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Diversity and seasonal occurrence of butterfly fauna in the Srivaikundam Region of Thoothukudi District, Tamil Nadu

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Abstract
Butterflies serve as vital bioindicators of habitat quality and environmental stability. This study investigated butterfly diversity in three habitat types—Perur Wetlands, Alwarthirunagari Temple Meadows, and Sivakalai Dry Scrublands—in the Srivaikundam region of Thoothukudi District, Tamil Nadu, from January to December 2024 using the Pollard Walk Line-Transect method. In total, 57 species of butterflies belonging to five families were recorded during the survey. Among these, the family Nymphalidae was the most common, forming 34.21% of the total. The ecological index values showed that the study sites supported a rich and well-balanced butterfly community. The monsoon hit, and boom—crowds poured in like crazy, thanks to the perfect weather and all those flowers bursting with nectar.
The Alwarthirunagari Temple Meadows site had the greatest butterfly abundance, mainly due to diverse flowering resources and relatively low human disturbance. This research really drives home how vital those patchwork, wild-ish landscapes are for thriving butterfly crews, but it also shines a spotlight on the real threats piling up from all the pesticides and the way we're reshaping the land. The information gathered here provides a useful baseline for future monitoring and conservation planning in this part of Tamil Nadu.

Keywords: Butterfly diversity, bioindicators, Srivaikundam, ecological indices, species richness, habitat variation

Introduction
Butterflies, belonging to the order Lepidoptera, are among the most visible and well-known groups of insects found in different terrestrial habitats.Tracking butterflies—where they hang out, how many there are, and their wandering patterns—is basically a real-time health check for their ecosystem, since they're crazy sensitive to tiny changes in temperature, rain, humidity, plants, or nectar shortages, and any trouble shows up fast in their populations. That razor-sharp radar turns them into top-notch bio-barometers, flashing early alerts on habitat havoc and climate curveballs (Bonebrake *et al*., 2010; Akite, 2008) [1, 5].
Butterflies are vital to ecosystems, primarily as pollinators that aid in plant reproduction and maintain genetic diversity among vegetation. They also occupy a key place in food webs, serving as prey for birds, reptiles, amphibians, and other insects, thereby supporting ecological balance (Ghazoul, 2005; Kehimkar, 2016) [7, 12].hProtecting butterflies is vital for keeping ecosystems balanced and resilient.
India is home to about 1,800 butterfly species, ranking it among the most butterfly-rich countries in the world. This diversity comes from its wide range of climates and landscapes—from the Himalayan mountains to tropical coasts. Southern India, with its mix of forests, farms, and wetlands, provides especially favorable habitats for butterflies to flourish (Kunte, 2000; Mani, 1986) [14, 16]. Tamil Nadu, in particular, displays a remarkable variety of ecological landscapes—including mangrove coasts, inland wetlands, paddy-dominated agricultural belts, deciduous forests, and rocky upland scrublands—offering multi-scaled habitats for both generalist and specialist butterfly fauna (Krishnakumar *et al*., 2019; Prasad & Varatharajan, 2016) [13, 20]. Long-term monitoring from Nilgiris and Western Ghats has demonstrated that Tamil Nadu serves as a distributional crossroads for both Peninsular and Indo-Malayan butterfly elements, resulting in high endemism and habitat specificity (Kalesh & Prakash, 2015; Eswaran & Pramod, 2010) [6, 10].
Recent studies from the Eastern Ghats and Cauvery basin reveal that butterfly numbers rise and fall with increasing habitat loss and the spread of monoculture crops (Arulprakash & Gunathilagaraj, 2010; Kannan *et al*., 2021) [2, 11]. In Salem, Coimbatore, and Tirunelveli, those nonstop pesticide sprays are nuking the host plants that butterfly caterpillars rely on, absolutely crushing populations of Pieridae and Papilionidae species (Ramesh *et al*., 2022) [21]. On the flip side, research out of Kanyakumari Wildlife Sanctuary shows how mixing in agroforestry with those old sacred temple groves creates these safe little pockets, helping butterfly communities thrive even beyond the usual protected areas (Arun & Azeez, 2015) [3]. Put it all together, and Tamil Nadu's landscapes are morphing in ways we can actually measure—crushing its butterfly diversity in the process—and it's a clear wake-up call to expand conservation efforts way past the traditional forest strongholds.
Take Srivaikundam, down in the Thamirabarani River's lower reaches: it's a prime example of that rich mix, blending riverbank greenery, temple groves, scrubby thornlands, and farmland-dotted villages into a buzzing hotspot of biodiversity.Habitat differences affect nectar availability, microclimates, and larval host distribution, shaping butterfly communities (Bhattacharya, 2019; Singh & Pandey, 2004) [4, 22]. While butterflies are ecologically important, studies in Thoothukudi have mostly focused on

aquatic systems, lagoons, and birds, leaving terrestrial insects understudied (Gurule & Nikam, 2013) [9]. Assessing butterfly richness and habitat-specific patterns in Srivaikundam is thus timely and essential for baseline data and cal conservation planning.

Materials and Methods

1. Study Duration

We ran the fieldwork for a full year straight, from January through December 2024. The sampling timeframe covered all three major seasons of Tamil Nadu: the pre-monsoon months (January–May), the southwest monsoon period (June–September), and the post-monsoon season (October–December). This seasonal span enabled the documentation of changes in butterfly composition and abundance in relation to climatic variation and flowering resource availability.

2. Study Area

We conducted the survey in three very different habitats found in the Srivaikundam region of Thoothukudi District, Tamil Nadu. We chose these sites because they vary in vegetation, floral density, the presence of larval host plants, and how active butterflies were in each spot.

Here's a quick look at the main features of each site:.

Study Site	Habitat Type	Key Ecological Features
Perur Wetlands	Riparian vegetation and agricultural land	Tamarind and neem groves, banana plantations, and home-garden flowering plants
Alwarthirunagari Temple Meadows	Temple groves and village garden ecosystem	High floral richness, shaded patches, minimal anthropogenic disturbance
Sivakalai Dry Scrublands	Deciduous scrubland and thorny vegetation	Grasslands, moderate disturbance from grazing, sparse floral patches

These habitats collectively represent the dominant ecological landscapes of the Srivaikundam region, thus offering a comprehensive overview of local butterfly assemblages.

3. Field Sampling Method

We used a modified Pollard Walk Line-Transect method to sample butterflies. At each site, I set up a 500-meter transect and walked it at a steady pace, counting every butterfly I spotted within a 5-meter strip—2.5 meters on each side. I only recorded butterflies that were flying freely inside that boundary, so I didn't accidentally count the same one twice.

4. Observation Schedule

I limited fieldwork to mornings, between 8 and 11, since that's when butterflies are busiest with feeding and warming up. Surveys happened pretty often all year, but I didn't stick to a strict schedule. This way, I could spot more butterflies overall. I skipped surveys when it rained, got too windy, or if the sky was overcast—those conditions really mess with the results.

5. Species Identification

Species identification was carried out in the field based on morphological features such as wing coloration, venation, size, flight pattern, and nectar preference.Individuals that could not be identified directly were photographed using a DSLR/smartphone with telephoto capabilities and later verified using authoritative references:

The Book of Indian Butterflies (Kehimkar, 2016) [12]

Butterflies of India – Species Identification Digital Database (Kunte *et al*., 2021) [15]

Taxonomic consistency was maintained using the Butterflies of India Online Database (BOI) and LepIndex.

6. Data Analysis

We crunched the butterfly community data with some tried-and-true ecological metrics to get a handle on things:

Metric	Index Used	Ecological Purpose
Species Diversity	Shannon–Wiener Index (H′)	To assess richness and distribution of individuals
Dominance	Simpson's Dominance Index (1–D)	To evaluate the extent of dominance by few species
Evenness	Pielou's Evenness Index (J′)	To measure how uniformly individuals are distributed

We whipped up some graphs and tables to spotlight how things shifted with the seasons and across habitats

7. Statistical Tools

All quantitative analyses were conducted using the following software programs:

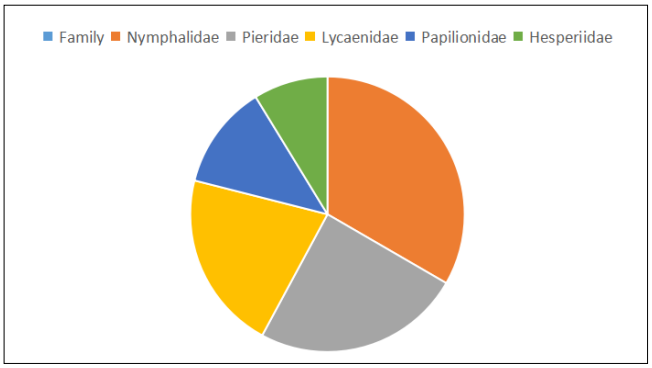
- **Microsoft Excel 2021** for descriptive statistics and graphs
- **PAST 4.03 (Paleontological Statistics Software)** for computation of ecological indices

Comparisons were made across the three habitats and seasons to identify trends in butterfly assemblages.

Results.

1. Species Composition and Family Distribution

Species Composition and Family DistributionNymphalidae stole the show as the top family for sheer species count, with Pieridae and Lycaenidae right on their heels. Papilionidae and Hesperiidae weren't the heavy hitters in numbers, but they tossed in some real spice to the diversity pot.A bunch of tough, adaptable types—like Euploea core, Junonia lemonias, Danaus chrysippus, Tirumala limniace, Eurema hecabe, and Papilio polytes—popped up at every site, showing they've got the chops to handle whatever the environment throws at them.Widespread species such as Euploea core, Junonia lemonias, Danaus chrysippus, Tirumala limniace, Eurema hecabe, and Papilio polytes were recorded at all three sites, indicating their broad ecological tolerance.



2. Site-wise Variation in Butterfly Diversity

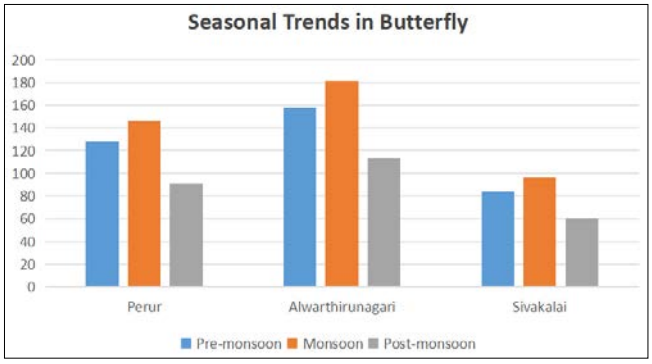
Site-wise Variation in Butterfly DiversityButterfly numbers peaked at Alwarthirunagari Temple Meadows, then dropped off at Perur Wetlands and Sivakalai Dry Scrublands.

Site	Individuals	Species Richness	Shannon (H′)	Simpson (1−D)	Evenness (J′)
Alwarthirunagari	180	57	3.9269	0.9339	0.9137
Perur	129	57	3.9301	0.9092	0.9182
Sivakalai	95	57	3.8042	0.9144	0.8884

The diversity scores paint a picture of steady communities everywhere—no one species running the whole show.

3. Seasonal Trends in Butterfly Abundance

Seasonal Trends in Butterfly AbundanceButterfly action ramped up big-time during monsoon season, eased off a bit in pre-monsoon, and hit a lull post-monsoon.That rainy-season surge lines up perfectly with nectar flowers blooming wild and host plants bouncing back after the downpours



The monsoon peak coincided with the flowering of nectar plants and regeneration of larval host plants after rainfall.

4. Overall Diversity of the Srivaikundam Region

Overall Diversity of the Srivaikundam RegionWhen data from all three sites were pooled, the Srivaikundam region demonstrated high butterfly diversity and even distribution of species:

Parameter	Value
Total individuals	404
Species richness	57
Shannon Diversity Index (H′)	4.3526
Simpson Dominance Index (1–D)	0.9725
Pielou's Evenness (J′)	0.9216

These results confirm that the Srivaikundam region supports a highly heterogeneous butterfly community, facilitated by a mosaic of riparian, meadow, and scrubland habitats.

Result highlights (for quick reference) Result Highlights

Key Finding	Summary
Total number of species	57
Dominant family	Nymphalidae
Highest abundance	Alwarthirunagari Temple Meadows
Peak season	Monsoon
Biodiversity status	High diversity, high evenness, low dominance

Discussion

The study shows that butterfly diversity in the Srivaikundam region changes noticeably across different habitats, with distinct variations in the number and types of species. The family Nymphalidae was the most common, likely because its members adapt well to different environmental conditions, similar to patterns seen in other tropical regions (Kunte, 2000; Tiple, 2012; Kehimkar, 2016) [12, 14, 24]. Butterflies were more abundant in riparian and semi-natural habitats, probably because these areas have plenty of vegetation, nectar-rich flowers, and suitable host plants (Krishnakumar *et al*., 2019; Akite, 2008) [1, 13]. In comparison, farmlands supported fewer species, probably due to pesticide use, monocropping, and the limited presence of flowering plants (Gunasekaran & Ganesh Kumar, 2010; Mohanraj & Rajmohan, 2018) [8, 17]. Fewer Papilionidae and Hesperiidae butterflies were found, suggesting that these groups are more sensitive to habitat changes and the loss of their preferred host plants (New, 1997; Singh & Pandey, 2004) [19, 22].Butterfly numbers increased after the monsoon, coinciding with the growth of vegetation and greater nectar availability (Arun & Azeez, 2015; Bhattacharya, 2019) [3, 4].

Although Srivaikundam still supports a rich butterfly community, the rising use of chemicals and the decline of native vegetation may put this ecological balance at risk. Protecting natural habitats, encouraging organic farming, and involving local communities can help maintain butterfly diversity, as seen in other parts of Tamil Nadu (Sundaran & Ramesh, 2021) [23]. This study provides important baseline information for future monitoring and emphasizes the importance of protecting native vegetation and limiting agrochemical use to support butterfly populations and keep the ecosystem healthy.

S.No	Scientific Name	Common Name	Family	Alwarthirunagari	Perur	Sivakalai	Total	Occurrence Status
1	*Euploea core*	Common Indian Crow	Nymphalidae	18	12	9	39	VC
2	*Danaus chrysippus*	Plain Tiger	Nymphalidae	16	10	7	33	VC
3	*Tirumala limniace*	Blue Tiger	Nymphalidae	14	11	6	31	C
4	*Junonia lemonias*	Lemon Pansy	Nymphalidae	13	10	5	28	C
5	*Junonia atlites*	Grey Pansy	Nymphalidae	9	6	5	20	C
6	*Junonia iphita*	Chocolate Pansy	Nymphalidae	7	4	3	14	UC
7	*Phalanta phalantha*	Common Leopard	Nymphalidae	10	7	4	21	C
8	*Hypolimnas misippus*	Danaid Eggfly	Nymphalidae	4	3	2	9	R
9	*Mycalesis perseus*	Common Bushbrown	Nymphalidae	5	4	2	11	UC
10	*Ypthima huebneri*	Common Fourring	Nymphalidae	7	6	3	16	C
11	*Acraea violae*	Tawny Coster	Nymphalidae	9	7	5	21	C

12	*Ariadne merione*	Common Castor	Nymphalidae	6	5	2	13	UC
13	*Lethe rohria*	Common Treebrown	Nymphalidae	2	2	1	5	VR
14	*Elymnias hypermnestra*	Common Palmfly	Nymphalidae	3	3	—	6	R
15	*Eurema hecabe*	Common Grass Yellow	Pieridae	17	13	8	38	VC
16	*Eurema brigitta*	Small Grass Yellow	Pieridae	10	8	5	23	C
17	*Catopsilia Pomona*	Lemon Emigrant	Pieridae	11	9	4	24	C
18	*Catopsilia pyranthe*	Mottled Emigrant	Pieridae	8	7	3	18	C
19	*Delias eucharis*	Common Jezebel	Pieridae	6	4	2	12	UC
20	*Appias albino*	Common Albatross	Pieridae	4	3	2	9	R
21	*Pieris canidia*	Indian Cabbage White	Pieridae	3	2	2	7	R
22	*Papilio polytes*	Common Mormon	Papilionidae	12	9	5	26	C
23	*Papilio demoleus*	Lime Butterfly	Papilionidae	11	8	5	24	C
24	*Papilio helenus*	Red Helen	Papilionidae	3	2	—	5	VR
25	*Graphium Agamemnon*	Tailed Jay	Papilionidae	4	3	1	8	R
26	*Graphium sarpedon*	Common Bluebottle	Papilionidae	5	3	1	9	R
27	*Graphium doson*	Common Jay	Papilionidae	4	3	—	7	R
28	*Jamides celeno*	Common Cerulean	Lycaenidae	8	7	3	18	C
29	*Zizina otis*	Lesser Grass Blue	Lycaenidae	12	10	5	27	C
30	*Zizeeria maha*	Pale Grass Blue	Lycaenidae	8	6	4	18	C
31	*Catochrysops Strabo*	Forget-Me-Not	Lycaenidae	6	5	2	13	UC
32	*Lampides boeticus*	Pea Blue	Lycaenidae	7	6	3	16	C
33	*Leptotes plinius*	Zebra Blue	Lycaenidae	5	4	2	11	UC
34	*Celastrina lavendularis*	Plain Blue Royal	Lycaenidae	3	2	1	6	R
35	*Talicada nyseus*	Red Pierrot	Lycaenidae	2	2	—	4	VR
36	*Spalgis epius*	Apefly	Lycaenidae	2	2	—	4	VR
37	*Hasora chromus*	Common Banded Awl	Hesperiidae	5	4	2	11	UC
38	*Borbo cinnara*	Rice Swift	Hesperiidae	6	5	3	14	UC
39	*Pelopidas mathias*	Small Branded Swift	Hesperiidae	7	6	4	17	C
40	*Pelopidas agna*	Dark Small Branded Swift	Hesperiidae	4	3	3	10	UC
41	*Suastus gremius*	Indian Palm Bob	Hesperiidae	3	2	2	7	R
42	*Udaspes folus*	Grass Demon	Hesperiidae	2	2	1	5	VR
43	*Acytolepis puspa*	Common Hedge Blue	Lycaenidae	6	5	3	14	UC
44	*Chilades parrhasius*	Indian Cupid	Lycaenidae	7	6	3	16	C
45	*Freyeria putli*	Grass Jewel	Lycaenidae	4	3	2	9	R
46	*Nacaduba kurava*	Transparent Six-Line Blue	Lycaenidae	3	2	1	6	R
47	*Arhopala amantes*	Large Oakblue	Lycaenidae	2	1	—	3	VR
48	*Caleta roxus*	Striped Pierrot	Lycaenidae	3	2	2	7	R
49	*Castalius rosimon*	Common Pierrot	Lycaenidae	4	3	2	9	R
50	*Melanitis leda*	Common Evening Brown	Nymphalidae	6	5	3	14	UC
51	*Melanitis phedima*	Dark Evening Brown	Nymphalidae	3	2	2	7	R
52	*Charaxes bernardus*	Tawny Rajah	Nymphalidae	2	1	—	3	VR
53	*Charaxes solon*	Black Rajah	Nymphalidae	3	2	1	6	R
54	*Kallima inachus*	Blue Oakleaf	Nymphalidae	1	1	—	2	VR
55	*Athyma perius*	Common Sergeant	Nymphalidae	3	2	—	5	R
56	*Neptis hylas*	Common Sailor	Nymphalidae	6	4	2	12	UC
57	*Parantica aglea*	Glassy Tiger	Nymphalidae	7	5	3	15	C

Conclusion

The findings suggest that areas with native plants and diverse vegetation help support strong butterfly populations, even within farmland (Gunasekaran & Ganesh Kumar, 2010; Mohanraj & Rajmohan, 2018) [8, 17]. Protecting native vegetation along canals and bunds, conserving larval host plants, and promoting eco-friendly farming with less pesticide use are key for long-term conservation (New, 1997 [19]; Vane-Wright *et al*., 1991). Preserving small temple groves, community green spaces, and vegetation along water channels can also enhance butterfly habitats (Sundaran & Ramesh, 2021) [23]. Regular monitoring of butterflies as bioindicators will help track environmental changes and support sustainable biodiversity planning in the region (Bonebrake *et al*., 2010 [5]; Pollard & Yates, 1993).

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