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Seasonality of butterflies in Alagar Hills reserve forest, India

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ABSTRACT: Seasonal prevalence of butterflies carried out in Alagar hills reserve revealed more number of butterflies in the summer with higher density of Nymphalid butterflies followed by Papilionidae. Hesperiidae species were more in post monsoon season than in rainy or dry season. On comparing the prevalence of butterflies with environmental factors, Hesperiidae exhibited a positive correlation with rainfall, humidity and negative correlation with temperature whereas Nymphalidae and Papilionidae showed a positive correlation with temperature and negative correlation with humidity. Study showed that summer period is a suitable period for butterfly prevalence in Alagar Hills.

KEY WORDS: Alagar Hills, Nymphalidae, summer season

INTRODUCTION

With the scenario of recent global warming, evidence documents ongoing changes in distribution of terrestrial species throughout the earth (Parmesan and Yohe, 2003). Seasonality is not a strange phenomenon in insect population (Hussain *et al*., 2011). Their population dynamics is influenced by a variety of factors (Rajagopal *et al*., 2011). Understanding the relationship between seasonality and geographical distribution of individual species is important for predicting anthropogenic forest disturbances (Wright *et al*., 1993). Some species show fluctuation in relation to variation in rainfall and host plant dynamics (Hill *et al*., 2003). Global warming has affected distribution ranges of many butterfly species (Hoyle and James, 2005). Abiotic factors like temperature, humidity and solar radiation have profound activity on the insects like butterflies because of their reduced thermal inertia (Piexoto and Beason, 2009). Most butterflies respond to habitat and climate change (Feest *et al*., 2011). Butterflies are sensitive to environmental gradient in tropical regions particularly in areas with well-defined wet and dry seasons. Many satyrine butterfly species of tropical low lands are known to be sensitive to changes in humidity (Braby, 1995). Phenological pattern in butterflies may be determined by fruiting and flowering plants (Scott, 1986), annual humidity distribution (Wolda, 1989), photoperiodic changes (Shapiro, 1975), substrate availability and palatability of larval food plants (Owen *et al*., 1972).Global warming has affected distribution ranges of many butterfly species and has led to the extinction or endangerment of others (Hoyle and James, 2005).

MATERIALS AND METHODS

The present study area Alagar hills reserve forest 10° 5' 30"N to 10° 9' 40"N and 78° 10' 20"E to 78°17'7"E of the Eastern Ghats and it is situated in

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the Nattam Taluk of Dindigul of Tamil Nadu, India. The prevalence of butterflies during the four different seasons namely, monsoon, pre monsoon, post monsoon and summer season was analyzed using standard transect sampling method (Ishii, 1993). The survey of butterflies was carried out at eight sites for two years from November2009 to October 2011. The butterflies were sampled using line transect method count (Pollard and Yates 1993).Collection of specimen was avoided in most cases and butterflies were documented using Canon and Nikon cameras with appropriate high quality lenses. Butterflies were identified with the help of various field guides (Kunte, 2000; Antram, 2002; Sharmila and Thatheyus, 2014).To investigate the seasonal abundance of tropical butterfly species; it is important to examine the climate data pertaining to rainfall, temperature and humidity (Thakur and Ghosh, 2014). The records of the mean daily temperature, mean daily humidity and total rainfall obtained for the period November 2009 to October 2011 were collected to find out the monthly average. The three ecological parameters namely rainfall, temperature and humidity were correlated with familial prevalence of butterflies using Karl Pearson's coefficient of correlation.

RESULTS AND DISCUSSION

Alagar Hills reserve forest registered more number of butterflies in the S4 season (summer) with higher density of Nymphalid butterflies in both the years, followed by Papilionidae. Nymphalidae exhibited sudden spurt and increase in the summer season compared to other seasons in both the years while the density of Papilionids did not show such spurts in various seasons. The total number of butterflies was highest in the first year during summer season with 51,788 and in the second year it was 30,909. In both the years of study, summer season had the maximum population. But the total population showed a decreasing trend in the second year (Fig.1). However irrespective of butterflies representing different families butterfly prevalence was the highest in summer season.

Among Nymphalids noted in Alagar Hills reserve forest, many species were seen in all the seasons, but certain species were prevalent only in a single season. Among the prevalent thirty two species seventeen species were found in all the seasons (Table 1). Most of the Papilionids were seen in all the seasons (Table 2). Among Pierids, forty percent species were seen in all the four seasons, and most of the abundant species were seen in all the seasons (Table 3). In Lycaenidae about sixteen percent were seen in all the seasons (Table 4). None of the Hesperiids were seen in all the seasons (Table 5). On comparing with the prevalence of butterflies of different families with the amount of rainfall, temperature and humidity, a few families showed correlation with these environmental factors. Hesperiidae exhibited a positive correlation with rainfall. Nymphalidae and Papilionidae showed a positive correlation with temperature, whereas Hesperiidae exhibited negative correlation with temperature. Nymphalidae and Papilionidae showed negative correlation with humidity while Hesperiidae exhibited positive correlation with humidity (Table 6).

Seasonality is a common phenomenon in insect population (Wolda, 1989). Butterflies are neither identical nor abundant throughout the year and their numbers decline over a period owing to harsh climatic changes and anthropological activities. Their appearance in the same place fluctuates with seasonal change and butterfly ranges are affected by global climate change (Forister *et al*., 2009). Hesperiids showed higher prevalence in post monsoon season during January, February and March and they differed in their phenological behaviour compared to other families. Similar results were also observed by Pozo *et al*. (2008) where they observed Hesperiidae species richness being more in post monsoon season than that of rainy or dry season.

Many of the Nymphalids found in Alagar Hills reserve forest were seen in all seasons. These Nymphalid larvae should be able to feed on wide range of locally available plant species and may face fewer constraints on their prevalence throughout the year rather than monophagous species. The species with wide range of host plants showed low seasonality. Similar type of results was

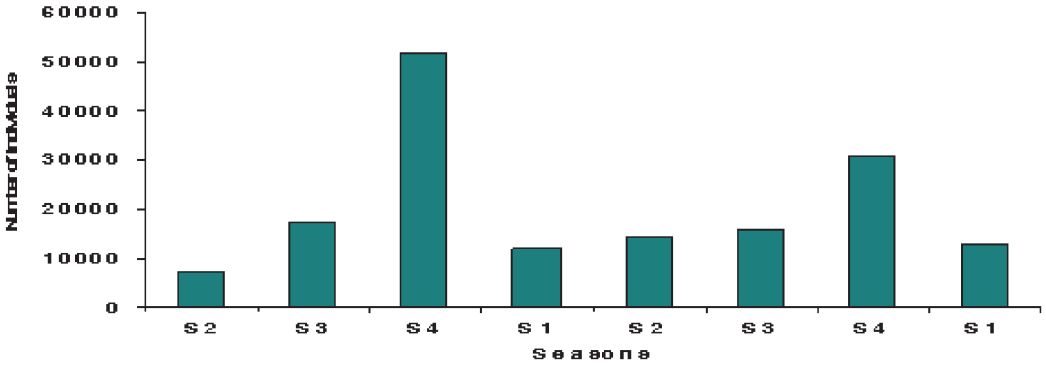

Fig 1. Butterfly sighting in different seasons during the study period

Table 1. Nymphalids in different seasons in Alagar Hills reserve forest

Sl.No.	Species	Seasons							
		S2	S3	S4	S1	S2	S3	S4	S1
1	*Acraea violae*(Fabricius)	+	+	+	+	+	+	+	+
2	*Ariadne ariadne*(Linnaeus}	+	+	+	+	+	+	+	+
3	*Charaxes solon* (Fabricius)	+	+	+	+	+	+	+	+
4	*Danaus chrysippus*(Linnaeus)	+	+	+	+	+	+	+	+
5	*Danaus genutia*(Cramer)	+	-	-	-	+	+	+	+
6	*Euploea core* (Cramer)	+	+	+	+	+	+	+	+
7	*Euploea midamus*(Linnaeus)	-	-	-	-	-	+	-	-
8	*Euthalia aconthea*(Cramer)	+	+	-	+	+	+	+	-
9	*Euthalia nais*(Forster)	+	-	-	-	-	-	-	-
10	*Hypolimnas bolina*(Linnaeus)	-	-	-	-	-	+	+	+
11	*Hypolimnas misippus*(Linnaeus)	+	+	+	+	+	+	+	+
12	*Junonia almana*(Linnaeus)	-	-	-	-	-	+	-	-
13	*Junonia atlites*(Linnaeus)	-	-	-	-	-	-	+	-
14	*Junonia hierta*(Fabricius)	+	+	+	+	+	+	+	+
15	*Junonia iphita*(Cramer)	+	+	-	+	-	-	-	-
16	*Junonia lemonias*(Linnaeus)	+	+	+	+	+	+	+	+
17	*Junonia orithiya*(Linnaeus)	+	+	+	+	+	+	+	+
18	*Libythea lepita*(Godrat)	+	+	+	+	+	+	+	+
19	*Melanitis leda*(Linnaeus)	+	+	+	+	+	+	+	+
20	*Moduza procris*(Cramer)	-	-	-	-	-	+	-	-
21	*Mycalesis patnia*(Moore)	+	+	-	+	+	+	+	+
22	*Mycalesis visala*(Moore)	-	-	-	-	-	+	+	+
23	*Neptis ananta*(Moore)	-	+	-	-	-	-	-	-
24	*Neptis hordonia*(Stoll)	+	+	+	+	+	+	+	+
25	*Neptis hylas*(Linnaeus)	+	+	+	+	+	+	+	+
26	*Phalanta phalantha*(Drury)	+	+	+	+	+	+	+	+
27	*Polyura athamas*(Drury)	+	+	+	+	+	+	+	+
28	*Thaumantis diores*(Doubleday)	-	-	-	-	-	+	-	-
29	*Tirumala septentrionis*(Butler)	+	+	+	+	+	+	+	+
30	*Ypthima baldus*(Fabricius)	-	-	-	-	-	+	-	-
31	*Ypthima ceylonica*(Hewitson)	+	+	+	+	+	+	+	+
32	*Ypthima huebneri*(Kirby)	+	+	-	+	+	+	+	+

+ present - absent

Table 2. Papilionids in different seasons in Alagar Hills reserve forest

Sl.No.	Species	Seasons							
		S2	S3	S4	S1	S2	S3	S4	S1
1	*Atrophaneura aristolochiae* (Fabricius)	+	+	+	+	+	+	+	+
2	*Atrophaneura hector* (Linnaeus)	+	+	+	+	+	+	+	+
3	*Graphium agamemnon*(Linnaeus)	+	+	+	+	+	+	+	+
4	*Graphium cloanthus*(Westwood)	+	+	+	+	+	+	+	+
5	*Graphium doson*(C&R Felder)	+	+	+	+	+	+	+	+
6	*Graphium nomius*(Esper)	+	-	+	+	+	+	+	+
7	*Graphium sarpedon*(Linnaeus)	-	-	-	-	-	+	+	+
8	*Papilio crino*(Fabricius)	+	+	+	-	+	+	-	-
9	*Papilio demoleus*(Linnaeus)	-	-	-	-	-	+	-	-
10	*Papilio polymnestor*(Cramer)	+	+	+	+	+	+	+	+
11	*Papilio polytes*(Linnaeus)	+	+	+	+	+	+	+	+
12	*Troides minos*(Cramer)	+	+	+	+	+	-	-	-

+ present - absent

Table 3. Pierids in different seasons in Alagar Hills reserve forest

Sl.No.	Species	Seasons							
		S2	S3	S4	S1	S2	S3	S4	S1
1	*Appias albina*(Bosiduval)	+	+	+	+	+	+	+	+
2	*Appias libythea*(Fabricius)	-	-	+	-	-	+	+	+
3	*Appias lyncida*(Cramer)	-	+	+	+	+	+	+	+
4	*Belonis aurota*(Fabricius)	-	-	-	-	-	+	-	-
5	*Catopsila crocale*(Fabricius)	+	+	+	+	+	+	+	+
6	*Catopsila pyranthe*(Linnaeus)	+	+	+	+	+	+	+	+
7	*Cepora nerissa*(Fabricius)	+	+	+	+	+	+	+	+
8	*Ceprora nadina*(Lucas)	-	-	-	-	-	+	+	+
9	*Colotis amata*(Fabricius)	-	+	-	+	+	-	-	-
10	*Colotis danae*(Fabricius)	-	-	-	-	+	+	+	-
11	*Colotis fausta*(Oliver)	-	-	-	-	+	+	+	+
12	*Colotis vestalis*(Butler)	-	-	-	-	-	+	+	-
13	*Delias eucharis* (Drury)	+	+	-	-	+	+	-	-
14	*Eurema andersoni*(Moore)	-	-	-	-	-	+	-	-
15	*Eurema blanda*(Bosiduval)	-	-	-	-	-	+	+	+
16	*Eurema brigit*(Cramer)	+	+	+	+	+	+	-	-
17	*Eurema hecabe*(Linnaeus)	+	+	+	+	+	+	+	+
18	*Hebomia glauccippe*(Linnaeus)	+	+	+	+	+	+	+	+
19	*Ixias marianne*(Cramer)	+	+	+	+	+	+	+	+
20	*Ixias pyrene*(Linnaeus)	+	+	+	+	+	+	+	+
21	*Leptosia nina*(Fabricius)	+	+	+	+	+	+	+	+
22	*Pareronia ceylanica*(C&R Felder)	-	-	+	+	+	+	+	+
23	*Pareronia valeria*(Cramer)	+	+	+	+	+	+	+	+

+ present - absent

Table 4. Lycaenids in different seasons in Alagar Hills reserve forest

Sl.No.	Species	Seasons							
		S2	S3	S4	S1	S2	S3	S4	S1
1	*Abisara echerius*(Stoll)	-	+	-	+	+	-	+	+
2	*Anthene lycaenina*(C & R Felder)	-	-	-	-	-	+	-	-
3	*Arhopala pseudocentaurus* (Doubleday)	-	-	-	-	-	-	-	+
4	*Azanus jesous*(Guerin Meneville)	-	-	-	-	-	-	-	+
5	*Caleta elna*(Hewitson)	-	-	-	-	-	-	+	+
6	*Castalius rosimon*(Fabricius)	+	+	+	+	+	+	+	+
7	*Catochrysops strabo*(Fabricius)	-	-	-	-	-	-	+	+
8	*Chilades lajus*(Stoll)	+	+	-	-	-	+	+	+
9	*Curetis thetis*(Drury)	+	-	-	+	+	+	+	-
10	*Deuodrix perse*(Hewitson)	+	-	-	-	-	-	-	-
11	*Discolampa ethion*(Westwood)	-	-	-	-	-	+	+	-
12	*Jamides celeno*(Cramer)	-	-	-	-	-	+	-	-
13	*Leptotes plinius*Fabricius	-	-	+	-	-	+	-	-
14	*Megisba malaya*(Horsfield)	-	-	-	-	+	-	-	-
15	*Nacaduba berenice* (wood – Mason & de Niceville)	-	-	+	+	-	+	-	+
16	*Nacaduba kurava*(Moore)	-	-	-	-	-	+	+	-
17	*Prosotas dubiosa*(Evans)	+	+	+	+	+	+	+	+
18	*Prosotas felderi*(Murray)	+	+	+	+	-	+	+	-
19	*Pseudozizeeria maha*(Kollar)	-	+	-	+	+	-	+	+
20	*Rathinda amor* (Fabricius)	+	+	+	+	+	+	+	+
21	*Spindasis lohita(*Horsfield)	-	-	-	-	-	-	-	+
22	*Spindasis vulcanus*(Fabricius)	-	-	-	-	-	-	-	-
23	*Talicada nyseus*(Guerin Meneville)	+	+	+	-	+	+	+	+
24	*Tarucus nara*(Kollar)	+	+	+	+	+	+	+	+
25	*Zizina otis*(Fabricius)	+	+	+	+	+	+	+	+

+ present - absent

Table 5. Hesperiids in different seasons in Alagar Hills reserve forest

Sl.No.	Species	Seasons							
		S2	S3	S4	S1	S2	S3	S4	S1
1	*Caprona agama* (Moore)	-	-	-	-	-	+	-	-
2	*Caprona ransonnetti*(C & R Felder)	+	+	-	+	+	-	+	-
3	*Hasora chromus*(Cramer)	-	+	-	+	+	-	+	+
4	*Hasora taminatus*(Hubner)	-	-	-	-	-	-	+	-
5	*Lambrix salsala*(Moore)	-	-	-	+	+	-	-	-
6	*Tagiades japetus*(Stoll)	-	-	-	-	+	+	-	-
7	*Telicota ancilla*(Herrich-Schaffer)	-	-	-	-	-	+	-	-
8	*Telicota colon* (Fabricius)	-	-	-	-	+	+	+	-
9	*Thoressa astigmata*(Swinhoe)	-	-	-	-	-	+	-	-

+ present - absent

Table 6. Pearson correlation coefficient between Families and Environmental variables in Alagar Hills reserve forest

Variables	Correlation coefficient	Significance(5% level)
Papilionidae		
Rainfall	-0.1909	Insignificant
Temperature	0.6057*	Significant
Humidity	-0.3707*	Significant
Nymphalidae		
Rainfall	-0.1497	Insignificant
Temperature	0.5178*	Significant
Humidity	-0.3403*	Significant
Pieridae		
Rainfall	-0.1803	Insignificant
Temperature	0.2952*	Significant
Humidity	-0.1701	Insignificant
Lycaenidae		
Rainfall	0.0669	Insignificant
Temperature	0.1025	Insignificant
Humidity	0.0329	Insignificant
Hesperiidae		
Rainfall	0.3065*	Significant
Temperature	-0.3176*	Significant
Humidity	-0.3403*	Significant

explained by Hill *et al*. (2001). Certain species of butterflies of Alagar Hills reserve forest were found only in specific seasons and these species may belong to closed canopy forest. Baura *et al*. (2010) also suggested that butterfly abundance was influenced by humidity and rainfall. Photoperiod will increase as summer heat approaches and decrease towards the cold winter. Hill *et al*. (2001) also attributed the following reasons for the prevalence of certain species found in specific seasons, where few species may not be able to adapt to change in moisture availability and humidity. When there is change in canopy cover, there is change in the amount of light penetration, thus changing the microclimatic effect. This will have an impact on adult and larva and indirectly on plant quality. The reasons explained by Hill *et al*. (2001) can account for the prevalence of certain species of butterflies in few seasons in Alagar Hills reserve forest.

In the summer season S4 (April, May, June) highest number of Nymphalids were found in both the years of study. These results coincided with that of Baskar and Rahman (2003) where butterflies of families Papilionidae and Nymphalidae were abundant during March to May. Flight periods of open forest species reached their peak in summer months and during late monsoon (Kunte, 1997). The open forest species are sun loving species and they predominate, but when the area becomes too hot the individuals tend to reach cooler areas. The prevalence of Nymphalidae and Papilonidae during dry seasons might be due to their ability to maintain water balance as they are large size individuals as suggested by Janzen and Schoener (1987).

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