

Diversity of Butterflies of Pune City

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ABSTRACT

Insects are the most fascinating creatures on the planet earth. They are specialized pollinators, hunters, parasites and predators forming basis for most of the terrestrial ecosystems. Among insects the butterflies are most charismatic ones. Their size ranges from the tiny jewels like blues, to the gorgeous birdwings with a wing-span as great as eight inches. Their glowing colours and delicate glittering movements catch and charm our eyes. No wonder then that they were willingly collected and studied by early naturalists.

Keywords: Butterflies, Organic Matter, Entomological Pins, Insect Box

I. INTRODUCTION

Gardens are discrete patches of human- managed habitat that are common in many urban areas. Man-made gardens and parks are inhabited by a variety of insects and other organisms. Insects play an important role in nutrient cycle, Organic matter decomposition, Pollination and soil aeration in urban ecosystem. Some insects visit park and gardens for nectar or other resources, while some reproduce and spend most of their lifespan in the gardens. Thus there has been a rising research to show the potential of small scattered habitats like domestic gardens, community gardens, green roofs and parks to support rich biodiversity, even in heavily populated urban areas. (Saha and Gaikwad, 2014).

Butterflies are commonly referred to as “insects of the sun” with their eye catching color and delicate charisma. They have been admired for centuries for their physical beauty and behavioral display (Arya and Chaudhari, 2014). Among the insects, butterflies occupy a vital position in the ecosystem and their occurrence and diversity are considered as good indicators of the health of any given terrestrial biotope. Butterflies are also good indicators of environmental changes as they are sensitive to habitat degradation and climate change (Kunte, 2000). The butterflies have fascinated peoples of all age group. That is why these are considered as the “fluttering jewels of nature” (Illustrated Encyclopedia of Wildlife). The order Lepidoptera is the

second largest order in the animal kingdom, coming under the class Insecta. The word Lepidoptera means ‘Scale wings’(Greek; Lepis- scale; Pteron-wing).

Butterflies are taxonomically well studied group of insects and receive reasonable amount of attention throughout world not only by the entomologists but also by laymen. Presently, butterflies are classified into two superfamilies, of which Hesperioidea has all the skippers, While Papilionoidea includes the rest, the ‘true’ butterflies. Hesperioidea consist of a single family of Hesperiidae, whereas papilionoidea has four families: Papilionidae(Swallowtails), Pieridae (White & Yellows), Nymphalidae (Brush- footed butterflies) and Lycaenidae(Blues). Out of about 25,000 species of butterflies recorded from all over the world, 1501 are from India (Gay et al., 1992). From which 321 are Skippers, 107 Swallowtails, 109 White and Yellows, 521 Brush footed butterflies and 443 Blues (Kehimkar). Pune, being one of the most urbanized, congested and polluted city, has been taken as the study site. PMC has already developed 111 big and small gardens and parks measuring upto 475 acres [Corbet PS., 1999]. The body of an adult butterfly is composed of the head and 13 segments, which are not obvious. Broadly, the insect’s body is divided into head, thorax and abdomen.

Lifespan, Butterflies as adult are short-lived insects. Small butterflies like some Blues may live only for a few weeks, while large butterflies like the Swallowtails

and some Nymphalids or Brush-footed butterflies may live for as long as eight months. Otherwise most butterflies live up to two to four weeks, if they not attacked or eaten by predators. Sometimes, ecological factors such as temperature, availability of food and suitability of habitat have an impact on the lifespan of an adult butterfly. Polymorphism is a unique variation that occurs within a species. In this kind of variation, two or more forms of the same species occur at the same time in the same area. The female of Common Mormon occurs in three forms, one of which mimics the Common Rose, while the second form mimics the Crimson Rose, and the female of the third form resembles the male. Some butterfly shows Seasonal variation, with two forms, the dry season form and the wet season form. The common evening brown is recognized by a series of eye spots on the wing border during the monsoon, while in the summer it is almost invisible among the leaves due to its mottled brown colour without the eyespot.

II. METHODS AND MATERIAL

Following equipment were used during present investigation. Insects

Collecting Net:

Samples were collected with insect collecting net or sweep net. It has a handle, a wire ring and cloth bag. The handle is about 2 feet long made up of wood or metal but light and strong. The handle at one end has a steel or iron wire ring. The wire ring is 30-35 cm in diameter. The bag is either of muslin cloth or fine nylon net. The bag is 2 or 2 1/2 times as deep as the diameter of ring i.e. 60 cm to 75 cm. The edge of bag is made up of cloth-like canvas. The strong cloth is folded around the ring to form home. Sweeping of flowers and other plants with side - wise motion of insect net helps in the collection of larger number of insects than up and down sweep.

Insect Packets:

Insect packets made up of butter paper were used to store the pinned butterflies during field collection. Size: 10×5 cm.

Entomological Pins:

Insects were held on entomological pins to facilitate their morpho-taxonomic. The pins are hard made up of non-corrosive metals (nickel etc) with sharp edge and small head with size: No 2 with 40×0.38 mm and No 3 with 41×0.42 mm. The pins were inserted vertically into the thorax body of butterflies.

Insect Spreading Board:

It is an insect spreading board for spreading the insects in desired position. It is made from the fine fiber wood. The base of the board is 4" X 12" x 3/4". These are two tap pieces of soft wood or cork on the upper side of the board which inclined towards centre. Out of 2 pieces one piece is fixed and another piece is movably articulated. In between the 2 pieces is an adjustable channel to accumulate the body of insects. The insect pin is passed through the body of insect & fixed in the channel. The thin paper strips are used to press the wings of insects on the spreading board. Then the specimens are allowed to remain in this position for 15 days or till they dry.

Insect Box:

Specimens were kept in insect box for presentation of pinned dried specimens. The box is made up of plywood with variable sizes but convenient in handling. The top of the box is made up of glass. The bottom of the box is covered with a thermacoal. The box is treated with saturated solution of naphthalene in benzene. Naphthalene balls are kept in corners of box to protect the dried insects from pest.

The present study was conducted during the period from August 2015 to February 2016. The study areas were monitored in every month during the study period with 10-15 days with minimum of 2 to 3 hours per day. The random method of sampling was used to collect the butterflies. The collections were done in four seasons comprising monsoon, and post monsoon. The collections were done in warm but not too hot condition especially in the morning from 7 am to 11 pm which is a peak time for butterfly activity and evening 4pm to 5.30 pm. The butterflies are very delicate in nature and hence their handling is also done with extreme care. Butterflies were collected by using aerial nets. The net consist of a strong, light handle with a length of 1m and at its end a 13" diameter ring is attached which is joined by the nylon cloth bag of 33" depth. The long handle allows the net to be used as far away from body as possible, making

sweeping over hanging bushes easier and extends the area of individual sweep.

The soft bodied butterflies were gently removed from the bottom of the bag, after it becomes enclosed in the bag by a rapid twist of the handle. The butterflies are killed by pressing the thorax region gently by the hands. Since immediate pinning is not possible, these butterflies are kept in a piece of paper with wings folded and then edges of the paper are folded over to lock it inside. The butterflies are pinned through the centre of thorax or a little behind, between bases of the forewings on a piece of thermocoal. It is then kept in insect box. The insect boxes are made of good quality wood and serve the purpose of keeping the collection away from moisture. It is also provided with a glass top to facilitate observation. Naphthalene balls are kept inside the box to prevent insect pest and fungal attack. On both the wings, a piece of paper strip is pinned so as to spread the wings. The collection was done on sunny days continuously for one year. The collected specimen was identified by following standard literature (Kehimkar 2008)

Species Diversity Analysis:

The present diversity study on species of 5 families of butterflies from gardens and park of Pune municipal corporation enumerated a total of 655 examples pertaining to 65 species distributed over 48 genera and belonging to 14 subfamilies. Among these Five families, Nymphalidae is more species rich and dominant one with 23 species pertaining to 15 genera. Family Lycaenidae with 20 species under 17 genera, family Pieridae consists of 12 species to 9 genera followed by family Papilionidae having 6 species to 3 genera and family Hesperidae shows very poor diversity.

Two diversity indices were calculated with the help of PAST software version, 2.17C. Simpson's diversity index and Shannon-Weiner index were taken under consideration to analyze the diversity.

G1: Savitribai phule University, pune; G2: Empress garden; G3: Sarus baug; G4: Deshpande garden; G5: Sant gajanan maharaj garden; G6: Peshve park; G7: Bund garden; G8: Parvati; G9: Sambhaji garden, G10: Botanical garden modern college, G11: Kamala Nehru

park; G12: Shaniwar wada; G13: Tathavade garden; G14: Thorat garden; G15: Dhondiba sutar park.

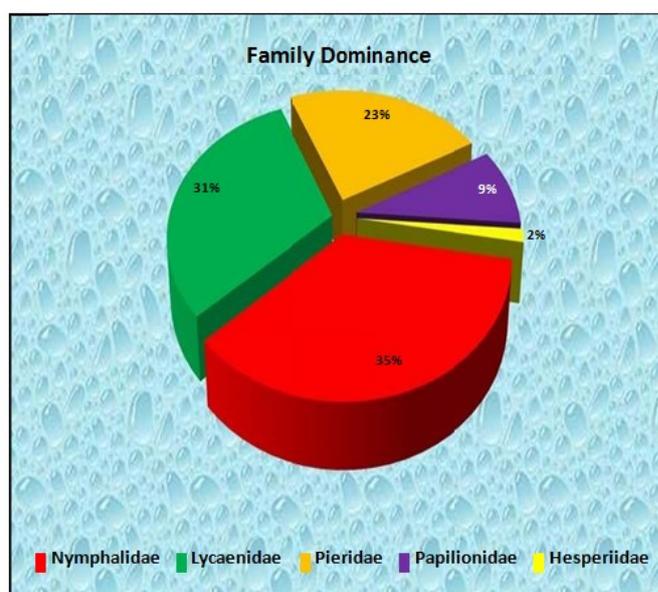


Figure 1. Family Dominance

Following graph shows the percentage wise family abundance as, A total number of 5 families have been studied from the collection sites. Family Nymphalidae was the most abundant with a total number of 23 species belonging to 195 individuals making a 35% of the total number. This is followed by family Lycaenidae with a total number of 20 species belonging to 171 individuals constituting a total of 31%. Then the Family Pieridae with a total number of 15 species including 210 individual consisting a total of 23%, family Papilionidae having a total number of 6 species belonging to 77 individual making a 9% .

The following graph shows the abundance and diversity of species in different localities as, The most diverse study site was Savitribai phule university, pune shows rich diversity of 56 species pertaining to 154 number of individuals followed by Empress garden represented by 50 species belonging to 88 number of individuals, Saras baug having 43 species pertaining to 64 number of individual. And Tathavade garden shows very less diversity consisting number of 14 species distributed to 15 individuals followed by Thorat garden shown number of 12 species consisting 15 number of individual and Dhondiba Sutar Park also shows very less diversity with 11 species belonging to 14 numbers of individuals.

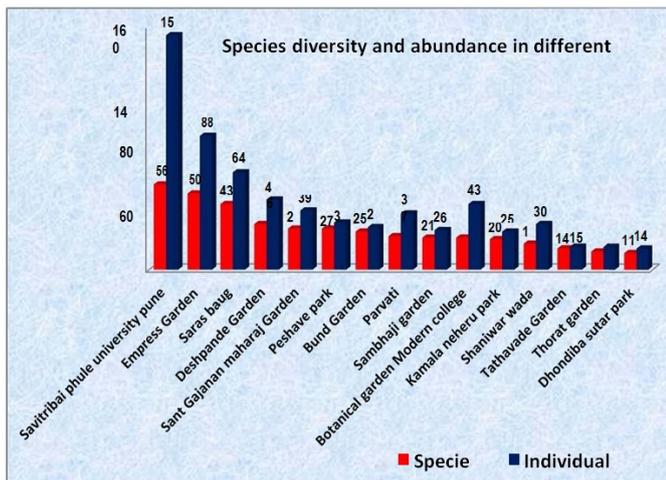


Figure 2 : Species diversity and abundance in different localities

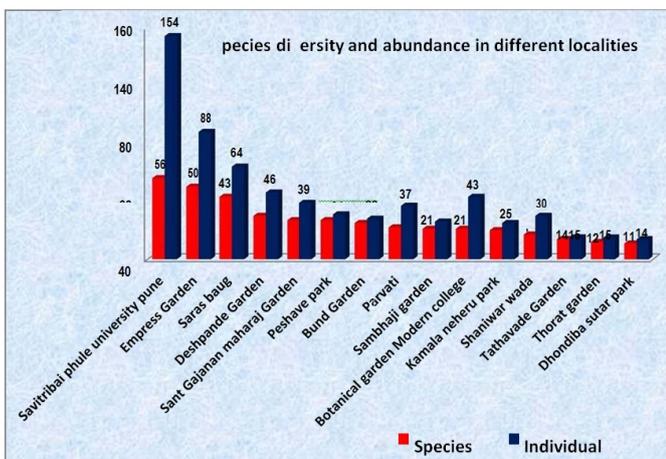


Figure 3: Locality wise species Diversity

The following graph shows the locality wise species diversity. The highest number of species (56 species) was observed in the Savitribai Phule University, pune, Empress garden and also from saras baug. The lowest number of species were recorded in Thorat garden, Dhondiba Sutar park, Shaniwar Wada and each of these localities recorded for species. Locality like Deshpande garden, Sant Gajanan Maharaj garden, Peshve park, Bund garden and Parvati recorded a medium number of species like 5 and 8 respectively.

Locality wise species Diversity

The species *Eurema hecabe* was the most abundant one with a total of 68 individuals recorded this is followed by the species *Junonia lemonias* with a total of 50 individuals and also the species *Pachliopta aristolochiae* includes 32 number of individuals. And also some species having very least number of individuals like, species *Papilio helenus* pertaining to very few number of

3 individual species, While the *Byblia ilithyia* with very poor individuals followed by the species *Ixias mariannae* with 1 individual recorded.

Biodiversity indices in the 15 Parks and Gardens of study area:

The biodiversity indices in the 15 sampling sites (Table: 2) indicates that most of the sampling sites were found to have moderate diversity. Among the 15 parks and gardens, site G1 (Savitribai phule university, Pune) records highest species diversity as well as abundance followed by site G2 (Empress garden) and site G3 (Saras baug). However, site G13, and G14 records lowest number of species diversity and site G15 having the very least number of individuals.

Table 2 : Biodiversity indices in the 15 sampling sites

Collection	No of	Individuals	Simpson_1-D	Shannon_H
G1	56	154	0.9577	3.631
G2	50	88	0.9675	3.683
G3	43	64	0.9688	3.627
G4	4	46	0.949	3.208
G5	27	39	0.952	3.175
G6	27	31	0.9594	3.255
G7	25	28	0.9688	3.184
G8	22	37	0.935	2.932
G9	21	26	0.9467	2.992
G10	21	43	0.9313	2.847
G11	2	25	0.9376	2.9
G12	17	3	0.9022	2.606
G13	14	15	0.9244	2.616
G14	12	15	0.8978	2.396
G15	11	14	0.8878	2.396

Discussion:

In 2014 S. Ankalgi and M. Jadesh recorded family Nymphalidae to be the most diverse from Ankalg village (Gulbarga District) Karnataka. Similarly the diversity study carried by H. A. Dhamke et al. in 2013 from Haveli and Maval Tahasil of pune District, Pune, Maharashtra. Their result also shows the family

Nymphalidae was the most dominant from this region. And also in 2014 P. Kumar and A. G. Murugesan recorded the relative abundance was high for family Nymphalidae among all other families. The present study also adheres earlier work of similar time by Ankalgi and Jadesh (2014), Dhamke et al (2013) also P. Kumar (2014).

The composition of species of individual families shows similar results obtained by Kunte (2001), Arun (2002), Manoj et al. (2004), Kunte (2001), Kunte (2009), Singh (2010), Alagumurugan et al. (2011), Menasagi Jyoti B. (2011), Nimbalkar et al. (2011), S Amala et al. (2011), Karve, et al. (2013), Abdul Hammed (2013), Kumar Ashok. (2013), Sharma et al. (2014), Arya et al. (2014), Bara Atanu et al. (2014), Kumar P. (2014), Sahu Usha et al. (2014), Prabakaran S. et al. (2014), Kumar Ashok. (2014), Aishwarya et al. (2014), Ravindra. (2014) and Shiva Rama Krishna et al. (2014), Naikwadi et al. (2015), Naikwadi et al. (2016).

III. CONCLUSION

Butterflies are most efficient pollinators as well as some species are agricultural pests; hence are of economic importance. The gardens and parks are important as regards of maintaining diversity of insect population in urban habitats moreover keeps the pollution under control. The present work represents an account on diversity of butterflies from parks and gardens of Pune City. The occurrence of butterflies depends on various factors like presence of indigenous flowering plants, levels of anthropogenic annoyance and garden management practices. Present work depicted the study from 15 gardens and parks of the city. Further exploration will unquestionably add to species number qualitatively as well as quantitatively. The present endeavor depicts the study of total 655 examples pertaining to 65 species distributed over 48 genera and belonging to 14 subfamilies under 5 families from 15 parks and gardens of Pune municipal corporation. Among 5 families studied, family Nymphalidae is found to be dominant with respect to species quantity and quality, the genus Junonia is the largest with 6 species. A species like Eurema hecabe, Euploea core and Catopsila pomona they are most divers among all species studied. Further study on seasonal basis will definitely add one more dimension to the study.

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