshwar Wildlife Sanctuary of Baramati Tehsil of Pune District (India) and its vicinity from June 2013 to May 2016 using transects lining method. The Mayureshwar Wildlife Sanctuary Campus is surrounded by lush green hillocks, natural lakes and the sugarcane farms. The total of 96 species of butterflies belonging to 68 genera and five families were recorded during the study period, of which 13 species were under the rare

category (included 9 rare* and 4 very rare**). It was observed that the family Nymphalidae represented by 23 genera and 34 species was the most dominant followed by Lycaenidae (19 genera, 20 species), Hesperidae (13 genera, 15 species), Pieridae (9 genera, 14 species) and Papilionidae (4 genera, 13 species). The diversity of butterflies in Mayureshwar Sanctuary deserve appreciations and exert a significant influence.

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