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The diversity and richness status of butterflies in south part of Eastern Ghats in Pachamalai Hills

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Abstract
When there are butterflies in a region, the ecosystem is doing well, and baseline research is crucial to biodiversity conservation and environmental protection. The goal of the current study was to determine the species richness of nymphalid butterflies in the Thuraiyur range of the Pachamalai hills in Tamil Nadu, India's Eastern Ghats. Evergreen forests had the highest reported species richness and total population, with a higher proportion of extremely rare and eight exclusive species. The population and species richness of the tropical thorn forest were lowest, with a higher proportion of common species. The common nawab was one of the sole species found in deciduous forests, whereas the blue oakleaf was the only species found in tropical thorn forests.

Keywords: Pachamalai, species richness, nymphalid butterflies, Eastern Ghats Habitat

Introduction
A subject of curiosity for both science and artists, butterflies are the most vibrant, noticeable, and exquisite creatures. India is home to 1501 species, or one-fifth, of all butterflies worldwide (Gaonkar, 1996) [11]. According to Gunathilagaraj *et al*. (1998), there are 341 species in the Western Ghats and about 150 species in the Eastern Ghats. An area's butterfly diversity is a good indicator of a healthy environment.

Significance of the Study
Research has been done on the diversity of butterfly communities across the globe in a variety of habitat types. Studies on the diversity of butterfly communities in tropical forests with varying forest habitats, however, are scarce. research on pharmaceutical.
In the Eastern Ghats, research was done on plants (Kolar and Basha, 2013) [2], flora (Kanagaraj *et al*., 2016) [14], and butterflies (Gunathilagaraj *et al*., 1998, Venkataramana, 2010). With the exception of the variety, at Pacahamalai Hills, there aren't many research on the diversity of butterfly communities in tropical forests within various habitat types (Carlton *et al*., 2020). The current research was conducted in this area to discover and examine the variety of nymphalid butterflies in various habitats in the current study area in Eastern Ghats region as well as to develop conservation methods.

AIM
To ascertain the variety of nymphalid butterflies found in the Pachamalai hills, or Thuraiyur range, in Eastern Ghats region

Objectives
- To determine the tropical thorn forest's butterfly richness
- To assess the abundance of butterflies in a deciduous type of forest
- To determine the amount of butterflies in an evergreen type of forest

The Study Area
The Pachamalai hills are located in the central region of Tamil Nadu, India, and have latitudes ranging from 11° 09’ 00’’ to 11° 27’ 00’’ N and longitudes from 78° 28’ 00’’ to 78°49’ 00’’ E (Fig. 1). Covering 19075.96 hectares, the vegetated area is divided into 35 Reserved Forests. With yearly rainfall ranging from 800 to 900 mm and temperatures ranging from 25 to 31 degrees Celsius, the Pachamalai hills experience a subtropical climate. Rainfall reaches its peak during the Northeast monsoon. The region is covered in red loamy and black soil, and the crystalline rocks of the Archaean period, including charnockites, gneisses, granites, and underlie the area. Along the river courses, there are small patches of alluvium (Pullaiah and Muralidharan, 2002). Almost all of these forests fall into one of the following three categories:
1. Deciduous type forest (DF) – 300 to 900m (slopes)
2. Evergreen type forest (EGF) – 800 to 1300m (Plateau)
3. Tropical Thorn type Forest (TTF) – up to 400m (foot hills)

Six reserve forests (RF) that encompassed the three habitats in the Pachamalai Hills were used for the current study. Top Sengattupatti RF (F1-281m AMSL) and Melur RF (F6-219m AMSL) are examples of tropical thorn forests; Sengattupatti Extension RF (F2-347m AMSL) and Manaloodai RF (F5-628m AMSL) are examples of deciduous forests; Solaimathi RF (F3-842m AMSL) and Kannimar Solai RF (F4-706m AMSL) are examples of evergreen forests.

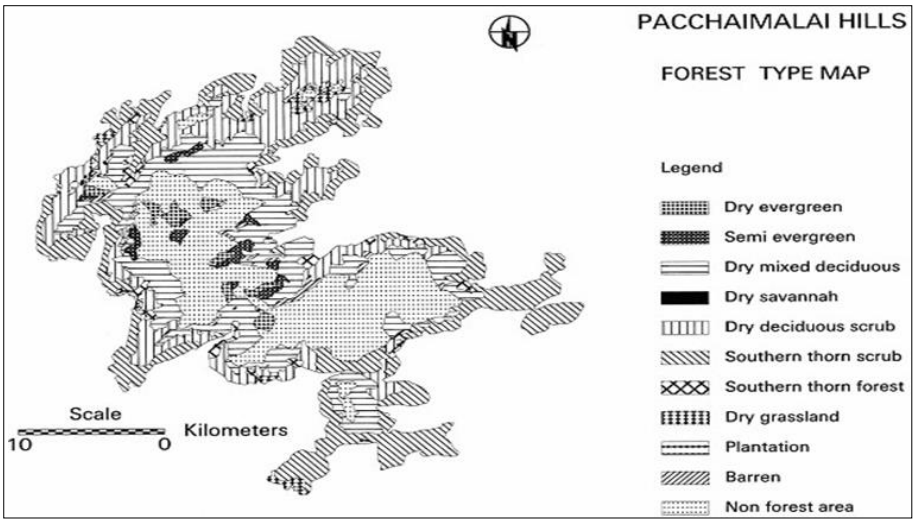

Fig 1: Map of different forest types in Pachamalai hills

Methdology

The transect method was used to survey the butterflies. Between 8:30 and 11:30 in the morning, observations were made. At the peak of the butterflies' activity (Kunte, 1997). In the field, butterflies were identified or later photographed and identified using standard field guides such as www.ifoundbutterflies.org.

Transect Method

A single, 200-meter-long permanent transect line was installed at each location. In closed and open habitats, as well as pristine and degraded areas, were included in the census routes. A fixed-width transect count approach was used to gather the data, where recorders counted individual adult butterflies along predetermined paths (Pollard *et al.*, 1977)

Results and Discussion

The Butterfly Richness in Different Forest Habitats

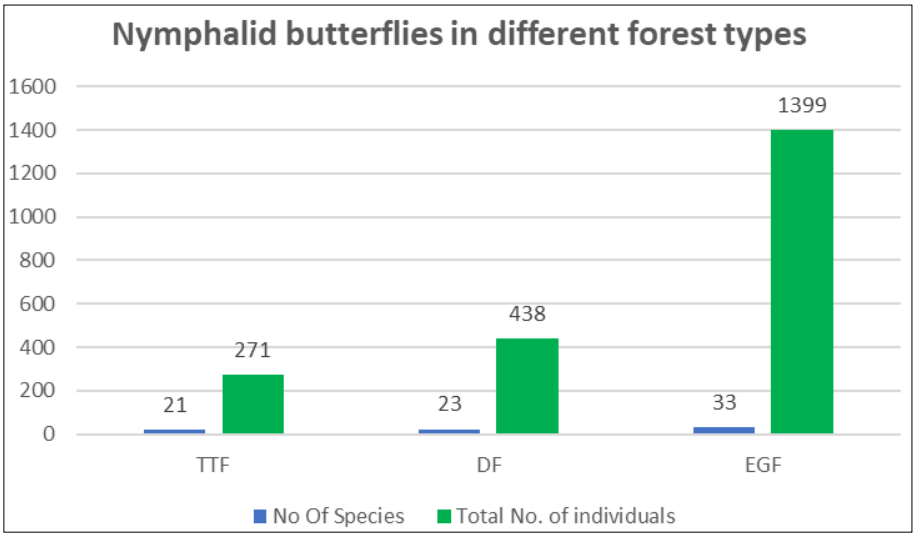

Fig 2: Nymphalid butterflies in different forests

TTF - Tropical Thorn forest; DF - Deciduous forest; EGF - Evergreen forest

Figure 2 shows the overall population and species count of nymphalids, or brush-footed butterflies, in various habitats, such as evergreen, deciduous, and thorn forests. The tropical thorn forest had the fewest species (21) and the deciduous forest had the most species (23), with the evergreen forest having the greatest number (33). In a similar vein, the entire butterfly population was observed to be following the same pattern. Evergreen forests have the highest reported species richness and total population, showing the most ideal environmental parameters. Rare species are more prevalent in closed canopy forests, and their abundance diminishes as habitat openness levels rise. Richness has also been enhanced by uncommon species found solely in evergreen forests, such as clear sailer, short banded sailer, common four ring, common lascar. The thorn woodland had the lowest species richness, indicating a less favorable environment caused by high temperatures and dryness. It should be mentioned that migratory species including the common Indian crow, blue tiger, and dark blue tiger made up the majority of the population. The eleven common and extremely common species that may be found in Pachamalai are all located in the located forest itself. These species include the chocolate pansy, lemon pansy, white four ring, tawny coster, common sailer, blue tiger, dark blue tiger, and

plain tiger. This corroborates the findings of Vu and Vu's (2011) [20] report, which claimed that common species are more prevalent in open forests.

23 species were found in deciduous forests, which is higher than in thorn forests but fewer than in evergreen forests. and the common nawab was the only species that it has.

Table 1: List of butterflies present in different forest types

Names of butterflies			Butterflies at different Forests		
S. No	**Common Name**	**Scientific Name**	**TTF**	**DF**	**EGF**
1.	Blue oakleaf	*Kallima horsfieldi*	✓		
2.	Danaid eggfly	*Hupolimnas missippus*		✓	✓
3.	Plain tiger	*Danaeus chrysippus*	✓	✓	✓
4.	Common nawab	*Polyuria athamas*		✓	
5.	Common evening brown	*Melaniti leda*	✓		✓
6.	Blue tiger	*Tirumala limniace*	✓	✓	✓
7.	Short banded sailer	*Phaedyma columella*	✓	✓	✓
8.	Clear sailer	*Neptis clinia*		✓	✓
9.	Common sailer	*Neptis hylas*	✓	✓	✓
10.	Common lascar	*Pantoporia hordonia*			✓
11.	Angled castor	*Ariadne ariadne*	✓	✓	✓
12.	Rustic	*Cupha erymanthis*		✓	✓
13.	Tawny coster	*Acraea violae*	✓	✓	✓
14.	Common four ring	*Ypthima huebneri*	✓		✓
15.	White four ring	*Ypthima ceylonica*			✓
16.	Common three ring	*Ypthima asterope*	✓		✓
17.	Common leopard	*Phalantha phalantha*	✓	✓	✓
18.	Great eggfly	*Hypolimnas bolina*	✓	✓	✓
19.	Lemon pansy	*Junonia lemonias*	✓	✓	✓
20.	Club beak	*Junonia hierta*			✓
21.	Chocolate pansy	*Junonia iphita*	✓	✓	✓
22.	Peacock pansy	*Junonia almana*		✓	✓
23.	Joker	*Byblia ilithyia*		✓	✓
24.	Common castor	*Ariadne merione*	✓	✓	✓
25.	Yellow pansy	*Junonia hierta*	✓	✓	✓
26.	Common beak	*Libythea lepita*			✓

Table 1 shows that 35 different kinds of nymphalids, including tropical thorn forest, deciduous forest, and evergreen forest, are found in the Pachamalai hills. All three forests contained 15 different species are documented in the Table. This shows that nectar plants of these butterfly species are present throughout various environments, and the fact that certain species are absent from any of these woods suggests that certain butterflies have certain needs or preferences.

With the exception of the common nawab and blue oakleaf, all 33 species were found in the evergreen forest, suggesting that it has the highest level of variety of the three. It should be mentioned, nevertheless, that blue oakleaf was identified in evergreen forests during the inventory of butterflies, not during the research. One unique species, the common nawab, was found in a deciduous woodland with 23 species recorded. In the deciduous woodland, no records of browns or rings were found. The larvae of rings eat on grass (Kunte, 1997). The lack of grasses in this area due to the scorching heat and sloping terrain prevented any rings from surviving, which may also be the cause of the lower species richness.

Table 2: Diversity, status and frequency of Nymphalid butterflies at Pachamalai Hills

S. No	Common Name	Occurrence (Months)	Relative Abundance	Status
1.	Common leopard	8.9,12-2	***	NR
2.	Rustic	8-10	**	R
3.	Tawny coster	6-1	****	C
4.	Common four ring**	7,8,10	**	R
5.	Common evening brown	10-3	***	NR
6.	Common Indian crow +	1-12	*****	VC
7.	Double banded crow	7,9,12,1	**	R
8.	Glassy tiger	7,10	*	VR
9.	Plain tiger	6-12,4	****	C
10.	Striped tiger	7,8,2-4	***	NR
11.	Dark blue tiger	1-12	*****	VC
12.	Blue tiger	1-12	*****	VC
13.	Club beak**	7,8	*	VR
14.	Common beak**	7,8	*	VR
15.	Common nawab#	6,7	*	VR
22.	Great eggfly	7,10-12	**	R
23.	Yellow pansy	10	*	VR
24.	Joker	9	*	VR
25.	Common castor	1-12	*****	VC
26.	Blue oakleaf#	6,7,11,12	**	R
27.	Common baron	7	*	VR
28.	Short banded sailer+	8,10	*	VR
29.	Clear sailer	10,12	*	VR
30.	Common sailer	4-1	*****	VC
31.	Danaid eggfly+	7,10,11	**	R
32.	Chocolate pansy	1-12	*****	VC
33.	Great eggfly	7,10-12	**	R
34.	Lemon pansy	1-12	*****	VC
35.	Angled castor	1-12	*****	VC

+ Butterflies Listed in Indian Wildlife (Protection) Act 1972 # Found only in Tropical Thorn Forest (TTF)

** Found only in Evergreen Forest (EGF)

VC- Very Common C- Common NR- Not Rare R- Rare VR- Very Rare

* Very rare; ** rare; *** not rare; **** common; ***** very common

The above table 2 reveal that among the 35 species recorded 1 species namely the Blue oakleaf were recorded only in Tropical thorn forest and 8 species were recorded only in Evergreen forest

Conclusion

35 species of nymphalid butterflies were found in three distinct types of forests—tropical thorn forest, deciduous forest, and evergreen forest—according to a study on the richness of nymphalid butterflies in Pachamalai Hills. The tropical thorn forest had the lowest species richness (21) and the evergreen forest had the highest species richness (33) among all of them. There were fifteen species throughout the entire forest. Only eight species were discovered in evergreen forests. Major risks identified are agricultural disturbance, livestock grazing disturbance, and firewood gathering that causes fragmentation. Pachamalai Hills is a

migratory location that requires significant attention for the conservation of biodiversity.

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