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Butterfly diversity in thorn forest, Kiluvamalai, Madurai district, Tamilnadu, India

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Abstract
A thorn forest in Kiluvamalai primarily consists of thorny trees, shrubs and patches of open scrubs. On the onset of monsoon the climbers, shrubs and grasses flourish throughout the hill and fade out during summer. Butterflies are good indicators of the environment, capable of supplying information on changes in the ambient features of any ecosystem. An attempt has been made to investigate Kiluvamalai's butterfly variety in the current study. Butterflies are the keystone species of the forest ecosystem. The current study was conducted from June 2014 to May 2015 and again from December 2019 to May 2023 to comprehend the diversity of butterflies in Kiluvamalai, Madurai, Tamil Nadu. The hill hosts various varieties of flora and fauna during the monsoon. The study revealed the status of butterflies in Kiluvamalai. During the investigation, about 80 species of butterflies from five families were seen.

Keywords: Butterflies, diversity, Thorny forest, Kiluvamalai

Introduction

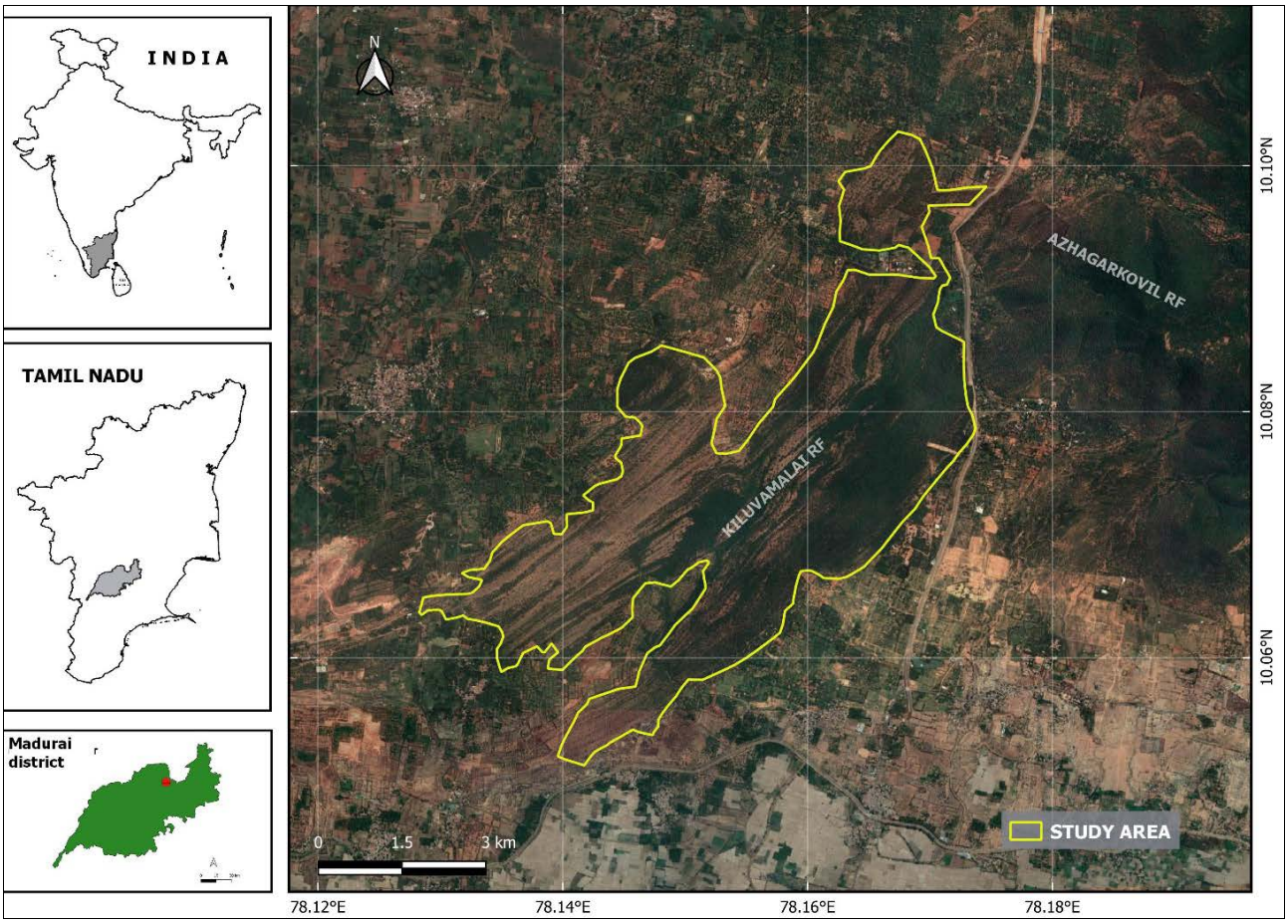
India's forests have a lengthy evolutionary and geological history, a wide range of climatic and edaphic conditions, and a much-diversified composition. Sir HG Champion classified India's forest kinds for the first time in 1936 and put together his enormous effort 'Preliminary Survey of Forest Type of India and Burma' (Champion, 1936) [6]. India's woods were divided into roughly 221 sub-type groupings and 16 major types by Champion and Seth in 1968. These forests are located in regions with low rainfall (200 to 800 mm), and the northeast monsoon also contributes significantly to the rainfall in the southern stretch of this ecoregion from October to December. Every year, there are up to six months of dry spells with significantly different rainfall amounts. (ERA India, 2022). The dry season limits the moisture availability for plant growth. The trees experience prolonged dry periods. The tree is between six and nine meters tall. Andhra Pradesh, Tamil Nadu, and Maharashtra are home to southern tropical thorn forests. These open woodlands are made up of short trees that typically belong to prickly tree species. (ICFRE, 2013). Kiluvamalai is one of the thorny forest area consists of vegetation like *Acacia latronum, Acacia sundra, Balsamodendron berryi, Bauhinia racemosa, Dichrostachys cinerea, Erythroxylon monogynum, Wrightia tinctoria* and shrubs like *Calotropis procera, Capparis sepiaria, Carissa carandas, Cassia auriculata* (Roopha *et al.*, 2022) [28]. Only a small number of studies carried out in India have concentrated on the significance of prickly shrub forests for vegetation (Jeganathan *et al.*, 2008) [19].

Butterflies are the most colourful insects with much ecological significance around the world. Though they are good pollinators they are considered as one of the major agricultural pests in a few crops (Daniel, 2018) [8]. They are grouped among Lepidopterans in the class Insecta under the phylum Arthropoda and the class Insecta (Kristensen *et al.*, 2007) [21]. Among 180,000 species of the Lepidoptera described around the world, 1504 species were documented in the Indian subcontinent (Capinera, 2008; Kunte, 2009) [4, 22]. They are excellent bio-indicators of environmental transformation, temperature and humidity shown by their habitats (Thomas, 2005) [35]. Because of their short lifespans, specialized host plants, and limited capacity to disperse, butterflies are extremely sensitive to even little variations in the surrounding environment and disturbances to their habitats. (Kocher and Williams, 2000; Bonebrake *et al.*, 2010) [20, 3], thereby necessitating strong and practical management and conservation initiatives. (Chettri *et al.*, 2018; Sharma *et al.*, 2020) [7, 32]. Since there has never been a butterfly record from the Kiluvamalai Reserve forest in the Madurai District of Tamil Nadu, India, the current study set out to assess the species diversity of butterflies and identify species of conservation significance. Numerous investigations have been conducted in diverse forest regions; nevertheless, the majority of these studies have not focused on these kinds of dense woods. Under these conditions, the current study has been undertaken to examine the variety of butterflies found in the Kiluvamalai RF in Madurai.

Materials and Methods

Study Area

Kiluvamalai Reserve Forest is located in Tamil Nadu's Madurai district's Reserve Forest Block. The topography and biological characteristics of Kiluvamalai are strikingly comparable to those of Sirumalai RF and the lower Alagarhills RF slopes (Fig. 1). Kiluvamalai is situated at an elevation of roughly 350 meters, at 10º 04' 23" N 78º 09' 22" E. One of Tamil Nadu's biggest and tallest hill ranges outside of the Western Ghats is the Alagar Hills, which are located around 15 kilometers from Sirumalai. (Santharam *et al.*, 2014) [30].



Data Collection

Consecutively, the regular monitoring of the butterflies was carried out by using the transect method and recording their number for the entire study period from June 2014 to May 2015 and a diminutive couple of year break again the assessment started from December 2019 to May 2023. A visual survey was done during each sampling period. Butterflies were identified through photographic evidence. All individuals were identified by the books written by Gunathilagaraj *et al.*, (1998) [14] & Kunte (2000) [23]. Using a DSLR camera Canon 200D ii, the specimens were photographed and specimen collecting was strictly prohibited.

Results and Discussion

According to Heppner's research, there are roughly 19,238 species of butterflies recognized worldwide (Heppner, 1998) [16]. According to Gaonkar (1996) [11] and Smetacek (1992) [34], the Indian subcontinent is home to about 1,504 different species of butterflies. While Gunathilagaraj *et al.*, (1998) [14] reported 150 species in the Eastern Ghats, Tiple & Khura (2009) [36] reported 334 species in the Western Ghats. One of the many irregular low hill ranges that make up the southernmost Eastern Ghats is Kiluvamalai.

Table 1 displays the total number of butterfly species identified across five families. The research conducted between 2014 and 2015 and between December 2019 and May 2023, identified a total of 80 butterfly species that fall into 5 groups. The Nymphalidae family accounted for the majority of butterfly diversity (37%) and was followed in order of prevalence by Pieridae (23%), Papilionidae (13%), Lycaenidae (18%), and Hesperiidae (10%) (Fig 2). The Nymphalidae family had roughly eighteen species identified (Fig 1). Nymphalidae are reportedly well-represented in the Tirunelveli region of Tamil Nadu, with 12 species (or 60%) according to Jeyaprabha and Mohideen (2017). At an elevation of roughly 350 meters, the terrain of the current research area is continuous with lower slopes of the Alagar Hills R.F. The total number of butterflies counted from each of the five families over various study periods is shown in Fig 2. For the duration of the investigation, the Nymphalidae family species was the most numerous, followed by Pieridae (Fig. 2). The diversity of their host plants has a major impact on the species diversity, richness, and community structure of butterflies (Padhye *et al.*, 2006) [26]. According to Ganeshwari *et al.*, (2021) [10], the greatest quantity of butterflies' species was found in plant species including Citrus sp., *Butea monosperma*, *Cadaba frusticosa*, *Acacia sp.*, and *Capparis sp.* A similar species of plant was also found in Kiluvamalai. It is covered in vegetation such as *Bauhinia racemosa*, *Balsamodendron berryi*, *Acacia latronum* and *Acacia sundra.*

They are scarce or nonexistent in the other months of the year, yet abundant in a few chosen months. The results of the study show that the post-monsoon season, which ran from late August to October, saw the greatest number of butterflies reported. This result is in line with earlier research (Tiple, 2012) [37]. The least diverse months were April and May, with only a few species recorded, and the richest month was November. A greater degree of species variation was seen in November. This could be due to the effects of temperature, humidity, and rainfall. *Atrophaneura*

hector (Crimson Rose) of the Papilionidae family, *Hypolimnas misippus* (Danaid Eggfly) of the Nymphalidae family, and *Euthalia aconthea* (Common Baron) are shielded under the 1972 Indian Wildlife Protection Act. According to Sharmila & Thatheyus (2013) [33] and Gowda *et al.*, (2011) [12], as endemic species, the Common Jeszebel, Danaid Eggfly, Baronet, and Great Eggfly are restricted to Peninsular India and Sri Lanka.

The Palani Hills are home to 174 different kinds of butterflies, according to Gunathilagaraj *et al.*, (2015) [13], whereas Rufus & Sabarinathan (2007) [29] found that Thengumarahada in the Nilgiris was home to 85 different species of butterflies. According to a 2017 study by Pavithra & Ananthi Rachel, 53 distinct species can be discovered in Tamil Nadu's Kanchipuram District. In agreement with the study's conclusions, Sethy *et al.*, (2014) [31] observed that, with 42.5% of the total, the Nymphalidae family is the most common in the study area. The Pieridae family is next with 14.1%, the Hesperidae family with 7.1%, the Papilionidae family with 21.2%, and the Lycaenidae family with 15.1%. Indhu *et al.*, 2023 [18] discovered 42 distinct species of butterflies in Namakkal.

Climate plays a major role in lepidopteran species richness by influencing temperature and indirectly influencing food availability through weather (Menendez *et al.*, 2007) [25]. Variables affecting butterflies include temperature, sun radiation, host plant availability for oviposition and larval development, and the microenvironment (Barlow *et al.*, 2007) [2]. Butterfly community structure and richness are influenced by temperature, relative humidity, and precipitation, among other climatic factors (Brown & Freitas, 2000). Butterfly communities' temporal dynamics revealed significant intra- and inter-annual variance. In seasonal forests, certain components of seasonality patterns like the highest recorded abundance probably coordinated. (i.e., transition and dry forest) over years, but not in unseasonal forests (i.e., wet forests) (Maria *et al.*, 2019) [24]. Furthermore, throughout all study sites and years, the wet season saw the greatest quantity of individuals and species; in fact, rainfall and temporal abundance were substantially positively correlated.

Table 1: Observed Butterfly Species List in Kiluvamalai from June 2014 - May 2015 and December 2019 to May 2023

S. No	Family	Common Name	Scientific Name	IUCN Status
1.	Nymphalidae	Angled Castor	*Ariadne ariadne*	
2.		Black Rajah	*Charaxes solon*	
3.		Blue Pansy	*Junonia orithya*	
4.		Blue Tiger	*Tirumala limniace*	
5.		Dark Blue Tiger	*Tirumala septentrionis*	
6.		Chocolate Pansy	*Junonia iphita*	
7.		Common Baron	*Euthalia aconthea*	Schedule II
8.		Common Crow	*Euploea core*	
9.		Common Evening Brown	*Melanitis leda*	
10.		Common Five Ring	*Ypthima baldus*	
11.		Common Four Ring	*Ypthima huebrei*	
12.		Common Lascar	*Pantoporia hordonia*	
13.		Common Leopard	*Phalanta phalantha*	
14.		Common Nawab	*Polyura athamas*	
15.		Common Sailor	*Neptis hylas*	
16.		Danaid Eggfly	*Hypolimnas misippus*	Schedule I
17.		Double Branded Crow	*Euploea sylvester*	
18.		Glad eye Bush Brown	*Mycalesis patnia*	
19.		Gray Pansy	*Junonia atlites*	
20.		Great Eggfly	*Hypolimnas bolina*	
21.		Joker	*Byblia ilithyia*	
22.		Lemon Pansy	*Junonia lemonias*	
23.		Peacock Pansy	*Junonia almana*	
24.		Plain Tiger	*Danaus chrysippus*	
25.		Striped Tiger	*Danaus genutia*	
26.		Tawny Coaster	*Acraea terpsicore*	
27.		White Four Ring	*Ypthima ceylonica*	
28.		Yellow Pansy	*Junonia hierta*	
29.	Papilionidae	Blue Mormon	*Papilio polymnestor*	
30.		Common Banded Peacock	*Papilio crino*	
31.		Common Mormon	*Papilio polytes*	
32.		Common Rose	*Pachliopta aristolochiae*	
33.		Common Jay	*Graphium doson*	
34.		Crimson Rose	*Pachliopta hector*	Schedule I
35.		Lime Swallow tail	*Papilio demoleus*	
36.		Southern Birdwing	*Troides minos*	
37.		Tailed Jay	*Graphium agamemnon*	
38.		Common bluebottle	*Graphium sarpedon*	
39.	Pieridae	Common Emigrant	*Catopsilia pomona*	
40.		Common Grass Yellow	*Eurema hecabe*	
41.		Common Gull	*Cepora nerissa*	

42.		Common Jezebel	*Delias eucharis*	
43.		Common Wanderer	*Pareronia valeria*	
44.		Crimson Tip	*Colotis danae*	
45.		Greater Orange Tip	*Hebomoia glaucippe*	
46.		Indian Cabbage	*Pieris canidia*	
47.		Mottled Emigrant	*Catopsila pyranthe*	
48.		Pioneer	*Belenois aurota*	
49.		Psyche	*Leptosia nina*	
50.		Small Grass Yellow	*Eurema brigitta*	
51.		Small Orange Tip	*Colotis etrida*	
52.		Small Salmon Arab	*Colotis fausta*	
53.		Three Spot Grass Yellow	*Eurema blanda*	
54.		White Orange Tip	*Ixias marianne*	
55.		Yellow Orange Tip	*Ixias pyrene*	
56.	Lycanidae	African Babul Blue	*Azanus jesous*	
57.		Angled Pierrot	*Caleta decidia*	
58.		Common Cerulean	*Jamides celeno*	
59.		Common Pierrot	*Castalius rosimon*	
60.		Slate flash	*Rapala manea*	
61.		Common Silver Line	*Spindasis vulcans*	
62.		Forget Me Not	*Catochrysops strabo*	
63.		Grass Jewel	*Chilades trochylus*	
64.		Indian Cupid	*Cupido lacturnus*	
65.		Indian Sunbeam	*Curestis thetis*	
66.		Lesser Grass Blue	*Zizina otis*	
67.		Lime Blue	*Chilades lajus*	
68.		Monkey Puzzle	*Rathinda amor*	
69.		Plumbeous Silverline	*Cigaritis schistacea*	
70.		Tiny Grass Blue	*Zizula hylax*	
71.		Zebra Blue	*Leptotes plinius*	
72.	Hesperiidae	Chestnut Bob	*Iambrix salsala*	
73.		Common Banded Awl	*Hasora chromus*	
74.		Common Palm Dart	*Telicota colon*	
75.		Fulvous Pied Flat	*Pseudocoladenia dan*	
76.		Golden Angle	*Caprona ransonnettii*	
77.		Indian Palm Bob	*Suastus gremius*	
78.		Indian Skipper	*Spialia galba*	
79.		Rice Swift	*Borbo cinnara*	
80.		Common Snow flat	*Tagiades japetus*	

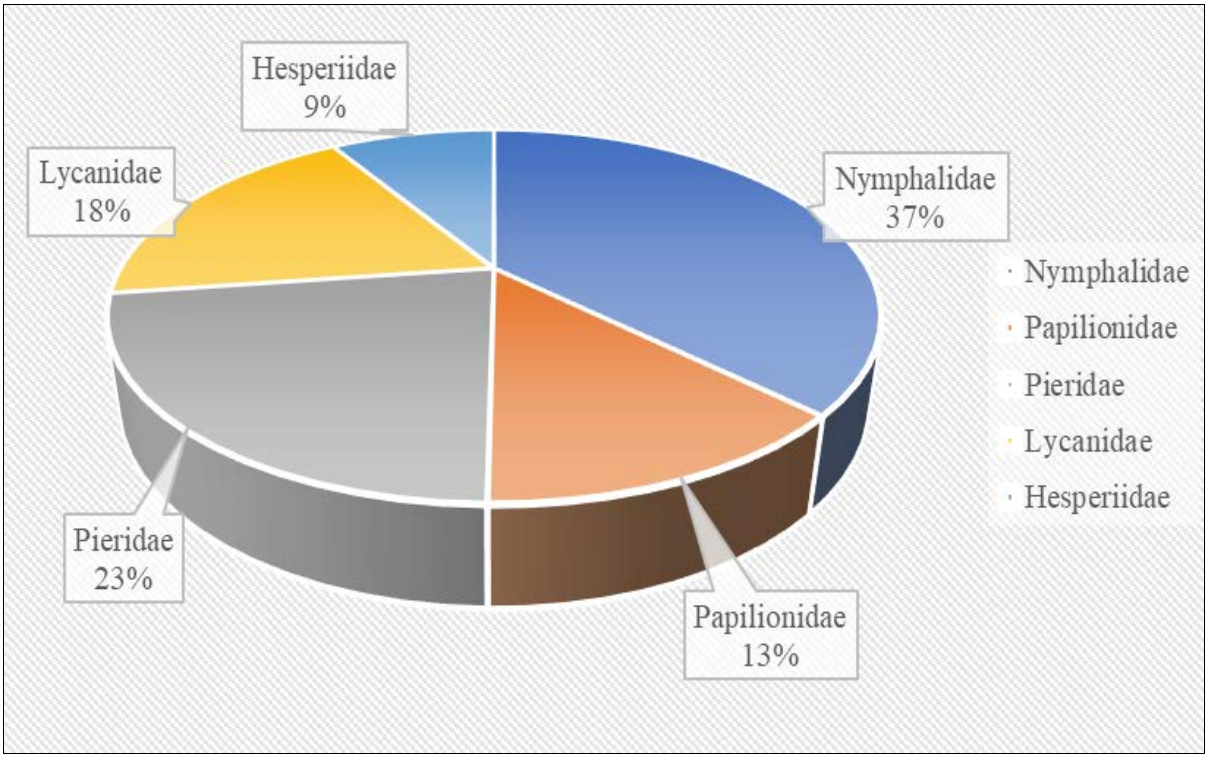


Fig 2: Total Butterfly Species in different families observed during different study period

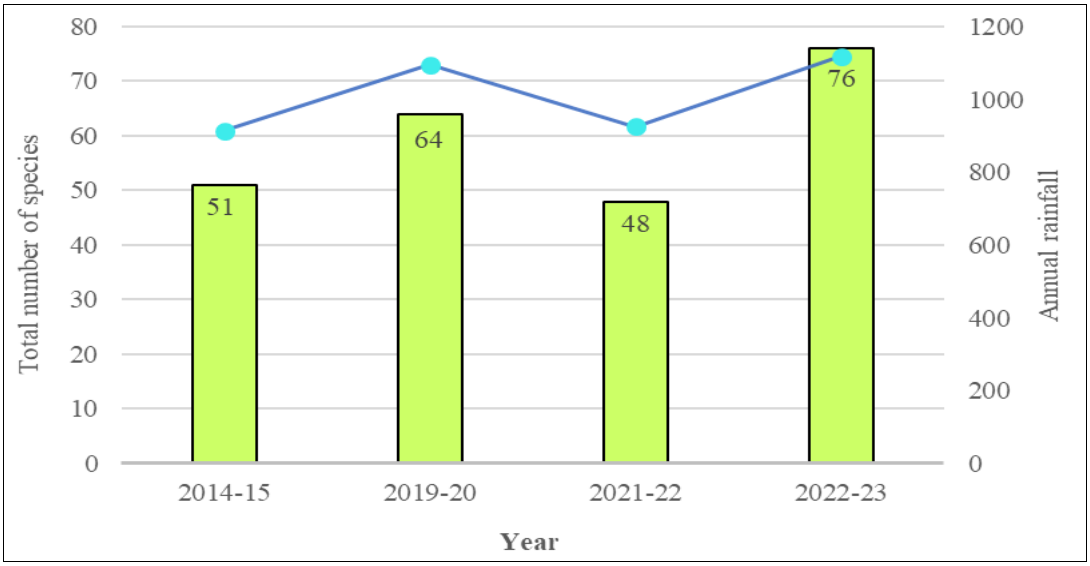


Fig 3: Butterfly Species and annual rainfall during the study period

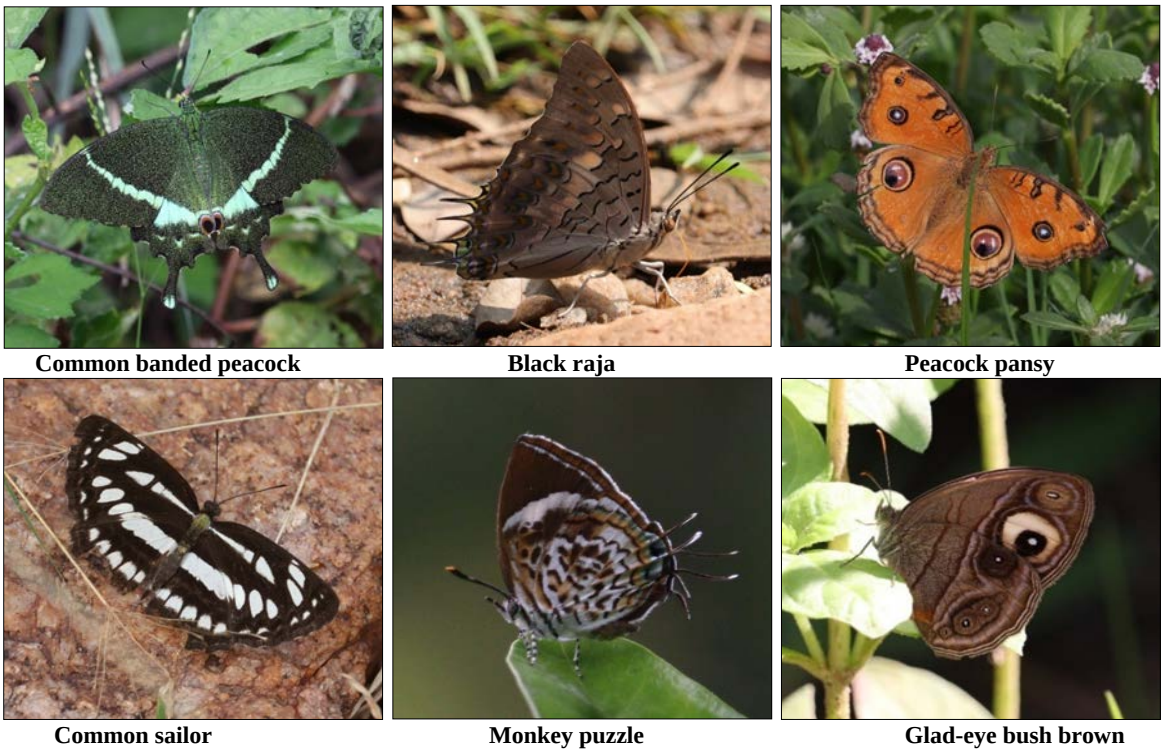


Fig 4: Butterfly Species observed in Kiluvamalai

Conclusion

The fact that all of these species coexist shows how unique and rich this forest is as a habitat, supporting a range of organisms that are unique to "thorny forests." The distribution of forest butterflies would be greatly impacted by anthropogenic disturbances such as agricultural disturbance, livestock grazing disturbance, firewood harvesting, etc. Local losses, population decrease, and habitat fragmentation may arise from this. In view of the study's findings, it is recommended that the intense monitoring be applied to protect the study area's tropical thorny forest ecosystems.

Reference

1. Annual Rainfall. India Meteorological Department, Hydrometeorological services. https://hydro.imd.gov.in/hydrometweb/(S(lhi0fz450jpsyn55figte3yn))/DistrictRaifall.aspx (accessed on 07.11.2023).
2. Barlow J, Overal W, Araujo T, Gardner, Peres C. The value of primary, secondary and plantation forests I. for fruit-feeding butterflies in the Brazilian Amazon. Ecology,2007:44:1001-1012.
3. Bonebrake TC, Ponisio LC, Boggs CL, Ehrlich PR. More than just indicators:a re-view of tropical butterfly ecology and conservation. Biological Conservation,2010:143(8):1831-1841. https://doi.org/10.1016/j.biocon.2010.04.044.
4. Capinera John L. "Butterflies and moths". Encyclopedia of Entomology,2008:4(2):626–672.
5. Champion H G, Seth S K. A Revised Survey of the Forest Types of India. The Manager of Publications, 1968, Delhi-6.

6. Champion H G. A preliminary survey of the forest types of India and Burma. Indian Forest Records (n.s.) Silva, 1936, 10(1).
7. Chettri PK, Sharma K, Dewan S, Acharya B K. Butterfly diversity in human-modified eco-systems of southern Sikkim, the eastern Himalaya, India. Journal of Threatened Taxa,2018:10(5):11551-11565. https://doi.org/10.11609/jott.3641,10.5.11551-11565.
8. Daniel AJ, Sankararaman H, Hegde DR. Butterfly diversity in Tamil Nadu agricultural university campus, Coimbatore, Tamil Nadu, India. Journal of Entomology and Zoology Studies, 2018:6(4):1354-1361.
9. ERA, India. Ecoregion Profile:Deccan Thorn Scrub Forests. Version 1.0. Ecological Restoration Alliance, India, 2022, 10.
10. Ganeshwari C, Kavibharathi P, Meenakshi P, Preethi S, Priyatharsini Rajendran. A comparative study on the species diversity of butterflies in Alagarkovil hills and Lady Doak College, Madurai. Int. J. Adv. Res. Biol. Sci,2021:8(10):39-47. http://dx.doi.org/10.22192/ijarbs.2021.08.10.005.
11. Gaonkar H. Butterflies of Western Ghats with notes on those of Sri Lanka. A Report to the Center of Ecological Sciences, Indian Institute of Science, Bangalore, Zoological Museum, Copenhagen and Natural History Museum, London, UK, 1996.
12. Gowda JHT, Kumara V, Pramod AF, Hosetti B. Butterfly diversity, seasonality and status in Lakkavalli range of Bhadra. Wildlife Sanctuary, Karnataka. World Journal of Science and Technology,2011:1(11):67-72.
13. Gunathilagaraj K, Perumal T N A, Jayaram K, Kumar MG. South Indian butterflies. Krab Media and Marketing, 2015, 1-358.
14. Gunathilagaraj K, Perumal T N A, Jayaram K, Kumar, M G. Some South Indian butterflies, Nilgiri Wildlife and Environmental Association, Nilgiri, Tamil Nadu, 1998, 274.
15. Gunathilagaraj K, Perumal TNA, Jayaram K, Ganesh Kumar M. Some south Indian Butterflies. Field Guide. Published under Project Lifecape, Indian Academy of Science, Bangalore, 1998, 270.
16. Heppner J. Classification of Lepidoptera. Part I Introduction. Holarctic Lepidoptera,1998:5:148.
17. ICFRE. Forest Types of India. Indian Council of Forestry Research and Education, Dehradun, Revisited, 2013.
18. Indhu B, Sivanantham S, Jayalakshmi C, Praveen S. "Butterfly diversity in four different areas of Namakkal, Tamil Nadu". International Journal of Entomology Research, 2023:8(12):32-36.
19. Jeganathan P, Rahmani AR, Green RE, Norris K, Vogiatzakis, I N, Bowden C, Pain D. Quantification of threats and suggested ameliorative measures for the conservation of the Critically Endangered Jerdon's Courser Rhinoptilus bitorquatus and its habitat. Journal of the Bombay Natural History Society,2008:105(1):73–83.
20. Kocher SD, Williams EH. The diversity and abundance of North American butterflies, vary with habitat disturbances and geography. Journal of Biogeography,2000:27:785-794. https://doi.org/10.1046/j.1365-2699.2000.00454.x
21. Kristensen NP, Scoble MJ, Karsholt O. Lepidoptera phylogeny and systematics:the state of inventorying moth and butterfly diversity. Zootaxa,2007:1668:699-747.
22. Kunte K 2009. Occurrence of Elymnias obnubila Marshall and de Niceville, 1883 (Lepidoptera: Nymphalidae: Satyrinae) in southern Mizoram: Range extension of the species and an addition to the Indian butterfly fauna. Journal of Threatened Taxa,2009:1(11):567-568.
23. Kunte K. India, a Life scape Butterflies of Peninsular India, Indian Academy of Sciences, University Press, 2000, 243.
24. Maria F Checa, Elisa Levy, Jaqueline Rodriguez, Keith Willmott. Rainfall as a significant contributing factor to butterfly seasonality along a climatic gradient in the Neotropics. Bio Rxiv preprint, 2019. doi:https://doi.org/10.1101/630947.
25. Menendez R, Gonzalez-Megias A, Collingham Y, Fox R, Roy DB, Ohlemuller R, Thomas CD. Direct and indirect effects of climate and habitat factors on diversity. Ecology,2007:88:605-611.
26. Padhye A, Dahanukar N, Paingankar M, Deshpande M, Deshpande D. Season and landscape wise distribution of butterflies in Tamhini, northern Western Ghats, India. Zoos' Print Journal,2006:21(3):2175-2181.
27. Pavithra S, Ananthi Rachel L. Climate Change and Its Impacts on Butterfly in and around KanchipuramDistrict, Tamil Nadu. Internationl Journal of Recent Science and Research,2017:8(9):20311-20314. DOI:http://dx.doi.org/10.24327/ijrsr.2017.0809.0870.
28. Roopha P Dailiah, Thatheyus A Joseph, Sonia T, Kishore R. Avifaunal diversity in the tropical thorn forest of Kiluvamalai, Madurai district, Tamil Nadu, India. Asian Journal of Conservation Biology,2022:11(2):274–280. https://doi.org/10.53562/ajcb.71111.
29. Rufus C K, Sabarinathan S P. A checklist of butterflies of Thengumarahada in The Nilgiris, Southern India. Zoos'Print Journal,2007:22(9):2837- 2818.
30. Santharam V, Sathasivam K, Badrinarayanan T, Sudhakar K V. Birds of Sirumalai hills, Indian Birds,2014:9(3):57-63.
31. Sethy J, Behera S, Chauhan NS. Species diversity of butterflies in south-eastern part of Namdapha Tiger Reserve, Arunachal Pradesh, India. Asian Journal of Conservation Biology,2014:3(1):75–82.
32. Sharma K, Acharya B K, Sharma G, Valente D, Pasimeni M, Petrosillo I, Selvan T. Land use effect on butterfly alpha and beta diversity in the Eastern Himalaya, India. Ecological Indicators,2020:110:105605. https://doi.org/10.1016/j.ecolind.2019.105605.
33. Sharmila JE, Thatheyus JA. Diversity of butterflies in Alagarhills, Tamil Nadu, South India. Current Biotica,2013;6:473-479.
34. Smetacek P. Record of Plebejus eversmanni (Stgr.). Indian Journal of the Bombay Natural History Society,1992:89:385-386.

35. Thomas J.A. Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. Philosophical Transactions of the Royal Society B: Biological Sciences,2005:360:339-357.
36. Tiple AD, Khura AM. Butterfly species diversity, habitats and seasonal distribution in and around Nagpur City, Central India. World Journal of Zoology,2009:4(3):153-162.
37. Tiple AD. Butterfly species diversity, relative abundance and status in Tropical Forest Research Institute, Jabalpur, Madhya Pradesh, Central India. Journal of Threatened Taxa,2012:7:2713-2717.