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## Butterfly diversity of Chennai, Kancheepuram, Chengalpet and Thiruvallur districts in Tamil Nadu, India

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### Abstract

A long term butterfly study was conducted from January 2014 to March 2020 at 17 locations with varied habitats namely Tropical Dry Evergreen forests, Grasslands, Scrubland, Wetland and Community park covering four districts namely Chennai, Kancheepuram, Chengalpet and Thiruvallur of Tamil Nadu, India. A total of 128 species from the Chennai district, 114 species from the Chengalpet district, 67 species from Thiruvallur district, and 66 species from Kancheepuram district were recorded. The habitat of Tropical dry Evergreen Forest habitat recorded the highest butterfly number with 118 species. The sighting of the Red-spot Jezebel (*Deliasdes combesi*) was the most significant record from this study. The butterfly diversity in the month of November was seen to be the highest. We also assessed the relative abundance and species distribution patterns of butterflies in the study area.

**Keywords:** Butterfly checklist Chennai, Kancheepuram, Chengalpet, Thiruvallur, Butterfly diversity South India

### Introduction

There are estimated to be over 20,000 species of butterflies around the globe <sup>[1]</sup>. Of these, 1318 species have been recorded from the Indian subcontinent <sup>[2]</sup> and 323 species are estimated to occur in the state of Tamil Nadu <sup>[3]</sup>. Butterflies are well-known pollinators and are known to visit a wide range of flowers <sup>[4]</sup>. Along with beetles, butterflies are also known to be biological indicators <sup>[5]</sup>. Certain butterfly migratory patterns have been used as an emerging model for migratory animals <sup>[6]</sup>. They have also been known to be affected by excess nitrogen and global warming and can act as indicators for the same <sup>[7, 8]</sup>.

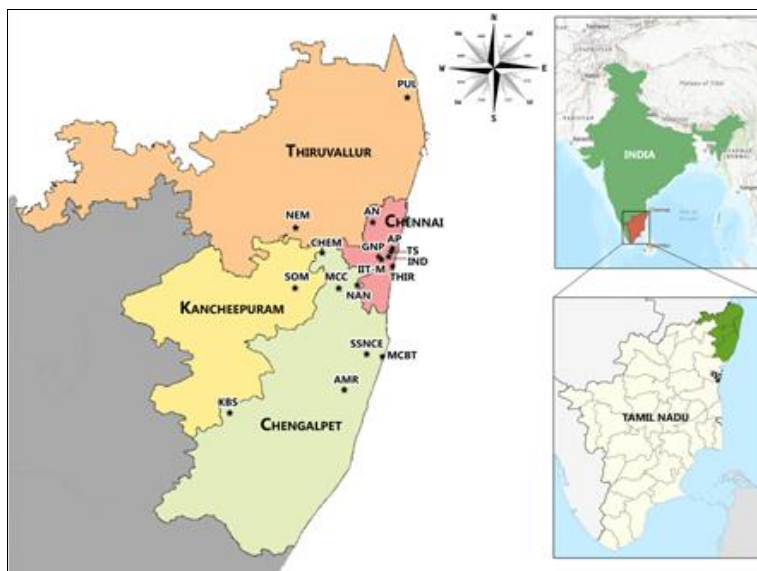
The Chennai city, which had its origin as a bunch of fishing hamlets about 373 years ago, has now evolved into one of India's major metropolitan cities. The city of Chennai and its neighborhood were once thickly vegetated with dry evergreen forest and coastal mangrove forests <sup>[9]</sup>. However, due to urbanization and rapid industrialization, the vegetation had been reduced drastically to certain pockets of the district. Still, Chennai is biodiversity-rich with 317 species of birds <sup>[10]</sup>, 18 species of mammals <sup>[9]</sup> and 1039 species of plants <sup>[11]</sup>. It is well known as a city with a national park (Guindy National Park (GNP), Chennai) within its city limits, that is home to the Blackbuck - *Antelope cervicapra* <sup>[12]</sup>. One of the oldest resources used to understand butterfly diversity in the past was the work by E. Y. Watson 1890, who recorded 73 species in 1890. Work by P. Dayanandan 1978 featured 70 species of butterflies from Tambaram, Chengalpet district. 34 species of butterflies were recorded from the Indian Institute of Technology-Madras (IIT-M), Chennai district in 1999 <sup>[15]</sup>. The bidirectional movement of butterflies was recorded from Kalpakkam, Chengalpet district in 2012 <sup>[16]</sup>. A study from Chennai covering 16 locations, including SRM University, GNP, IIT-M and Anna University, documented 47 species <sup>[17]</sup>. Evangeline & Santhi 2017 recorded 90 species from the Guindy National Park, Chennai district <sup>[18]</sup>. Though there were several published works of literature on the butterflies from different localities of the Chennai, Kancheepuram, Chengalpet and Thiruvallur, no comprehensive study had been made earlier to provide district-wide butterfly checklist to understand the butterfly diversity. This study is an attempt to present a preliminary checklist for butterflies documented from the districts of Chennai, Kancheepuram, Chengalpet and Thiruvallur.

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## Materials and Methods

Chennai is a metropolitan city in South India, situated on the Coromandel Coast, spread over 490 km<sup>2</sup>. It is located in Northern Tamil Nadu, with hills of the Eastern Ghats about 100 km away from the city. Chennai has Tropical Dry Evergreen forests (TDEF) [18–20], grasslands, Scrubland, wetland and community park habitats, some of which are found in protected or private areas. The average rainfall received during the North-east monsoon, and the mean temperature of the city is 140 cm and 28.6 °C respectively

(<https://www.skymetweather.com>). These collective environmental factors create a natural habitat for butterflies to be present in Chennai. In this study, we selected 17 locations from four districts of Chennai, Kancheepuram, Chengalpet and Thiruvallur representing four different habitats namely Tropical Dry Evergreen forests (TDEF), grasslands, scrubland, wetlands and community park habitats. The study area surveyed has been listed in Table 1 and illustrated in Figure 1.



**Fig 1:** Study area covering 17 locations from districts of Chennai, Kancheepuram, Chengalpet and Thiruvallur

The butterfly field surveys were conducted from January 2014 to March 2020 covering all month with a total of 416 field days. At each study area, a fixed transect was chosen such that each transects covered the majority of the study area. Field surveys were carried out on fixed transects during morning hours (0730 hrs to 1200hrs) and late evening hours (1430hrs to 1700hrs). We documented every butterfly species that we sighted on mud-puddling, both sides of the transect and the butterflies perching overhead or in flight at any distance from the transect. The field surveys were only performed during favorable weather without heavy rains and winds. The butterflies were photo-documented and identified using the butterfly field guide [21] and online resources [22]. For some butterflies, we couldn't identify them without dissection to the species level. For such species, we recorded only the Genus name. No specimens were collected during the study.

To assess the relative abundance of the butterfly species, we proposed a new butterfly categorization as follows: The butterflies were categorized as Common (C) [recorded >60%], Occasional (O) [recorded 40-60%], Rare (R) [recorded 10-40%] and Very Rare (VR) [recorded <10%] based on the sightings on the field surveys.

## Results and Discussion

During the course of the study, a total of 150 species of butterflies (Table 2) belonging to 19 subfamilies and 36 tribes were documented from the study area. This includes 31 species of Hesperidae, 41 species of Lycaenidae, 39 species of Nymphalidae, 13 species of Papilionidae, 25 species of Pieridae and one species of Riodinidae. The number of butterflies documented from different areas are represented in Table 1.

**Table 1:** List of Locations surveyed in the study with GPS coordinates.

District	Location	Abbreviation	Habitat	GPS Coordinate	Number of species
Chennai	Guindy National Park	GNP	TDEF	12°59'55.0"N 80°13'44.8"E	118
	Indian Institute of Technology-Madras	IIT-M	TDEF	12°59'30.6"N 80°14'09.1"E	78
	Theosophical society	TS	TDEF	13°00'39.8"N 80°15'38.9"E	67
	Indiranagar	IND	Community park	12°59'55.5"N 80°15'17.7"E	99
	Adyar Poonga	AP	TDEF with small patches of grassland	13°01'10.9"N 80°15'53.9"E	71
	Thiruvanmaiyyur	THIR	Community park	12°58'26.3"N 80°15'56.1"E	72
	Anna Nagar	AN	Community park	13°05'11.8"N 80°12'49.1"E	57

Chengalpet	Chembarambakam Lake	CHEM	Grassland and TDEF	13°00'31.9"N 80°04'54.4"E	68
	Nanmangalam	NAN	Scrubland	12°55'33.8"N 80°10'24.0"E	72
	Madras Christian college	MCC	Scrubland and TDEF	12°55'05.1"N 80°07'30.3"E	89
	Amoor Reserve forest	AMR	Scrubland	12°39'30.7"N 80°08'21.9"E	57
	SSN College of Engineering	SSNCE	Grassland and tree cover	12°44'59.1"N 80°11'51.3"E	71
	Karikili Bird Sanctuary	KBS	Wetland and TDEF	12°35'58.5"N 79°50'28.5"E	53
	Madras Crocodile Bank Trust	MCBT	Forest	12°44'34.8"N 80°14'21.7"E	56
Kancheepuram	Soomangalam	SOM	Scrubland	12°55'06.8"N 80°00'40.9"E	57
Thiruvallur	Neemam	NEM	Grassland	13°04'20.7"N 80°00'46.2"E	56
	Pulicat Lake	PUL	Wetland and grassland	13°24'17.7"N 80°18'12.4"E	52

**Table 2:** Checklist of butterflies with their months observed and relative abundance.

S. No	Common Name	Scientific Name	Month	Relative abundance
<b>Hesperiidae</b>				
1	Common Banded Awl	<i>Hasora chromus</i>	1-12	C
2	White Banded Awl	<i>Hasora taminatus</i>	6-9	R
3	Brown Awl	<i>Badamia exclamationis</i>	4-10	O
4	Plain Banded Awl	<i>Hasora vitta</i>	11	VR
5	Bush Hopper	<i>Ampittia dioscorides</i>	1-12	O
6	Tree Flitter	<i>Hyarotis adrastus</i>	1-12	VR
7	Common Redeye	<i>Matapa aria</i>	1	VR
8	Chestnut Bob	<i>Iambrix salsala</i>	1-12	C
9	Indian Palm Bob	<i>Suastus gremius</i>	1-12	C
10	Grass Demon	<i>Udaspes folus</i>	1-12	O
11	Paint-brush Swift	<i>Baoris farri</i>	12	VR
12	Rice Swift	<i>Borbo cinnara</i>	9-1	LC
13	Blank Swift	<i>Caltois kumara</i>	11-1	VR
14	Little Branded Swift	<i>Pelopidas agna</i>	11-3	O
15	Conjoined Swift	<i>Pelopidas conjuncta</i>	1-12	O
16	Small Branded Swift	<i>Pelopidas mathias</i>	1-12	C
17	Straight Swift	<i>Parnara bada</i>	1-12	C
18	Dart spp	<i>Pothanthus sp</i>	9,10	VR
19	Common Grass Dart	<i>Taractrocerma maevius</i>	9-3	O
20	Indian Dartlet	<i>Oriens goloides</i>	9-3	R
21	Dark Palm-Dart	<i>Telicota bambusae</i>	6-1	R
22	Pale Palm-Dart	<i>Telicota colon</i>	1-12	R
23	Tamil Grass Dart	<i>Taractrocerma ceramas</i>	1	VR
24	African Marbled Skipper	<i>Gomalia elma</i>	1-12	O
25	Indian Skipper	<i>Spialia galba</i>	1-12	C
26	Common Small flat	<i>Sarangesa dasahara</i>	5	VR
27	Spotted Small Flat	<i>Sarangesa purendra</i>	1,7	VR
28	Golden Angle	<i>Caprona ransonnetii</i>	12	VR
29	Tricolour Pied Flat	<i>Coladenia indrani</i>	1-12	O
30	Suffused Snow Flat	<i>Tagiades gana</i>	12-3	R
31	Common Snow Flat	<i>Tagiades japetus</i>	10-1	R
<b>Lycaenidae</b>				
32	Indian Sunbeam	<i>Curetis thetis</i>	1-12	C
33	Apefly	<i>Spalgis epius</i>	1-12	O
34	Pointed Ciliate Blue	<i>Anthene lycaenina</i>	1-12	R
35	Common Hedge Blue	<i>Acytolepis puspa</i>	9	VR
36	African Babul Blue	<i>Azanius jesus</i>	1-12	O
37	Bright Babul Blue	<i>Azanius ubaldus</i>	7-9	R
38	Angled Pierrot	<i>Caleta decidia</i>	10-3	R
39	Common Pierrot	<i>Castalius rosimon</i>	1-12	C
40	Forget-me-not	<i>Catochrysops strabo</i>	1-12	C
41	Lime Blue	<i>Chilades lajus</i>	1-12	C
42	Plains Cupid	<i>Chilades pandava</i>	1-12	C
43	Small Cupid	<i>Chilades parrhasius</i>	1-12	O

44	Gram Blue	<i>Euchrysops cnejus</i>	1-12	C
45	Indian Cupid	<i>Everes lacturnus</i>	1-12	R
46	Small Grass Jewel	<i>Freyeria putli</i>	1-12	C
47	Grass Jewel	<i>Freyeria trochylus</i>	1-12	O
48	Dark Cerulean	<i>Jamides bochus</i>	2, 4-8	LC
49	Common Cerulean	<i>Jamides celeno</i>	1-12	C
50	Pea Blue	<i>Lampides boeticus</i>	1-12	C
51	Zebra Blue	<i>Leptotes plinius</i>	1-12	C
52	Transparent Six-Lineblue	<i>Nacaduba kurava</i>	3	VR
53	Tailless Lineblue	<i>Prosotas dubiosa</i>	1-12	O
54	Common Lineblue	<i>Prosotas nora</i>	1-12	C
55	White-tipped Lineblue	<i>Prosotas noreia</i>	12	VR
56	Pale Grass Blue	<i>Pseudozizeeria maha</i>	12-2	R
57	Black-spotted Pierrot	<i>Tarucus balkanicus</i>	2	VR
58	Rounded Pierrot	<i>Tarucus nara</i>	4-8	VR
59	Dark Grass Blue	<i>Zizeeria karsandra</i>	6-11	C
60	Lesser Grass Blue	<i>Zizina otis</i>	6,7,11-3	C
61	Tiny Grass Blue	<i>Zizula hylax</i>	1-12	C
62	Purple Leaf Blue	<i>Amblypodia anita</i>	12	VR
63	Silverstreak Blue	<i>Iraota timoleon</i>	2-6	R
64	Common Shot Silverline	<i>Spindasis ictis</i>	5	VR
65	Common Silverline	<i>Spindasis vulcanus</i>	1-12	O
66	Large Oakblue	<i>Arhopala amantes</i>	5-12	O
67	Cornelian	<i>Deudorix epijarbas</i>	1	VR
68	Red Flash	<i>Rapala iarbus</i>	3,7,8	R
69	Slate Flash	<i>Rapala manea</i>	9-2	R
70	Common Guava Blue	<i>Virachola isocrates</i>	1-12	O
71	Monkey Puzzle	<i>Rathinda amor</i>	1-12	O
72	Peacock Royal	<i>Tajuria cippus</i>		VR
<b>Nymphalidae</b>				
73	Angled Castor	<i>Ariadne ariadne</i>	1-12	C
74	Common Castor	<i>Ariadne merione</i>	1-12	C
75	Joker	<i>Byblia ilithyia</i>	1-12	R
76	Anomalous Nawab	<i>Charaxes agraria</i>	9-12	R
77	Common Nawab	<i>Charaxes bharata</i>	9-12	VR
78	Black Rajah	<i>Charaxes solon</i>	1-12	O
79	Plain Tiger	<i>Danaus chrysippus</i>	1-12	C
80	Striped Tiger	<i>Danaus genutia</i>	1-12	C
81	Common Crow	<i>Euploea core</i>	1-12	C
82	Double-branded Black Crow	<i>Euploea sylvester</i>	6-9	C
83	Brown King Crow	<i>Euploea klugii</i>	7,12-2	R
84	Glassy Tiger	<i>Parantica aglea</i>	11-2	R
85	Blue Tiger	<i>Tirumala limniace</i>	1-12	C
86	Dark Blue Tiger	<i>Tirumala septentrionis</i>	7-9	C
87	Tawny Coster	<i>Acraea terpsicore</i>	1-12	C
88	Common Leopard	<i>Phalanta phalantha</i>	1-12	C
89	Cruiser	<i>Vindula erota</i>	10-12	VR
90	Southern Beak	<i>Libythea laius</i>	5-8	R
91	Common Baron	<i>Euthalia aconthea</i>	1-12	R
92	Baronet	<i>Symphaedra nais</i>	10-3	R
93	Common Sailer	<i>Neptis hylas</i>	1-12	C
94	Chestnut-streaked Sailer	<i>Neptis jumbah</i>	1-12	O
95	Great Eggfly	<i>Hypolimnas bolina</i>	3,6-12	C
96	Danaid Eggfly	<i>Hypolimnas misippus</i>	1-12	C
97	Peacock Pansy	<i>Junonia almana</i>	1-12	C
98	Grey Pansy	<i>Junonia atlites</i>	1-12	C
99	Yellow Pansy	<i>Junonia hierta</i>	1-12	C
100	Chocolate Pansy	<i>Junonia iphita</i>	1-12	C
101	Lemon Pansy	<i>Junonia lemonias</i>	1-12	C
102	Blue Pansy	<i>Junonia orithya</i>	1-12	C
103	Painted Lady	<i>Vanessa cardui</i>	6-8	C
104	Common Palmfly	<i>Elymnias caudata</i>	1-12	R
105	Common Evening Brown	<i>Melanitis leda</i>	10-2	C
106	Dark Evening Brown	<i>Melanitis phedima</i>	9,12	R
107	Long-branded/ Dark-brand Bushbrown	<i>Mycalesis visala /Mycalesis mineus</i>	9	R
108	Common Bushbrown	<i>Mycalesis perseus</i>	9-12	C
109	Tamil Bushbrown	<i>Mycalesis subdita</i>	7-12	R
110	Common Three-ring	<i>Ypthima asterope</i>	12	VR

111	Common Five-ring	<i>Ypthima baldus</i>	12,5	VR
<b>Papilionidae</b>				
112	Tailed Jay	<i>Graphium agamemnon</i>	1-12	C
113	Common Jay	<i>Graphium doson</i>	1-12	C
114	Spot Swordtail	<i>Graphium nomius</i>	5-9	C
115	Southern Bluebottle	<i>Graphium terebon</i>	11	O
116	Common Mime	<i>Papilio clytia</i>	12-7	R
117	Common Banded Peacock	<i>Papilio crino</i>	9-2	O
118	Lime Butterfly	<i>Papilio demoleus</i>	1-12	C
119	Red Helen	<i>Papilio helenus</i>	9	VR
120	Blue Mormon	<i>Papilio polymnestor</i>	9,11-4	O
121	Common Mormon	<i>Papilio polytes</i>	1-12	C
122	Common Rose	<i>Pachliopta aristolochiae</i>	9-12	C
123	Crimson Rose	<i>Pachliopta hector</i>	1-12	C
124	Southern Birdwing	<i>Troides minos</i>	5-9	LC
<b>Pieridae</b>				
125	Common Emigrant	<i>Catopsilia pomona</i>	1-12	C
126	Mottled Emigrant	<i>Catopsilia pyranthe</i>	1-12	C
127	One-spot Grass Yellow	<i>Eurema andersoni</i>	6-10	R
128	Three-spot Grass Yellow	<i>Eurema blanda</i>	9-12	R
129	Small Grass Yellow	<i>Eurema brigitta</i>	1-12	C
130	Common Grass Yellow	<i>Eurema hecabe</i>	1-12	C
131	Spotless Grass Yellow	<i>Eurema laeta</i>	1	VR
132	Great Orange-tip	<i>Hebomoia glaucippe</i>	6-3	R
133	Psyche	<i>Leptosia nina</i>	1-12	C
134	Common Wanderer	<i>Pareronia hippia</i>	1-12	C
135	Common Albatross	<i>Appias albina</i>	5-7	C
136	Striped Albatross	<i>Appias libythea</i>	7,11-3	C
137	Chocolate Albatross	<i>Appias lycinda</i>	2	VR
138	Pioneer	<i>Belenois aurota</i>	6-10	C
139	Common Gull	<i>Cepora nerissa</i>	1-12	C
140	Common Jezebel	<i>Delias eucharis</i>	1-12	C
141	Red-spot Jezebel	<i>Delias descombesi</i>	5	VR
142	Indian Cabbage White	<i>Pieris canidia</i>	12-2	VR
143	Small Salmon Arab	<i>Colotis amata</i>	1-12	C
144	Plain Orange-tip	<i>Colotis aurora</i>	6,7	C
145	Crimson-tip	<i>Colotis danae</i>	1-12	C
146	Little orange-tip	<i>Colotis etrida</i>	1-12	LC
147	Large Salmon Arab	<i>Colotis fausta</i>	1-12	LC
148	White Orange-tip	<i>Ixias marianne</i>	7-10	O
149	Yellow Orange-tip	<i>Ixias pyrene</i>	1-12	C
<b>Riodinidae</b>				
150	Plum Judy	<i>Abisara bifasciata</i>	10	VR

Out of the 150 recorded species, listed in Table 2, 12 species were protected under the Wildlife (Protection) Act, 1972; with three species (Crimson Rose - *Pachliopta hector*, Common Mime - *Papilio clytia* and White-tipped Lineblue - *Prosotas noreia*) from Schedule-I, four species (Pea Blue - *Lampides boeticus*, Gram Blue - *Euchrysops cnejus* and Chocolate Albatross - *Appias lycinda*) from Schedule-II, one species namely Danaid Eggfly - *Hypolimnas misippus* featured both in Schedule-I and II and five species (Paintbrush Swift - *Baoris farri*, Plain Banded Awl - *Hasora vitta*, Tree Flitter - *Hyarotis adrastus*, Brown King Crow - *Euploea klugii* and

Striped Albatross - *Appias libythea*) from Schedule-IV. Four species namely Common Banded Peacock (*Papilio crino*) was endemic to both Peninsular India and Bengal; Crimson Rose (*Pachliopta hector*) was endemic to Peninsular India and Sri Lanka; Southern Birdwing (*Troides minos*) and Southern Bluebottle (*Graphium terebon*) were endemic to South India, and Tamil Bushbrown (*Mycalesis subdita*) was endemic to both South India and Sri Lanka.

The overview of the family-wise butterfly distribution and the species protected under The Wildlife (Protection) Act, 1972 is tabulated in Table 3.

**Table 3:** The overview of the family-wise butterfly distribution and the species protected under Wildlife (Protection) Act, 1972

Family	Number of sub-families	Number of tribes	Number of species	WPA-protected species			
				Schedule I	Schedule I and Schedule II	Schedule II	Schedule IV
Hesperiidae	3	6	31				3
Lycaenidae	4	9	41	1		2	
Nymphalidae	8	12	39		1	1	1
Papilionidae	1	3	13	2			
Pieridae	2	5	25			1	1
Riodinidae	1	1	1				
Total	19	36	150	3	1	4	5



Chennai district recorded the most number of species, with 128 species, followed by Chengalpet with 114 species, Thiruvallur with 67 species and Kancheepuram with 66 species. The recent bifurcation of the erstwhile Kancheepuram district into Kancheepuram and Chengalpet district can be attributed to the low numbers from Kancheepuram. Thiruvallur district's open landscape and limited access to the existing forested patches could be attributed to the lower species count. Few of the representative butterfly images is illustrated in Figure 2.

The results of other recent publications from the state were compared diversity of butterflies in the study area. A study from Amrita Vishwa Vidyapeetham recorded 138 species of butterflies, slightly lesser than the whole region, but more than any single hotspot in our study area [23]. Another study from Adukkam forest recorded 72 species of butterflies, less

than half the total number of species of butterflies recorded in the study area, but more than the number of butterflies recorded in ten of the hotspots in the current study [24]. It is interesting to note that wet forest species such as the Southern Birdwing (*Troides minos*), One-spot Grass Yellow (*Eurema andersonii*), Red Helen (*Papilio helenus*) and Southern Bluebottle (*Graphium teredon*), that were recorded in these two studies, were recorded in our study from Chennai. Another study from Nehru Memorial College and Puthanampatti Village also recorded 72 species [25]. A study Manonmaniam Sundaranar University reported 57 species of butterflies and another from Tamil Nadu Agriculture College and Research Institute Campus (Madurai), showing less diversity when compared to the hotspots in the study area under consideration [26, 27].



**Fig 2:** 1. White-banded Awl (*Hasora taminatus*) 2. Brown Awl (*Badamia exclamationis*) 3. Tree Fliter (*Hyarotis adrastus*) 4. Spotted Small Flat (*Sarangesa purendra*) 5. Common Redeye (*Matapa aria*) 6. Angled Pierrot (*Caleta decidia*) 7. Transparent Six-Lineblue (*Nacaduba kurava*) 8. White-tipped Limeblue (*Prosotas noreia*) 9. Common Shot Silverline (*Spindasis ictis*) 10. Monkey Puzzle (*Rathinda amor*) 11. Joker (*Byblia ilithyia*) 12. Tamil Bushbrown (*Mycaliesis subdita*) 13. Southern Beak (*Libythea laius*) 14. Baronet (*Symphaedra nais*) 15. Dark Evening Brown (*Melanitis phedima*) 16. Red Helen (*Papilio helenus*) 17. Blue Mormon (*Papilio polymnestor*) 18. Spot Swordtail (*Graphium nomius*) 19. Southern Birdwing (*Troides minos*) 20. Common Mime (*Papilio clytia*) 21. Spotless Grass Yellow (*Eurema laeta*) 22. Great Orange-tip (*Hebomoia glaucippe*) 23. Red-spot Jezebel (*Delias descombesi*) 24. Indian Cabbage White (*Pieris canidia*) 25. Plum Judy (*Abisara bifasciata*)

GNP (Guindy National Park) was recorded as the most diverse habitat in the region, with 118 species. IND (Indiranagar) and MCC (Madras Christian College) were the next locations with high diversity, recording 99 and 88 species respectively. Interestingly, only 66% of species recorded at GNP were recorded from IIT-M (Indian Institute of Technology- Madras), an adjacent campus selected in the study. This could be due to the fragmentation of habitat and disturbances in habitat caused by anthropogenic activity, as recorded in other studies across the world [28, 29]. The least butterfly diversity was recorded from PUL, with 52 species, probably due to the lack of forest cover in the wetland habitat.

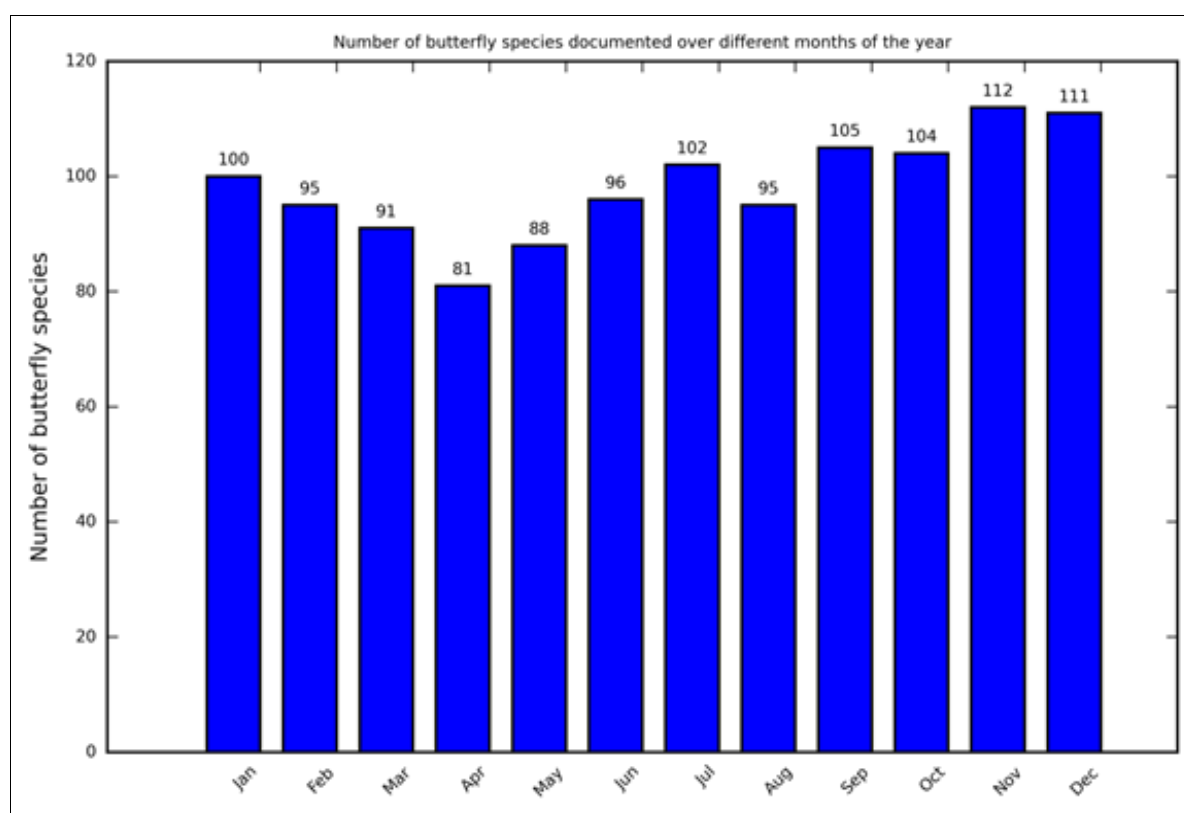
Vandalur Reserve Forest, though not surveyed in this study, has the potential to be a butterfly hotspot from previous work [30].

The distribution of butterflies in a location was seen to be closely related to the habitats present in the hotspot. The richest habitat from the survived habitats was the TDEF habitat, with 118 species. The next highest species diversity was seen in community parks with 73 species, and scrub forests with 67 species. 57 species were recorded in grassland habitats, while wetland setups had the poorest diversity, with only 40 species.

74 species of butterflies were recorded throughout the year

during the study. 19 species, the Plain Banded Awl (*Hasora vitta*), Complete Paint Brush swift (*Baoris farri*), Tamil Grass Dart (*Taractrocera ceramas*), Common Small Flat (*Sarangesa dasahara*), Golden Angle (*Caprona ransonnetii*), Common Hedge Blue (*Acytolepis puspa*), Transparent Six-Lineblue (*Nacaduba kurava*), White-tipped Lineblue (*Prosotas noreia*), Black-spotted Pierrot (*Tarucus balkanica*), Rounded Pierrot (*Tarucus nara*), Purple Leaf Blue (*Amblypodia anita*), Common Shot Silverline (*Spindasis ictis*), Cornelian (*Deudorix epijarbas*), Common Three-ring (*Ypthima asterope*), Common Five-ring (*Ypthima baldus*), Red Helen (*Papilio helenus*), Spotless Grass Yellow (*Eurema laeta*), Red-spot Jezebel (*Delias descombesi*) and the Double-banded Judy (*Abisara bifasciata*) were documented only once and five species, the Dart spp (*Potanthus sp.*), Peacock Royal (*Tajuria cippus*), Common Nawab (*Charaxes bharata*), Cruiser (*Vindula erota*) and the Chocolate Albatross (*Appias lyncida*), were documented only twice during the study

period. The months during the North-east Monsoon recorded the highest number of species. During the study, a maximum number of species was seen in the month of November (112 species), while a maximum number of individuals was recorded between the third week of July and late September period when the mass emergence of butterflies such as Lime blue (*Chilades lajus*), Lime butterfly (*Papilio demoleus*) and Common Emigrant (*Catopsilia pomona*), and Danainae migration movement was observed. This coincides with the SW monsoon season, even though Chennai receives only 20% of its rainfall (<https://www.skymetweather.com>) from this season. The period of April- May was seen to be the poorest for butterfly diversity and density, probably due to the lack of favorable conditions such as availability of nectar plants and necessary climatic conditions. However, more than half of the months recorded greater than 100 species of butterflies. The number of butterflies documented over different months is illustrated in Figure 3.



**Fig 1:** Number of butterflies sighted over different months of the year

Figure 4 shows the variation of species recorded across the years. The most number of species was observed in the year 2016. This could be attributed to the heavy rains at the end of 2015<sup>[31]</sup> and regular monthly showers in the summer of 2016<sup>32</sup>. This helped in recording many species that were associated with wetter habitats, as reported by others<sup>[33]</sup>.

The earlier studies<sup>[14-18]</sup> that had been conducted in Chennai from various areas collectively documented not more than 100 species and did not cover the entirety of the city. Though they individually do not represent a comprehensive representation of the city, they collectively helped collate a baseline understanding of the city

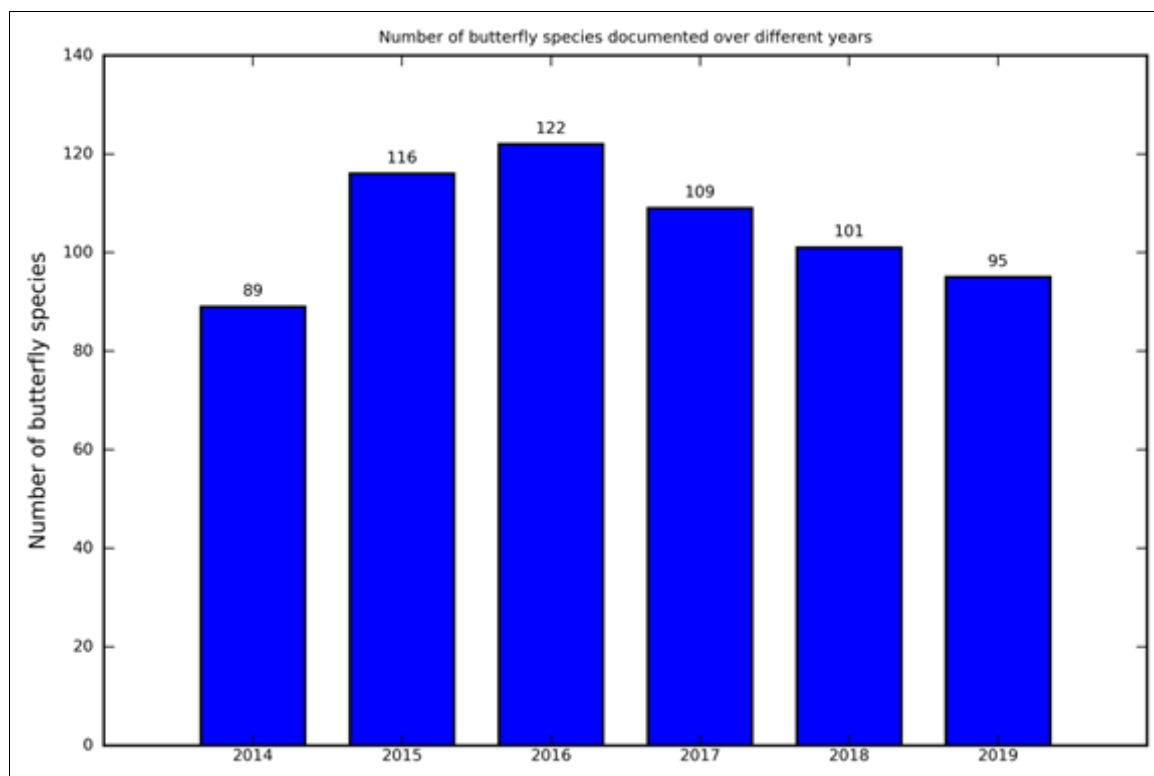


Fig 2: Number of butterflies sighted over different years of the study

Species that were not recorded by previous studies were considered as new records to the study area. 28 species were recorded for the first time from the study area. More than half the species belonged to Hesperiiidae. However, the Scare Shot Silverline, reported by E. Y. Watson 1890, (*Cigaritis elima*), was not seen in the study.

As an outcome of this study, several species considered to be confined to the Western Ghats and the Eastern Ghats habitats like Tree Flitter (*Hyarotis adrastus*), Paint Brush swift (*Baoris farri*), Conjoined Swift (*Pelopidas conjuncta*), Golden angle (*Caprona ransonnetii*), Suffused Snow Flat (*Tagiades gana*) and Common Grass Dart (*Taractroceras ceramas*) were recorded, by comparing with the known distribution of the species [21, 22].

The most notable sighting is the record of the Red-spot Jezebel (*Delias descombesi*), the first sighting of this species from Southern India and the State. The distribution is usually restricted to North East India and Sikkim [2]. According to Kehimkar 2016, it is seen from Sikkim-Arunachal, North-east India, Nepal, Bhutan and Myanmar. The butterfly is common in Assam [34]. Indian Cabbage White (*Pieris canidia*) was recorded five times between 2015- 2017, by the first author, not seen ever since in the park. One individual was seen in December 2018 at IND. Nearest verifiable photographic records of the species are from Sim's Park, Coonor. Nilgiri District, Tamil Nadu [35]. Known to be a higher elevation species from South India [21]. The known host plants of this species from the Western Ghats include *Brassica oleracea*, *Rorippa dubia*, *Rorippa indica* and *Sisymbrium* [36], which are not seen in Chennai. Hence, these records could be accidental or could be explained from vegetable produce transportation. More records will be needed to confirm the distribution of this species outside of the Western Ghats.

## Conclusion

The study reports 150 species of butterflies from the study area, with 128, 114, 67 and 66 species reported from Chennai,

Chengalpattu, Thiruvallur and Kancheepuram districts respectively. The butterfly diversity in the month of November was seen to be the highest. Our butterfly sampling sites at Kancheepuram and Thiruvallur were limited to three. So in the future, more sites should be chosen to assess the butterfly diversity in the districts of Kancheepuram, and Thiruvallur and to have a better understanding of the butterfly diversity of these districts. The extensive plantation of native larval host plants and nectar plants will help to support the butterfly diversity in the study area. The growing of green corridors in the city might help in sustaining the butterfly diversity.

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