

Diversity of Butterflies in Shendurny Wildlife Sanctuary, Kerala (India)

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Abstract: During a two year survey, seventy-three species of butterflies belonging to five families were recorded from the Shendurny Wildlife Sanctuary. Maximum number of species recorded belonged to Nymphalidae. The butterflies recorded from the sanctuary included five species having protected status under the Indian Wildlife Act and three Western Ghats endemics. The fauna also contained several rare species such as *Papilio paris tamilana*, *P. buddha*, *Cyrestis thyodamas*, *Cupha erymanthis maja* and *Pantoporia ranga*. Thenmala and Rosemala are the major forest bearing the tracts in the sanctuary. Species diversity and richness were highest in the Rosemala area compared to Thenmala.

Key words: Butterfly fauna • Rare • Endemic • Protected

INTRODUCTION

The Shendurny Wildlife Sanctuary located between 77°4 and 77°17 East longitude and 8°48 and 8°58 North latitude, belongs to the Thenmala Forest Division in the Kollam District of Kerala State (Fig.1). Situated on either side of the Shendurny River, it forms a lush green valley and is acclaimed for its rich biodiversity. The area was proclaimed a Wildlife Sanctuary in 1984 and is the only sanctuary in Kollam District. The locality name Shendurny has reference to the presence of the endemic tree species 'Chenkurungi' (*Gluta travancorica*), found abundantly in this area.

The sanctuary has an area of 100 km², including the Kallada reservoir, which has an extent of 13.72 km². About 450 ha of area within the notified boundary of the sanctuary are under private possession. The sanctuary has a core area of 45 km² [1]. However, most of these areas have been reclaimed and brought under forest cover lately.

Thenmala and Rosemala are the major forest bearing the tracts in the sanctuary. Species diversity and richness were highest in the Rosemala area compared to Thenmala.

The whole area is hilly in character. The continuous stretch of dense forests and the lofty cliffs in the east with elevation varying from 800 m to 1500 m above mean sea level act as great barrier separating the States of Kerala and Tamilnadu. The Rosemala area is located just

opposite to Arienkavu main road. The altitude varies from 1000 m to 1800m.

Vegetation: Vegetation of the sanctuary has been classified into following types based on Chandrasekaran [2] and Champion and Seth [3]:

- West Coast Tropical Evergreen
- Southern Hill Top Tropical Evergreen
- West Coast Semi Evergreen
- Southern Moist Mixed Deciduous Forest

Fauna: A diverse population of wildlife is present in the sanctuary. Elephant, Gaur, Barking Deer, Tiger, Indian Porcupine, Three Striped Squirrel, Malabar Giant Squirrel, Flying Squirrel, Indian Wild Boar are the most commonly seen mammals. The reptiles present here include the Cobra, Viper, Python, Rat Snake, Flying Snake etc. As per the report under Peoples Campaign for the Ninth Plan entitled Forest and Biodiversity, only nine species of insects have been reported specifically from this district. With regard to diversity of butterflies, no detailed survey has been made. In addition to this, some information on certain specific forest pests is also available. This includes the bark caterpillar, *Indarbela quadrinotata* (*Paraserianthes falcataria*), *albizia* defoliator (*Eurema blanda*) and the *albizia* bagworm (*Pteroma plagiophleps*).

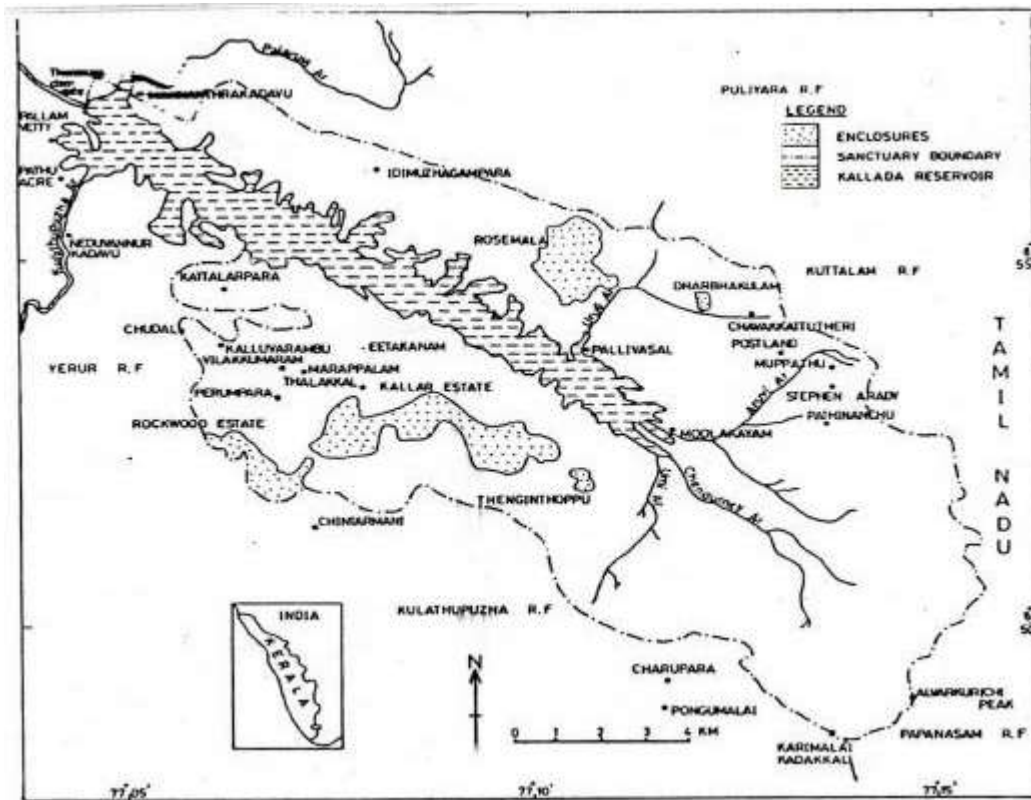


Fig. 1: Map of Shendurny Wildlife Sanctuary.

MATERIALS AND METHODS

Survey of butterflies was made at different altitudes from Rosemala and Thenmala areas during day times (8 a.m to 1 p.m.) for a period of two months and data on the butterflies present in these areas was recorded on data sheets. From the data, indices of diversity, species richness, evenness and dominance were computed. An inventory of butterflies was also prepared based on data generated in this study.

Statistical Analyses

Diversity Index: The quantification of diversity must address two statistical properties common to any mixture of different objects. The first property is the number of different classes or types of object i.e., species, genera, families, different habitats and so on. The second property is the distribution of objects among classes, such as the relative abundance of individuals of different taxa or the relative area of the habitat that falls into different habitat types. In this study, only species diversity was studied. For this, the Shannon-Weiner diversity index (H) was used [4]

$$H = -P_i \log_e P_i$$

Where 'H' is the Shannon's index of species diversity and P_i is the proportion of individuals in the i^{th} species. In order to find out whether any significant differences existed in the insect diversity between the vegetation types, a 't' test was done [4] using the following formula:

$$t = \frac{H_1 - H_2}{[\text{var}(H_1) + \text{var}(H_2)]^{1/2}}$$

Whereas ' H_1 ' and ' H_2 ' are diversity indices of first and second locality and $\text{var}(H_1)$ and $\text{var}(H_2)$ are their variances. Variance of diversity index [4] is defined as follows:

$$\text{Var}(H) = \frac{\sum P_i (\log_e P_i)^2 - [\sum P_i \log_e P_i]^2}{N} + \frac{S-1}{2N^2}$$

Whereas n_i = number of insects in the ' i^{th} ' Order; 'S' is the number of species recorded and N is the total number of insects in all the orders collected during the study period.

Dominance Index: Patterns of relative abundance of species that determine the dominance of each insect Order in a locality was determined by calculating the dominance index using the following formula:

$$\text{Relative dominance} = n_i \times \frac{100}{N}$$

Evenness or Equitability Index: This index, which measures the evenness of species abundance, is complimentary to the diversity index concept and it indicates how the individuals of various species are distributed in the community.

For estimating evenness, Shannon's evenness index was calculated [5]. Mathematically, the evenness of frequency distribution of species abundance in a community with 'S' component species is the degree to which it approximates the uniform distribution for 'S' species i.e., equal abundance of all species in the sample or community.

In a collection or in a community with 'S' component species, diversity will be greater if all 'S' species are well represented. In this condition, there is high evenness and low dominance. On the contrary, if a few of the species, say 't' are very common and the rest (S-t) are very rare, then it is a case of low evenness and high dominance.

The Shannon's evenness index of the community (E) was calculated following Pielou [5].

$$E = H/\log_e(S)$$

Whereas, 'H' is the Shannon-Weiner index of diversity.

Species Richness Index: The index of species richness (d) was calculated using the formula given by Menhinick [6]:

$$D = S/\sqrt{N}$$

Whereas 'N' is the total number of individuals summed over all species.

RESULTS AND DISCUSSION

Butterflies recorded in this study belonged to five families with Nymphalidae and Papilionidae containing maximum number of species followed by Pieridae and Satyridae. Altogether, 73 species were collected (Appendix 1). Rosemala area contained 69 species and

Thenmala had 63 species. The faunal elements contained moist deciduous as well as evergreen forms. *Neptis hylas*, *Junonia lemonias*, *Argynnis hyperbius*, *Euploea core*, *Danus genuta* and *D. chrysippus* (Nymphalidae), as well as *Catopsilia pomona*, *Eurema hecabe* and *Leptosia nina* (Pieridae) were the moist deciduous species while *Cupha erymanthis*, *Kaniska canace* and *Elymnias caudata* (Nymphalidae) were the evergreen forms.

Butterflies recorded in this study included five protected species viz. *Papilio buddha*, *Euthalia lubentina*, *Hypolimnas misippus*, *Mycalesis anaxias* and *Castalius rosimon* in addition to three Western Ghats endemics (*Papilio buddha*, *Papilio dravidarum* and *Troides minos*). Some of the butterflies like *Papilio paris tamilana*, *Cyrestis thyodamas*, *Kaniska canace*, *Cupha erymanthis maja*, *Junonia iphita pulvialis*, *Cepora nadina* and *Pantoporia ranga* recorded from this area are currently rare in distribution.

Dominance Index: The dominance index for various groups of butterflies in the study area is presented in Table 1.

At thenmala and rosemala, nymphalidae had the highest dominance index - 48.92 and 35.15 respectively. this was followed by papilionidae having a value of 30.54 in rosemala and 18.88 in thenmala. the values for all other groups were relatively low. hesperiidae and lycaenidae showed least values (7.72 and 9.01, respectively).

With regard to altitudinal variations in distribution, Nymphalidae showed highest dominance index (48.92.) at 800 m elevation. The values for all other groups were relatively low. At 1000 m elevation, Papilionidae had higher value (30.54), followed by Nymphalidae (35.15) and Pieridae (Fig.2).

Table 1: Dominance index worked out for various families of butterflies

Family	Dominance index					
	Thenmala		Rosemala		Pooled	
	I	D	I	D	I	D
Nymphalidae	114	48.92	122	35.15	236	40.68
Papilionidae	44	18.88	106	30.54	150	25.86
Pieridae	36	15.45	93	26.80	129	22.24
Hesperiidae	18	7.72	16	4.61	34	5.86
Lycaenidae	21	9.01	10	2.88	31	5.34

I- No. of Individuals D- Dominance index

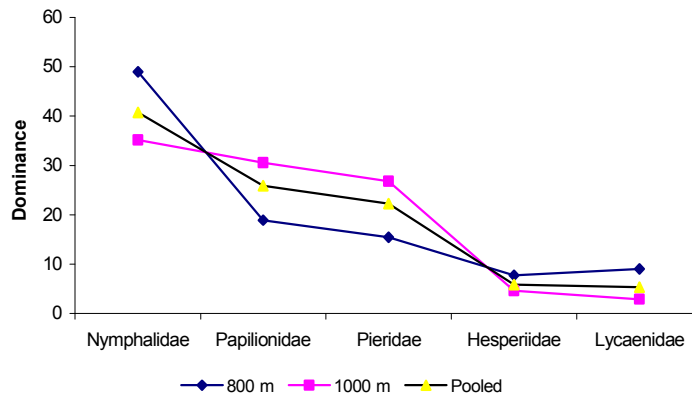


Fig. 2: Dominance index for various groups of butterflies in shendurny wildlife sanctuary

Table 2: Data on Butterflies at various region of Shendurny wild life sanctuary

Locations	No. of species	No. of individuals	R_{Mg}	λ	H^1	E3
Thenmala	63	233	11.37	0.024	3.83	.729
Rosemala	69	347	11.62	0.026	3.84	.665
Pooled data	73	580	11.31	0.020	4.02	.761

Table 3: Species richness of some biodiversity hotspots of Kerala

Neyyar [7]	53
Peppara [7]	51
Parambikulam [8]	124
Silent valley [10]	95
Shendurny (Present study)	73

Species Richness Index: The species richness was more or less the same in Rosemala (11.62) and Thenmala (11.37).

Species Diversity: Shannon's index of species diversity calculated for different region is given. The species diversity ranged from 3.83- 3.84. The value obtained using pooled data was 4.02 (Table 2).

Evenness or Equitability Index: The evenness index ranged between 0.665 to 0.729 in Thenmala and Rosemala region respectively. However, for pooled data the evenness was 0.761 indicating uniform distribution of insects in the entire region. This shows that the species are uniformly distributed in the Sanctuary.

Concluding Remarks: In general, both the areas were more or less similar in diversity and faunal elements. However, the butterfly distribution was found to be more or even in Thenmala compared to Rosemala. The fauna at both locations contained distinct elements so as to suit the typical altitudinal and vegetational characteristics of the area. The butterflies species such as *Junonia iphita*

pluvialis J. lemonias vaisya, Kaniska canace, Melanitis leda, Mycalesis patnia and Lethe rohria recorded from Rosemala could not be traced from Thenmala. Since the survey was of short duration, it could not be ascertained whether these species are actually absent in Thenmala area. The butterfly diversity of the sanctuary was comparable to that of other biodiversity hotspots of Kerala (Table 3).

The butterflies recorded from Shendurny Wild life sanctuary (73 species), formed nearly one third of butterflies recorded from whole of Kerala (314 species) and of the Western Ghats (330 species). On the whole, the butterfly fauna of shendurny wildlife sanctuary is rich and varied containing several rare, endemic and protected species.

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Appendix 1: List of Butterflies recorded from Shendurny Wildlife Sanctuary

Order	Locations		Remarks
	Thenmala	Rosemala	
Family			
Lepidoptera			
Rhopalocera			
Papilionidae			
<i>Chilasa clytia</i> Lin.	+	+	Rare
<i>Graphium sarpedon</i> Felder	+	+	Common
<i>G. agamemnon agamemnon</i> Lin.	+	+	Common
<i>G. doson doson</i> Felder	+	+	Common
<i>Papilio helenus</i> Lin.	+	+	Common
<i>P. polymnestor parinda</i> Moore	+	+	Common
<i>P. buddha</i> Westwood	+	+	Rare, endemic to the Western Ghats. Schedule II
<i>P. dravidarum</i> Wood-Mason	+	+	Rare, endemic to the Western Ghats
<i>P. polytes thesus</i> Cramer	+	+	Common
<i>P. demoleus demoleus</i> Lin.	+	+	Common. Mostly noted in Thenmala
<i>P. paris tamilana</i> Moore	+	+	Rare
<i>Pachliopta aristolochiae</i> Lin.	+	+	Common
<i>P. hector</i> Lin.	+	+	Common
<i>Troides minos</i> Cram.	+	+	Endemic to Western Ghats
Nymphalidae			
<i>Argynnis hyperbius</i> (Johannsen)	+	+	
<i>Cupha erymanthis maja</i> Fruhstorfer	-	+	Rare
<i>Cyrestis thyodamas</i> Kollar	+	+	Not rare
<i>Ariadne merione</i> Cramer	+	-	Common
<i>Euthalia lubentina</i> (Cramer)	+	+	Rare, Schedule IV
<i>Hypolimnas bolina</i> Lin.	+	+	Common
<i>H. misippus</i> Lin.	+	+	Common, Schedules I and II
<i>Neptis hylas varmona</i> Moore	+	+	Very common
<i>N. perius perinus</i> Fruhstorfer	+	+	Rare
<i>Pantoporia ranga</i> (Moore)	+	+	Rare
<i>Phalanta phalantha</i> Drury	+	+	Common
<i>Junonia atlites</i> Lin.	+	+	Common
<i>J. heirta</i> Fb.	+	+	Very common
<i>J. iphita pluvialis</i> Fruhstorfer	-	+	Rare
<i>J. lemonias vaisya</i> Fruhstorfer	-	+	Common
<i>Kaniska canace</i> Moore	-	+	Not rare
<i>Danaus genyita genyita</i> Cramer	-	+	Common
<i>D. chrysippus</i> (Lin.)	+	+	Common
<i>Euploea core core</i> Cramer	+	+	Very common
<i>Parantica aglea</i> Stoll	+	+	Fairly common
<i>Tirumala limniace leopardus</i> Butler	+	+	Common
<i>T. septentrionis dravidarum</i> Fruhstorfer	+	+	Rare
<i>Elymnias caudata</i> Butler	+	+	Common
<i>Melanitis leda</i> Lin.	-	+	Very common
<i>Mycalesis anaxias</i> Hewitson	+	+	Not rare, Schedule II
<i>M. patnia</i> Moore	-	+	Common
<i>Lethe rohria</i> Fruhstorfer	-	+	Common
<i>Ypthima ceylonica</i> Hewitson	+	+	Fairly common
<i>Ypthima</i> sp.	+	+	Fairly common
<i>Acraea violae</i> (Fb.)	+	+	

Appendix 1: Continued

Pieridae			
<i>Delias eucharis</i> Drury	+	+	Common
<i>Appias indra</i> Moore	+	+	Rare
<i>A. lycida</i> (Cramer)	+	+	Not rare
<i>Catopsilia florella</i> (Fb.)	+	+	Fairly common
<i>C. pomona</i> Fb.	+	+	Very common
<i>C. pyranthe</i> (Lin.)	+	+	Very common
<i>Cepora nadina</i> Moore	+	+	Rare
<i>Cepora nerissa</i> Fb.	+	-	Fairly common
<i>Eurema blanda</i> Boisd.	+	-	Common
<i>Eurema brigitta</i> Stoll	+	+	Common
<i>E. hecabe</i> Lin.	+	+	Common
<i>Ixias marianne</i> (Cramer)	+	+	Common
<i>I. pyrene</i> Lin.	+	-	Common
<i>Leptosia nina</i> Fb.	+	+	Common
Hesperiidae			
<i>Badamia exclamationis</i> Fb.	+	+	Fairly common
<i>Celaenorrhinus leucocera</i> (Kollar)	+	+	Common
<i>Potanthus pava pava</i> Fruhstorfer	+	+	
<i>Pelopidas mathias</i> Fb.	+	+	Fairly common
<i>Tagiades litigiosa</i> Moschler	+	+	Fairly common
<i>Taractrocera ceramas</i> (Hewitson)	+	+	Rare
<i>Telicota acigias</i> Lin.	+	+	Fairly common
Lycaenidae			
<i>Arhopala centaurus</i> Moore	+	+	Common
<i>Castalius rosimon</i> (Fb.)	+	+	Rare, Schedule II
<i>Cheritra freja</i> (Fb.)	+	+	Rare,
<i>Euchrysops cnejus</i> (Fb.)	+	+	Common
<i>Jamides alecto</i> (Felder)	-	+	Rare
<i>Loxura atymnus</i> Cramer	-	+	Fairly common
<i>Talicauda nyseus</i> (Guerin.)	+	+	Fairly common
<i>Abisara echerius</i> Stoll	+	+	Common

+ Recorded; - Not recorded