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Diversity of butterflies and their conservation in Dharmapuri Forest Division,Tamil Nadu, India

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Abstract

Survey on butterflies was carried out in Dharmapuri Forest Division, and altogether 65 species representing 5 families were recorded. Plant-pollinator interaction was observed and the available food and host plants for the butterflies were enumerated. Report on the threats to the butterfly diversity in the study area and suitable conservation and management recommendations are discussed for better forest management.

Keywords: Butterfly, Conservation, Dharmapuri Pollinator,

INTRODUCTION

Butterflies are amongst the most beautiful and colourful creatures and are appreciated for their aesthetic value (Boonvannoa *et al*., 2000). They are ecologically important as pollinators and beneficial in controlling few harmful insect pests. In India due to its rich and varied topographical, climatic and vegetation conditions supports a wide variety of butterfly species. Recent estimates indicate that the Indian sub-continent has about 1,501 species of butterflies (Gaonkar, 1996), of which peninsular part of southern India alone has 350 species (Kunte, 2000, Padhye *et al*., 2012). Lepidoptera, encompassing most of the pollinators, are exposed to a wide range of environmental influences, and are highly sensitive to changes in temperature, humidity and light (Kremen, 1992). The butterfly fauna in particular is affected and endangered by many factors including land use, forest and farm cultivation and agriculture practices, predominated by pesticide based crop protection. Effects of such alterations on the diversity of butterflies include decline in population and reduction in species richness which rather indicates the modified ecosystem (Blair, 1999; Kunte, 2000). Butterflies are regarded as indicators that explain the quality of ecosystem and the ecological processes occurring in a particular region (Sawchik *et al*., 2005). Changes in the butterfly populations would reflect the modifications in the system and hence would enable assessment of the environmental impact in that area to prompt management efforts.

Dharmapuri is an inland district of Tamil Nadu, which lies along the tri-junction of Karnataka, Andhra Pradesh and Tamil Nadu. It is mainly an undulating rugged terrain in the middle, surrounded by hill ranges, on the north and northwest the Mysore plateau, on the east Javadi hill range, and on the south Chitteri and Shevaroy hill ranges. The main rivers flowing through the district are Pambar, Ponnaiyar and Chinnar rivers. The Cauvery river flows along the South-western boundary of the district. The soil in the forest region is stony and gravelly excepting for the presence of alluvium to a limited extent on the banks of the major streams and rivers in their lower reaches. Hence, the prevailing locality factors in the forest division are not conducive to warrant the growth of luxuriant vegetation. A few of the regular reserved forests occurred in the division, especially in Dharmapuri range via Parigam, Thoppur and Kalappambadi. The area is drought prone and is a recurring feature. The prime factors that influence the natural vegetation are the climate, soil and biotic activity. Thus the Forest Division does not support prominent wildlife. However, the adoptability and cosmopolitan distribution of insects have made them easy to occupy this region well. Butterfly is one among insects to inhabit and thrive healthy in this forest division.

The diversity and ecology of butterflies received attention in the recent years in India (Agarwala *et al*., 2010; Menasagi and Kotikal, 2011; Nimbalkar *et al*., 2011; Das *et al*., 2012; Majumder *et al*., 2012; Roy *et al*., 2012; Manendra *et al*., 2013; Nair *et al*. 2014; Palei and Rath, 2014). Documentation of butterflies in Peninsular Indian region has been made in all the four southern states, and reports on species richness of butterflies in Tamil Nadu has been made frequently (Larsen, 1987a, 1987b, 1987c, 1988; Asaithambi, 1994; Arun; 2003; Baskaran and Eswaran, 2003; Ambrose and Raj, 2005; Easwaran and Pramod; 2005; Gunasekaran and Balasubramanian, 2010; Ramesh *et al*., 2010; Rajagopal *et al*., 2011; Parandhaman *et al*., 2012; Sharmila and Thatheyus, 2013; Prabaharan *et al*., 2014). With no other previous study available in the Dharmapuri forest region, this work

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forms the first ever survey on Butterfly pollinators. The present work aims at documenting the butterfly species with the objectives to survey the butterfly species, record the Butterfly-plant interactions, to identify the threats available and to suggest suitable management recommendations for conservation.

MATERIALS AND METHODS

Study area

Dharmapuri forest division is situated in the north western portion of the state lying between latitudes N 11 ^{0} 47′ and 12 ^{0} 53′ and longitudes E 77 ^{0}28′ and 78 ^{0} 45′ (Fig. 1). It has a total area of 9619 km^2 which is divided into three taluks. The forests of this region form part of Eastern Ghats. The altitude ranges from 380 to 1395 m above mean sea level. Guttirayan is the highest peak in the mountain range (1395.10 m above msl). River Cauvery bounds it on the west and is joined by the Sanatkumarnadi, which flows through the North-western portion of the district. The climate of this region is mainly tropic and the region receives maximum rainfall from southwest monsoon. The mean annual atmospheric temperature is 26.37 ^{o}C. Dharmapuri Forest Division consists of four forest ranges i.e. Dharmapuri, Pennagaram, Palacode and Hogenakkal.

Sampling and identification

Diversity of butterflies was studied during the period of June - August 2009 for the Forest Working Plan in Dharmapuri Forest Division. The Survey was carried out by counting 5 m. on either side of one km length transect in one hour time duration (Moore,1975). A total of 33 transects were selected randomly to cover all the forest types to perform the butterfly community study. A hand net was used to capture the butterflies during the transect walk. Captured butterflies were released after identification. The manual of Sathiyamurthy (1994), Gunathilagaraj *et al.* (1998) and Kunte (2000) were referred for the identification, and Larson (1987-88) was referred for correct scientific nomenclatures of butterflies. During transect walk, butterfly visit to the flowers and plants were observed carefully. Plant specimens were identified with the help of Flora of the Presidency of Madras (Gamble, 1986) and Flora of Tamil Nadu (Nair and Henry, 1983; Henry *et al.,* 1987, 1989).

RESULTS

Totally 65 species representing five families were recorded in the Dharmapuri Forest Division (Table 1). Of the five families recorded, Nymphalidae wass the dominant family with 24 species followed by Pieridae with 17 species (Fig. 2). Among the 65 species of butterflies recorded, certain butterfly species are belonged to threatened and endemic category. Common Mime, Crimson Rose and Common Pierrot are protected under schedule - I of Wildlife Protection Act 1972. Common Gull is protected under schedule – II and Common Crow is conserved under schedule - IV of Wildlife Protection Act 1972. Double-Branded Crow, Blue Mormon and Crimson Rose are endemic to Peninsular India and Common Silver Line and Common banded Peacock are endemic to Peninsular India and Sri Lanka. The richness of butterfly species was observed to be the same in all the four forest ranges. Evenness of butterflies more or less followed the similar pattern in all four forest ranges.

Butterflies – Plant interaction

During the survey, direct observations were made to record the pollinator –plant interaction during pollination and some important associations were enumerated. Rutaceae plant species were the major food source for Common Mormon and Lime Butterfly among butterflies. C*adaba fruticosa* and *Capparis sepiaria* were in full bloom in the study area and Common Gull, White Orange Tip, Crimson Tip, Dark Blue Tiger, Yellow Orange Tip, Pioneer and Common Wanderer butterflies repeatedly visited the flowers of these plants. Mottled Emigrant, Pioneer, White Orange Tip, Crimson Tip and Lime Butterflies preferred the flowers of *Cassia auriculata.* The flowers of *Ziziphus* spp. were favorite for Common Pierrot, Lime Butterfly, White Orange Tip, Blue tiger as observed by the regularly and frequent visits. Species such as Plain Tiger, Yellow Orange Tip, White Orange Tip, Lemon Pansy, Pioneer, Lime Butterfly, Common Emigrant and Pale Grass Blues relied on the flowers of *Tephrosia purpurea* which was evident in almost all the ranges of the forest division. Food preference also depended on variety of plants available in the particular area, flowers of *Jatropha gossypifolia* for instance was visited by Small Salmon Arab, Lime Butterfly, Crimson Tip, White Orange Tip, Yellow Orange Tip and Pioneer. Among food plants *Pavetta indica* was the most preferred plant by the butterflies which attracted as high as 14 species of the total 65 species recorded. Even the exotic species *Lantana camara* supported a range of pollinators for their sustenance that include Lemon Pansy, Yellow Pansy, Common Rose, Crimson Tip, Crimson Rose, White Orange Tip, Yellow Orange Tip, Pioneer and Lime Butterfly. *Tridax procumbens* and *Jasminum auriculatum* a creeper, were among plants that nourished very few butterflies.

Certain species of butterflies were observed to be strictly associated with some specific plants such as *Tribulus terrestris* - Pioneer and Gram Blue; *Cleome viscosa* - Pioneer and lime butterfly; *Justicia tranquebariensis*- Small Salmon Arab; *Blepharis maderaspatensis*-Crimson Tip; *Asclepias curassavica*- Plain Tiger and Common crow; *Acalypha fruiticosa*- Lemon Pansy and Lime Butterfly; *Parthenium hysterophorus* - Common Emigrant. The milk weed butterflies mostly depended on *Calotropis* sp. and *Ficus* sp. Pollination of these plants are ensured by these

Table 1 List of Butterflies recorded in the Dharmapuri Forest Division

S. No.	Common name	Scientific name	Status
I	Papilionidae		
1.	Common rose	*Atrophaneura aristolochiae*	
2.	Common mime	*Chilasa clytia*	Shed. I
3.	Common mormon	*Papilio polytes*	
4.	Crimson rose	*Atrophaneura hector*	Shed. I & Endemic
5.	Spot swordtail	*Graphium nomius*	
6.	Lime butterfly	*Papilio demoleus*	
7.	Common blue bottle	*Graphium sarpedon*	
8.	Common banded peacock	*Papilio crino*	Endemic
9.	Blue mormon	*Papilio polymnestor*	Endemic
II	Pieridae		
10.	Common gull	*Cepora nerissa*	Shed. II
11.	Common jezebel	*Delias eucharis*	
12.	Yellow orange tip	*Ixias pyrene*	
13.	White orange tip	*Ixias marianne*	
14.	Common emigrant	*Catopsilia pomona*	
15.	Common grass yellow	*Eurema hecabe*	
16.	One spot grass yellow	*Eurema andersoni*	
17.	Three spot grass yellow	*Eurema blanda*	
18.	Crimson tip	*Colotis danae*	
19.	Small grass yellow	*Eurema brigitta*	
20.	Mottled emigrant	*Catopsilia pyranthe*	
21.	Pioneer	*Belenois aurota*	
22.	Common wanderer	*Pareronia valeria*	
23.	Small salmon arab	*Colotis amata*	
24.	Large salmon arab	*Colotis fausta*	
25.	Indian cabbage white	*Pieris canidia*	
26.	Psyche	*Leptosia nina*	
III	Nymphalidae		
27.	Joker	*Byblia ilithyia*	
28.	Chocolate pansy	*Junonia iphita*	
29.	Common leopard	*Phalanta phalantha*	
30.	Common castor	*Ariadne merione*	
31.	Angled castor	*Ariadne ariadne*	
32.	Blue pansy	*Junonia orithya*	
33.	Yellow pansy	*Junonia hierta*	
34.	Lemon pansy	*Junonia lemonias*	
35.	Grey pansy	*Junonia atlites*	
36.	Danaid eggfly	*Hypolimnas misippus*	
37.	Anomalous nawab	*Polyura delphis*	
38.	Common nawab	*Polyura athamas*	
39.	Common sailer	*Neptis hylas*	
40.	Common evening brown	*Melanitis leda*	
41.	Common tree brown	*Lethe rohria*	
42.	Common bush brown	*Mycalesis perseus*	
43.	Dark blue tiger	*Titumala septentrionis*	
44.	Plain tiger	*Danaus chrysippus*	
45.	Striped tiger	*Danaus genutia*	
46.	Blue tiger	*Tirumala limniace*	
47.	Common crow	*Euploea core*	Shed. IV
48.	Glassy blue tiger	*Parantica aglea*	
49.	Tawny coster	*Acroea violae*	
50.	Double-banded crow	*Euploea sylvester*	Endemic
IV	Lycaenidae		
51.	Common pierrot	*Castalius rosimon*	Shed. I
52.	Pale grass blue	*Pseudozizeeria maha ossa*	
53.	Common silver line	*Spindasis vulcanus*	Endemic
54.	Red pierrot	*Talicada nyseus*	
55.	Zebra blue	*Syntarucus plinius*	
56.	Gram blue	*Euchrysops cnejus*	
57.	Yamfly	*Loxura atymnus*	
58.	Plum judy	*Abisara echerius*	
V	Hesperiidae		
59.	Common banded awl	*Hasora chromus*	
60.	Brown awl	*Badamia exclamationis*	
61.	Indian palm bob	*Suastus gremius*	
62.	Indian skipper	*Spialia galba*	
63.	Suffused snow flat	*Tagiades gana*	
64.	Common grass dart	*Taractrocera maevius*	
65.	Rice swift	*Borbo cinnara*	

Fig. 1 Study Area with location of transacts laid for the survey.

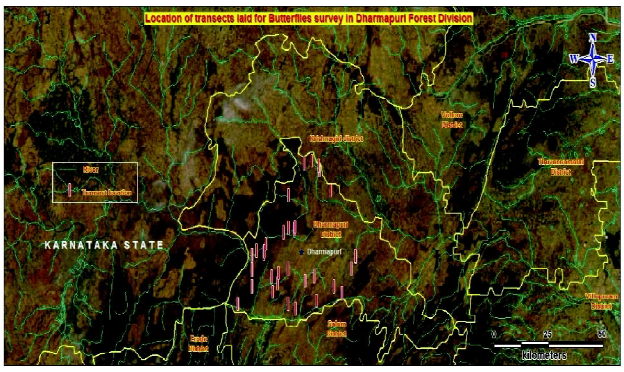
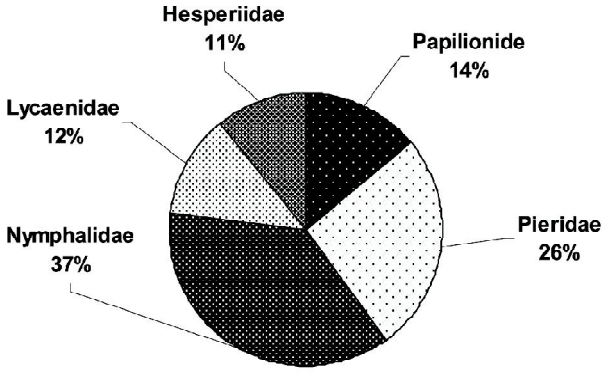


Fig. 2 Proportion of Butterfly families recorded during the survey.



butterflies and the butterflies get food materials from the plants. Presence of the pollinators indicates the quality of the forest.

Threats

Threats to the butterfly pollinators in the study area were also observed during the survey. Among all threats grazing is regarded as a serious threat to the forest vegetation and to the resident wildlife. Illegal grazing by cattle and goats is the major problem in the forest area as the people are traditionally dependent on the forest area for such activities. Continuous grazing in particular forest area leads to the reduction of ground cover vegetation and gradual degradation of habitat and poor natural regeneration. Certain species of butterflies are directly dependant on the ground cover vegetation. Dharmapuri Forest division is a dry and drought prone area and hence the forest area is constantly under threat from fires during the summer. Repeated fires lead to habitat degradation and expansion of grass lands.

Collection of Minor Forest produces (MFP)

Local people often with the help of tribes indulge in illegal collection of minor forest products such as fruits of Gooseberry, Tamarind, soapnut, Broom stick, Honey, Wood apple, various tubers and medicinal plants. This illicit collection leads to the reduction of food availability to butterflies, and depletion of natural regeneration also damages the forest vegetation.

Illicit collection of fire woods

During the survey, the researchers noticed the collection of fire woods throughout forest areas by various ways. It is one of the major threats to the vegetation of the study area. The areas are also prone for felling of timbers by local peoples. *Albizia amara* and *Chloroxylon swietenia* were the most important fire wood species collected by local villagers..

Mining activities

Dharmapuri is one of the mineral rich districts in Tamil Nadu and several mining projects are occurring. A few major granite mines were found inside the forest area. Clouds of dust and sand particles spread around the mining area inside the forest after blasting the rocks. This practice severely affects the occurrence wildlife, particularly butterflies around the mines.

DISCUSSION

Butterflies are plant dependant organisms and hence floral diversity has a strong role in the determination of their community structure. Preference of habitat for butterflies varies but mostly depends on the needs like plants that host the larval forms and plants that supply nectar (Nair *et al.,* 2014). Undisturbed parts of the forest area with rich source of plants supported maximum richness whereas regions close to agricultural lands and urban areas showed fewer species also observed by Padhye *et al.* (2012). During this study, area under cultivation was not included and hence the species richness was optimum. Also all the ranges surveyed yielded almost equal number of species, which denotes uniformity in the forest area and the plant community.

Butterfly is highly potential pollinator among pollinators group i.e. ants, bees, beetles, wasps, etc. These insect pollinators ensure pollination and seed setting in several plants species, especially Papilionidae members have long antennae, which guarantee the pollination of even long and tubular flowers and due to the adaptation Papilionidae are regarded as the best pollinator among butterflies. Butterflies also flash the pollens at that time of winging near the anthers and flowers. Most of the butterflies found in the Dharmapuri Forest Division directly depend on the host and nectar plants. Presence of such pollinators could ensure a sustained use of agricultural and forest products for human benefit as well as help to maintain biological diversity (Boonvannoa *et al.,* 2000). Degradation of the habitat, increased developmental activities inside forest and areas near forest fringes would impact the butterfly diversity leading to the extirpation of rare and specialized species. Forest region with rich plant diversity composition could sustain a variety of butterfly

species, as the majority of insects being herbivores, are dependent on plants for nutrition and survival. Activities, be it natural or human mediated, that decimate forest ecosystem would directly impact the survival of butterflies.

Based on the field survey and ground reality few recommendations are proposed towards management implications for better conservation of Butterflies. 1) Livestock grazing has to be stopped to conserve the ground cover vegetation, since it forms the important feeding ground for butterflies. 2) Forest cover should be protected from forest fire by various precautionary methods. 3) Collection of forest products should be regulated. 4) Illicit firewood collection should be controlled by imposing punishment on the defaulters. 5) All mining activities can be stopped inside forest area.

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