

Seasonal Fluctuations of Butterfly Population: A Study in Butterfly Garden at Peechi, Kerala, India

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Abstract

Seasonal abundance and diversity of butterfly population in the Butterfly Garden of KFRI at Peechi was examined. A total of 11,104 individuals belonging to 50 butterfly species from five families and 37 genera were recorded. Nymphalidae was the most dominant family with 21 species followed by Papilionidae (11 species), Lycaenidae (7 species), Hesperidae (6 species) and Pieridae (5 species). By pooling the generated data, the overall butterfly population showing an increasing trend from January to December with many butterfly population had an average sightings in January, minimum in April and maximum in November. Data generated in this study shows that butterflies requires appropriate climatic conditions and they respond quickly to even subtle changes in temperature and humidity. It has been observed that the pupal period of certain Papilionids may be extended from the normal days in November and December months. The lifecycle of butterflies is directly depends on temperature and humidity. A steady increase in the butterfly population count among all families shows the importance of such gardens in attracting and sustaining the butterfly population. Butterfly gardens help in caring wild butterfly population and to maintain the biodiversity in natural ecosystems, which in turn, may increase the existence of human beings.

Highlights

- A total of 11,104 individuals belonging to 50 butterfly species and 37 genera were recorded.
- Nymphalidae was the most dominant family with 21 species.
- Butterfly population showed average sightings in January, minimum in April and maximum in November

Keywords: Butterfly Population, Seasonality, Endemic, Rare, Protected sp.

Introduction

Butterfly gardening has been defined as an art of growing plants to attract butterflies (Bloom and Allen, 1990) and it serves as conservation cum educational programme. Recreation of butterfly habitats through site amelioration and resource enrichment through nectar and larval food plant introduction are the initial steps for creating a butterfly garden.

Recently, butterfly gardens and butterfly houses have become popular in several Asian, European and American countries. The first butterfly exhibit was opened in the year 1960 in England (Hughes and Bennett, 1991) and in the early 1970's, the first true butterfly house was established at the Isle of Guernsey (Spevak, 1996). The significance of butterfly gardens in promoting environmental education and biodiversity conservation has been recognized by authors (Pyle, 1995). In India, our knowledge of



butterfly gardening and their importance in promoting the *in-situ* conservation of butterflies through has been greatly enhanced through the studies carried out at KFRI (Mathew, 2001).

The major purpose of setting up butterfly gardens are butterfly conservation, environmental education, research and entertainment. Butterfly gardens have provide better nectar-host plant availability, the suitable habitat and suitable microclimatic conditions to facilitate the establishment of butterfly population. Butterfly gardens also attract visitors especially children and students and thus offer opportunities for generating awareness on biodiversity conservation. Information pertaining to the diversity, abundance, patterns of seasonality and habitat associations of butterflies have been studied at different places and reported by various workers such as Kunte (1998), Arun (2008) and Ramesh *et al.* (2010).

Seasonal fluctuations in population abundance and species richness of various butterfly population in the butterfly garden at Peechi, Kerala is studied and discussed in this paper.

Materials and Methods

Study area: The study was carried out in the butterfly garden maintained in the KFRI campus at Peechi (10.31°N, 76° 24E, 100-150 m in altitude). The garden covering an area of 0.5 ha has been developed in a degraded moist deciduous forest patch. Appropriate habitats were recreated by setting up streams, waterfalls and sprinklers and by setting up bushes, lianas and creepers on either side of nature trail of 175 m long x 1.5 m wide and the basic design of the garden is based on the geographical features of the terrain, for attracting and sustaining the butterfly populations. Adult nectar plants such as *Clerodendron capitatum*, *Lantana camera*, *Heliotropium keralense* and *Crotalaria retusa* as well as larval host plants such as *Kalanchoe pinnata*, *K. laciniata*, *Wattakkaka volubilis*, *Thottea siliquosa*, *Citrus* sp, *Murraya koenigii*, *Mussanda luteola*, *Ixora*, *Michelia champaka*, *Passiflora edulis*, *Aristolochia indica*, *Calotropis gigantean*, *Hydnocarpus pentandra* and *Tylophoa indica* were introduced in the garden to sustain various butterfly population.

Monitoring of butterflies and Transect count

Data pertaining to the number of species occurrence, habitat associations, natural mortality factors and weather parameters was generated using standard transect count

method (Pollard 1997, Ishaii, M 1993). The butterflies encountered along the transect route were recorded daily for the period from September 2010 to August 2012. All the butterflies observed at a distance of 10m from the observer were recorded during the counts. All observations were made during the forenoon between 10.30 and 11:30 hrs during which the butterfly show maximum activity. Butterflies were identified by referring to the KFRI insect collection and the literature (Larsen, 1987, 1988 and Wynter-Blyth, 1957).

Data Analysis

For analyzing the collected data, the year was divided into three periods – Pre-monsoon –(January to April), Monsoon – (May to August) and Post– monsoon (September to December) Mean abundance and seasonal index of butterflies of each family were calculated and graphically presented. The seasonal index of butterflies of each family was calculated by using the formula:

$$\text{Seasonal Index} = \frac{\text{Month-wise mean} \times 100}{\text{Overall mean}}$$

Where, the month-wise mean is the number of butterflies for a given family sighted during the study period and the overall mean is the mean of all month-wise means. By calculating the seasonal index, it is possible to interpret the mean occurrence of each butterfly in a month in relation to the overall mean monthly sightings. Shannon –Weiner diversity index, species richness, evenness and dominance index were computed.

Results and Discussion

A total of 11,104 individuals comprising 50 butterfly species from five different families and 37 genera were recorded. Continuous monitoring of the garden showed 4847 individuals during the first half of the study and 6257 individuals in the second half, of which 20 species are common in this area and the remaining ones found only in specific seasons. Out of these, Nymphalidae was the most abundant family with 21 species followed by Papilionidae (11 species), Lycaenidae (7 species), Hesperidae (6 species) and Pieridae (5 species). Of the various species recorded, seven were endemics, five species having protected status under the Indian Wildlife Act (GOI, 1972) and five were rare species (Appendix I).

Seasonal Index of different butterfly populations in the garden

Papilionidae: The population was present throughout the year with maximum sightings in September and November 2011 and minimum sightings during the months of January to May. After the commencement of monsoon, the Papilionids showed an increase in population and its peak during September to November. The population remained moderate during the remaining months (Fig.3).

Among the Papilionids, the Southern bird wing (*Troides minos*), Common Rose (*Pachliopta aristolochiae*), Common mormon (*Papilio polytes*) and Blue mormon (*Papilio polymnestor*) were observed during all months of the year. Almost all Papilionids were found to lay their eggs during September to November when their population showed maximum count. In the case of the Buddha peacock (*Papilio buddha*) an endemic, protected butterfly, adults were observed from June to November and laying egg was observed during September to November on the leaves of their larval host plant *Zanthoxylum retusa*. The Southern Birdwing and Malabar Rose were very common in June – September and their immature stages were also present during the monsoon season. Sightings of certain rare Papilionids such as Red Helen (*Papilio helenus*) were recorded in the garden during August to November.

Pieridae: Even though the Pierids were present in all seasons in significant numbers, the species- wise representation was very low throughout study period. Maximum number of sightings was observed in November 2011 (Fig 3). The population was low during the dry months

from December to May. Then gradually population showed steady increase and reached its peak during the September to November. *Delias eucharis* (Common Jezebel), an endemic species was sighted in the Garden during post monsoon season. Species sighted during all months of the year included such as *Catopsilia pomona*, *C. Pyranthe*, *Eurema hecabe* and *Leptosia nina* (Psyche).

Nymphalidae:The population was present throughout the year. Highest count was observed during November in both the years. Even though the Nymphalids were most common and adapted, population count was low from January to April and then the population was sustained in the field till December. Species sighted during all months of the year included such as *Parantica aglea* (Glassy Blue Tiger), *Tirumala limniace* (Blue Tiger), *T. septentrionis* (Dark Blue Tiger), *Danaus chrysippus* (Plain Tiger), *D. genutia* (Striped tiger), *Euploea core* (Common Indian Crow), *Hypolimnas bolina* (Great Egg-fly) and *H. misippus* (Danaid Egg-fly).

Lycaenidae:Lycaenids showed an upward trend from December and reached its peak during February. They were present in all months, with minimum in numbers. They had very low population number during May to October, then population showed a steady increase in number and reached its peak during February. Red pierrot, (*Talicauda nyseus*) is the most commonly sighted species during the pre-monsoon season, while the protected species, *Castalius rosimum* (Common Pierrot) was also observed in the garden.

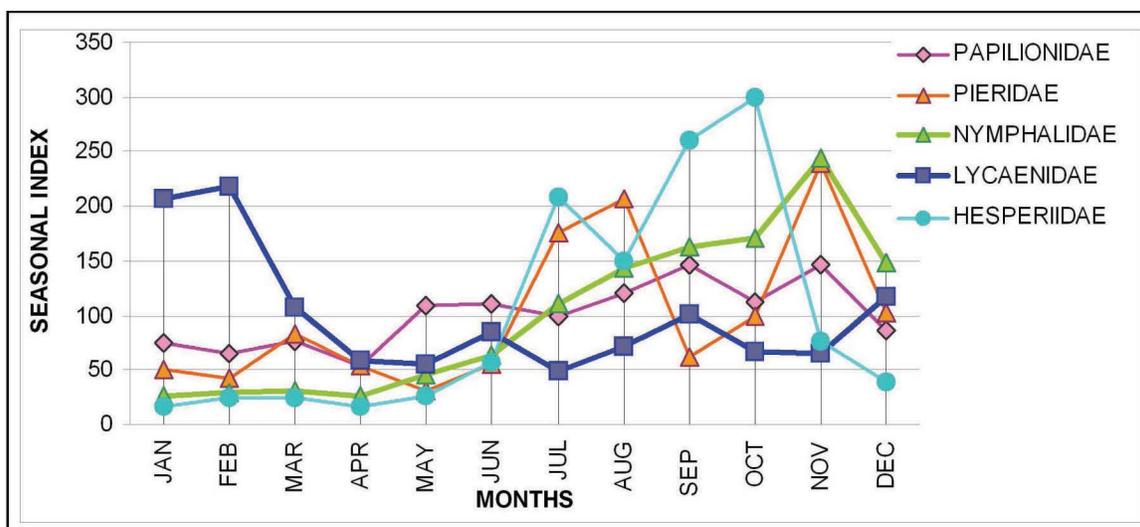


Fig. 1: Seasonal Index of different butterfly families

Hesperiidae: The population of Hesperidae was high during the monsoon season. The seasonal index showed highest count during October 2011 and minimum during January to April of both years. *Tagiades litigiosa*, *Calaenorrhinus leucocera*, *Borbo cinnara*, *Ampittia dioscorides*, *Imbrix salsalawere* some of the Hesperids observed during the rainy season.

Overall Population Trend in the butterfly garden

The population trends butterflies are given in Fig II. The overall butterfly abundance showed an increasing trend from January to December. The butterfly population in the butterfly garden at Peechi showed highest population sightings during August to November and this may be related to flowering of plants and the appropriate climatic

conditions. For many species, an average temperature ranging between 25-26°C and relative humidity ranging between 80-90% are most preferred (Mathew & Anto 2007). The butterfly population showed a gradual decline in numbers from December onwards with the onset of dry condition and reached its peak during March – April. This dry period was least favourable to many butterflies, probably due to the scarcity of water, nectar and fresh foliage. Earlier Hussian *et al* (2005) also reported that maximum butterfly activity was observed during North East monsoon season and least during the summer season.

During the first half of the study in the Peechi Butterfly Garden, 4,847 sightings of butterflies was recorded and 6,257 sightings of butterflies in the second half. Altogether, 11,104 sightings of butterflies belonging to 50 species have

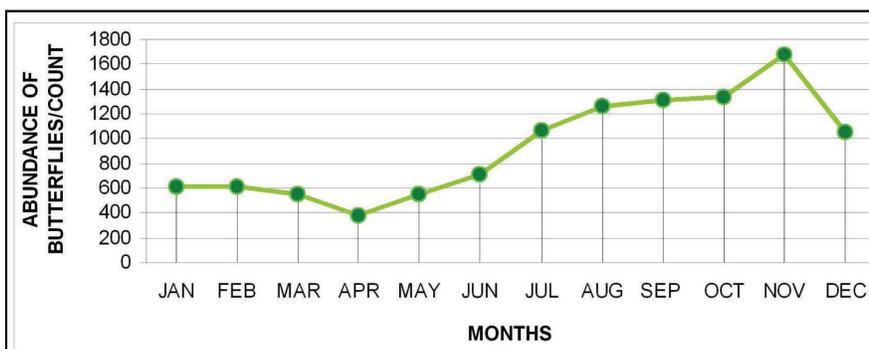


Fig. 2: Seasonal abundance pattern of butterfly community on different months.as

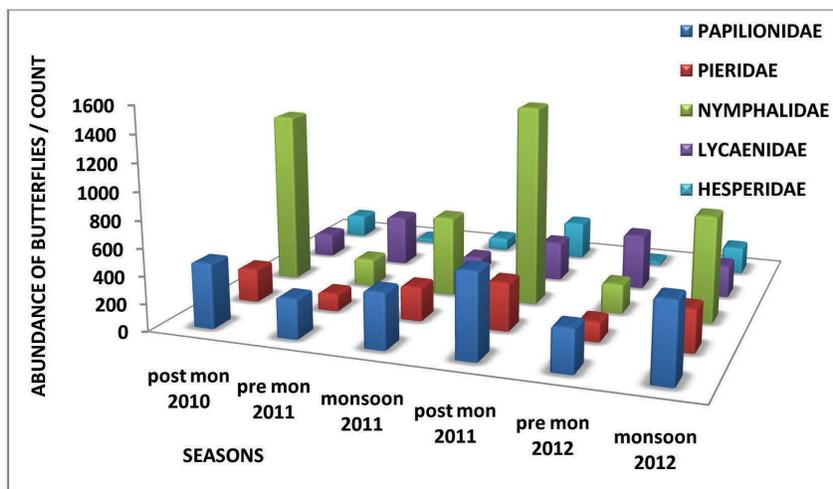


Fig. 3: Overall population trend of various families of Butterflies from September 2010 to August 2012. Pre monsoon- Jan- April, Monsoon – May- August, Post monsoon- Sep- Dec.



been recorded during the 24 months of study period. An examination of pooled data on the overall population trend of various butterfly families from September 2010 to August 2012 showed that Papilionids were abundant during the post monsoon season of 2011 and monsoon season of 2012, with least sightings during the pre monsoon period. Of the various groups of butterflies, Nymphalids were most established species being found in almost all seasons with a significant species richness which is reversibly explaining their ability to exploit the recreated habitats most efficiently. The seasonal population trends of various groups of butterflies studied herein is presented in Fig 3.

Species Richness and Diversity indices

The diversity of butterflies during the three seasons was found to be significantly different from each other. Comparison of the Shannon diversity index showed higher diversity in monsoon, followed by post monsoon and pre-monsoon. Species richness was found to be higher in pre-monsoon season followed by monsoon and post-monsoon seasons.

The comparison of Shannon diversity index among five different families showed Nymphalidae has high value and Pieridae had least diversity index in all seasons. The families like Papilionidae, Pieridae and Nymphalidae showed high diversity index in post-monsoon season. Hesperiid prefers monsoon season and Lycaenids had high index in pre monsoon and least index in post monsoon season.

Table 1: Diversity indices for butterflies recorded during different seasons

Parameters	Pre monsoon	Monsoon	Post monsoon	Total
Shannon index	3.294	3.498	3.493	3.586
Species Richness	1.368	1.229	0.889	0.657
Evenness	0.870	0.914	0.912	0.931
dominance index	0.057	0.038	0.040	0.034

Diversity is directly correlated with the stability of ecosystems, being highest in biologically controlled systems, and lower in polluted ecosystems (Rosenberg, 1976). According to Boecklen and Simberloff (1986), habitat heterogeneity is an important determinant of species richness.

Conclusion

Butterfly gardens are the ‘gate-ways’ to protect the butterfly population. Information related to the community structure, composition and seasonal fluctuations of the butterfly fauna are very important in any conservation programme and butterfly gardens serve as an ecotourism cum *in-situ* conservation enterprise. Habitat recreation involving resource enrichment through host plant introduction and site amelioration are the key factors to be considered while setting up butterfly gardens. During the first half of the study in the Peechi Butterfly Garden, 4,847 sightings of butterflies was recorded and 6,257 sightings of butterflies in the second half. Altogether, 11,104 sightings of butterflies belonging to 50 species have been recorded during the 24 months of study period. These included seven species endemic to the Western Ghats, five species having protected status under the Indian Wildlife Act and five rare species. Data generated in this study shows that butterflies requires appropriate climatic conditions and they respond quickly to even subtle changes in temperature and humidity. It has been observed that the pupal period of certain Papilionids may be extended from the normal days in November and December months. The lifecycle of butterflies is directly depends on temperature and humidity.

The population in the butterfly garden at Peechi showed highest population sightings during August to November and from February onwards, the population showed a gradual decline in numbers and it is reached in its peak during March – April months. This shows the extreme significance of butterfly gardens in conservation

Table 2: Diversity indices of various butterfly families during different seasons

	Dominance index			Diversity index		
	Pre monsoon	Monsoon	Post monsoon	Pre monsoon	Monsoon	Post monsoon
Papilionidae	0.187	0.184	0.145	1.874	1.869	2.042
Pieridae	0.237	0.235	0.257	1.509	1.514	1.447
Nymphalidae	0.091	0.075	0.108	2.645	2.708	2.556
Lycaenidae	0.264	0.211	0.268	1.625	1.695	1.599
Hesperidae	0.224	0.236	0.233	1.603	1.559	1.573



programme. Because of the unscientific developmental activities of man, the habitats of many species of butterflies have been altered, threatening to their survival. Species loss has tremendous implications on the survival of mankind in this universe. It has been estimated that there has been a loss of 50% forest cover in the past 50 years in the Western Ghats (Goanker 1999). Due to large scale ecological disturbances, many species are facing extinction (Varshney, 1986). Since the butterflies are good bio indicators of environment, they can be used to identify ecologically important landscapes for conservation purpose (Barlow *et al.* 2008). Butterfly gardens help in caring wild butterfly population and to maintain the biodiversity in natural ecosystems, which in turn, may increase the existence of human beings.

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**Appendix I:** Butterflies sighted from the Butterfly Garden at Peechi.

Butterfly Family / Species	Sightings I year	II year	Total sightings	Remarks	
Papilionidae <i>Troides minos</i> (Southern Birdwing)	258		314	572	Endemic
<i>Pachliopta hector</i> (Crimson Rose)	50		49	99	Endemic, Schedule I
<i>P. aristolochiae</i> (Common Rose)	251		270	521	Common
<i>P. pandiyana</i> (Malabar Rose)	178		172	350	Endemic
<i>G. agamemnon</i> (Tailed Jay)	8		24	32	Common
<i>P. Buddha</i> (Buddha Peacock)	27		46	73	Endemic
<i>Papilio clytia</i> (Common Mime)	67		127	194	Protected
<i>P. polytes</i> (Common Mormon)	162		250	412	Common
<i>P. polymnestor</i> (Blue Mormon)	72		143	215	Endemic
<i>P. helenus</i> (Red Helen)	79		96	175	Rare
<i>P. demoleus</i> (Lime Butterfly)	27		29	56	Common
Total	1,179		1,520	2,699	
Pieridae <i>Catopsilia Pomona</i> (Common Emigrant)	178		215	393	Common
<i>C. pyranthe</i> (Mottled Emigrant)	151		74	225	Common
<i>Eurema hecabe</i> (Common Grass Yellow)	75		239	314	Common
<i>Delias eucharis</i> (Common Jezebel)	56		52	108	Endemic
<i>Leptosia nina</i> (Psyche)	170		230	400	Common
Total	630		810	1,440	
Nymphalidae <i>Parantica aglea</i> (Glassy Blue Tiger)	98		123	221	Common
<i>Tirumala limniace</i> (Blue Tiger)	149		218	367	Common
<i>T. septentrionis</i> (Dark Blue Tiger)	268		301	569	Rare
<i>Danaus chrysippus</i> (Plain Tiger)	81		93	174	Common
<i>D. genutia</i> (Striped tiger)	119		95	214	Common
<i>Euploea core</i> (Common Indian Crow)	439		456	895	Protected
<i>Hypolimnas bolina</i> (Great Egg-fly)	84		88	172	Rare
<i>H. misippus</i> (Danaid Egg-fly)	122		118	240	Schedule I
<i>Ypthima baldus</i> (Common Four-ring)	14		29	43	Common
<i>Y. huebneri</i> (Common Five-ring)	19		29	48	Common
<i>Melanitis leda</i> (Common Evening Brown)	24		45	69	Common
<i>Polyura athamas</i> (Common Nawab)	20		44	64	Common
<i>Moduza procris</i> (Commander)	94		98	192	Rare
<i>Cupha erymanthis</i> (Southern rustic)	133		114	247	Common
<i>Cirrochroa thais</i> (Tamil yeoman)	90		100	190	Endemic
<i>Neptis hylas</i> (Common Sailor)	91		103	194	Common
<i>Elymnias hypemenstra</i> (Common palmfly)	24		74	98	Common
<i>Mycalesis perseus</i> (Common bush brown)	15		73	88	Common
<i>Ariadne merione</i> (Common Castor)	80		139	219	Common
<i>J. iphita</i> (Chocolate Pansy)	114		131	245	Rare
Total	2,078		2,471	4,549	
Lycaenidae <i>Jamides celeno</i> (Common Cerulean)	104		127	231	Common
<i>J. bochus</i> (Dark Cerulean)	40		49	89	Rare
<i>Castalius rosimon</i> (Common Pierrot)	85		86	171	Schedule I
<i>Cheritra freja</i> (Common Imperial)	52		61	113	Common
<i>Curetis thetis</i> (Indian Sunbeam)	36		54	90	Common
<i>Rathinda amor</i> (Monkey Puzzle)	46		52	98	Common
<i>Talicauda nyseus</i> (Red Pierrot)	299		514	813	Common
Total	662		943	1,605	
Hesperiidae <i>Tagiades litigiosa</i> (Water snow flat)	73		145	218	Common
<i>Calaenorrhinus leucocera</i> (C.spotted flat)	89		154	243	Common
<i>Borbo cinnara</i> (Rice swift)	30		70	100	Common
<i>Gangara thyrasis</i> (Giant Red Eye)	6		22	28	Common
<i>Ampittia dioscorides</i> (Bush hopper)	57		66	123	Common
<i>Imbrix salsala</i> (Chestnut Bob)	43		56	99	Common
Total	298		513	811	
Grand Total	4,847		6,257	11,104	

