



Butterflies of Mukkuruthi wildlife habitat, western ghats of Kerala

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Abstract

It is discussed the butterfly flora of Kerala's Silent Valley National Park (SVNP) and its surrounding area. A total of 290 species can be found in SVNP and its surroundings, including the 335 species recorded from Western Ghats (WG) and the 326 species from Kerala. Of these, 269 species were documented from inside the borders of the core of SVNP, and another 21 species are confirmed from its buffer zone. The Papilionidae, 26 Pieridae, 85 Nymphalidae, 82 Lycaenidae, and 77 Hesperidae, 1 Riodinidae, species were among them. A total of 63 species were classified in the WPA 1972 schedules, 31 species were exclusively indigenous to the Western Ghats, and 19 species were listed on the IUCN Red Lists. The area is home to 89% of the 326 species of butterflies found in Kerala as well as 87% of the 335 species found in Western Ghats. In the SVNP, the Western Ghats are home to about 11% of the butterfly biodiversity. 86% of all IUCN Red listed species are listed in Kerala and the WG in Silent Valley and surrounding areas. In addition, 90% of the species listed under WG and 91% of those classified under WPA are found in this area. As a result, SVNP and its surroundings are among the butterfly-richest areas.

Keywords: Shola, lepidoptera, grasslands, WPA, checklist, endemics, IUCN

Introduction

On the western slopes of the Nilgiri Landscape of the Western Ghats, close to the Palghat gap, is Silent Valley National Park (SVNP). The majority of the division is located in Kerala's Mannarkkad Taluk, which is part of the Palakkad District. The Malappuram District's Nilambur Taluk contains a portion of the buffer zone. The region is located between latitudes 76.40 and 76.53 OE and 11.03 and 11.22 ON. The Silent Valley Forest Division presently covers a total area of 237.52 km² that is made up of the Silent Valley Range (143.52 km²) and the Bhavani Range buffer zone (94 km²) (Image 1). From 95 meters in Thatthengalam to 2,383 meters at the Anginda peak, this area's height varies. Rainfall in this region is caused by both the north-east and south-west monsoons. However, the south-west monsoon, which arrives during the first week of June, accounts for the lion's share. The three months of June, July, and August get the most rainfall. Rainfall varies from 7,500 mm per year on the northern side to 2,800 mm (southeastern dry zone) according to weather data collected from forest parts. For the core zone and the buffer zone, respectively, the river Kunthipuzha (Bharatapuzha) and Bhavanipuzha are the main drainage basins (Nair 1991) [11]. The typical minimum temperature is from 8 to 14 oC, and the typical maximum temperature goes from 23 to 29 oC. Based on Champion & Seth (1968), the forests and surroundings of Silent Valley Division can be divided into the following types. 20% of the protected area is grassland, and the remaining 75%–80% is covered in dense woody forest. While the southeastern boundaries feature drier Dry Deciduous Scrub vegetation, the areas on the northwestern slopes contain abundant wet evergreen forests (Image 2).

2,000 plant species, 41 mammal species, 97 bird species, 42 reptile species, and 46 amphibian species have all been recorded in the area, demonstrating its excellent biodiversity

(Manoharan *et al.* 1999) [9]. During the 1980s, Larsen (1987a,b,c; 1988) [8], who was researching the butterflies of Tamil Nadu's Nilgiris District, made a brief trip to Mukkali. *Eurema andersoni shimai* has been found in the Nilgiris by Yata & Gaonkar (1999) [15], who also defined the new subspecies, its host plants, and flight times. 96 species from the SVNP were reported by Mathew (1999) during a research from 1987 to 1990. In surveys conducted by Mathew & Rahamathulla (1993) [10] and Mathew (1994), 100 species of butterflies were identified. According to Larsen's 1978 report on the Nilgiris and Mathew & Binoy's 2002 report on the New Amarambalam Reserve Forest, butterfly migration reports have been made from nearby areas.

On the butterfly flora of this protected tract, there are no further published records. The first rigorous systematic survey of butterflies in Silent Valley National Park, conducted by TNHS in collaboration with SVNP in September 2016 and yielding records of 180 species over the course of three days, was not before conducted. On the basis of an analysis of prior research and our fieldwork in the area, we present 290 butterfly species from SVNP in this publication.

Materials and methods

This essay is a collection of the writers' field observations from the last two decades. Hampson (1888) [5], Larsen (1987a,b,c, 1988) [8], Mathew & Rahamathulla (1993) [10], Mathew (1994, 1999), and Mathew & Binoy (2002) were reviewed for their prior work on butterflies in the area. Additionally, the information recorded in the management plan (Anonymous 2012) and the report on the first thorough invertebrate survey of the SVNP conducted in 2016 that TNHS submitted to the Kerala Forest Department (Sadasivan & Jayakumar 2016) were both consulted. A 4-

day trek from Mukurthi to Mukkali and the authors' field data from sporadic visits to the area were also included. Field surveys were conducted using the usual transect methodology (3 km in 3 hours), with basecamps located strategically to cover all ecosystems and elevational gradients of the National Park. Walakkad, Poochipara, Sispara, Punnamala, Havelock, Neelikkal, and Sairandry were used as basecamps for the evaluation of the core region. Kottappuzha, Keerippara, Panthanthodu, Mukkali, Thathengalam and Thudukki, were among the neighborhoods in the buffer zone that were sampled. Karuvarakundu was occasionally visited, both on the Mukkali side in the southeast dry zone and in the wetter, evergreen Nilambur slopes in the northwest. The butterfly wildlife of the central of SVNP and its buffer are taken into record combined for all controls. In this paper we have classified the occurrence data based on transect encounters with the status as Very Common (VC) if seen in >75% of transects, Common (C) if seen in 50–75%, Not Rare (NR) if seen in 25–50% transects, Rare (R) in a case seen in 5–25%, and Very Rare (VR) if seen in <5% of the transects. Doubtful records are mentioned under the discussion part of each family. Based on analysis of male brands, observation and raising of early stages, and examination of the male genitalia of specimens outside protected areas bordering the research region, species of the genera *Mycalesis*, *Nacaduba*, *Pelopidas*, and *Potanthus* were identified. Transects with biodiversity indices and conservation values will be thoroughly analyzed and published elsewhere. The IUCN website <http://www.iucnredlist.org> provided the information on the worldwide conservation status (IUCN 2021). In order to determine the species classified under the schedules, the Wildlife (Protection) Amendment Act 2002 has been examined, along with the Indian Wildlife Protection Act (WPA) of 1972 and its revisions up until 2022.

Results and discussion

According to the most recent estimations (Sadasivan & Sengupta 2023, in press; Sadasivan *et al.* 2023, in press), Kerala state has 326 species while the Western Ghats have 335 species. From SVNP and its buffer zone, we discovered 290 different species of butterflies. This includes 82 Lycaenidae, 77 Hesperidae, 85 Nymphalidae, 19 Papilionidae species, 26 Pieridae species, 1 Riodinidae species, and 82 Lycaenidae species (Figure 1A). We discovered 269 species inside the SVNP's core borders, while another 21 species were confirmed in its buffer zone. 13 species' records need to be verified in further detail.

The remarkable diversity of butterflies in the SVNP and surrounding areas is suggested by analysis of historical writings. From the Nilgiri region, Wynter-Blyth listed 290 species, Hampson (1888) ^[5] had 260 valid taxa, Yates (1935) ^[16] had 282 species, and Larsen (1987–1988) ^[8] reported 299 species. We can observe that approximately 100 species were recorded by Mathew & Rahamathulla (1993) ^[10], Mathew (1994, 1999), and Mathew & Binoy (2002) from the SVNP on the western slopes of the Nilgiris. For a region as biodiverse as SVNP, 290 species are reported in this study, which is a more reasonable total. Due to the smaller land area and lack of pure dry scrub vegetation in SVNP, which is home to many arid species on the northern slopes of Nilgiris, the total may be lower than in Nilgiris proper. At SVNP, all 19 of the Papilionidae species observed in Kerala and the Western Ghats have been

identified. This contains the three strictly endemic species of the Western Ghats, *Papilio buddha* Westwood, 1872, and *Pachliopta pandiyana* Moore, 1881. In the area, one can witness peacocks of all three species: *Papilio paris tamilana* Moore, 1881; *P. buddha* Westwood, 1872; and *P. crino* Fabricius, 1793. *C. etrida etrida* (Boisduval, 1836), and *C. fausta fulvia* (Wallace, 1867), were reported from the drier south-eastern edge of the buffer zone. It is necessary to confirm whether these straggler species exist in the SVNP. In a study on butterflies in Anaikatti, a location bordering the SVNP's southeast, these species are also listed (Selvaraj & Arun 2014) ^[13]. *Appias lalage lalage* (Doubleday, 1842) has also been the subject of reporting from Walakkad and Mukurthi. SVNP and its surroundings are home to 85 species of Nymphalidae, including the 12 Western Ghat endemics listed below, out of the 100 species in WG and the 97 species in Kerala.

Only *Abisara bifasciata suffusa* Moore, 1882, of the two Riodinidae species recorded from the WG was seen there. There is still no sign of *Abisara echerius prunosa* Moore, 1879, in this area.

82 of Kerala's 94 species and 98 of the Western Ghats' species belonged to the Lycaenidae family. *Celatoxia albidisca* (Moore, [1884]), *Arhopala alea* (Hewitson, 1862), and *Curetis siva* (Evans, 1954) were three strictly endemic species that were reported.

Two species—*Nacaduba calauria evansi* Toxopeus, 1927, and *Thaduka multicaudata kanara* Evans, 1925—as well as three species—*Hypolycaena nilgirica* Moore, [1884], *Tajuria jehana jehana* Moore, [1884], and *Ancema sudica* (Evans, 1926)—were included based on our records from the buffer zone. However, the nearby Nilgiris and Nilambur valley species *Freyeria trochylus* (Freyer, 1845), *Arhopala bazaloides bazaloides* (Hewitson, 1878), *Tajuria maculatus* (Hewitson, 1865), and *Tajuria melastigma* de Nicéville, 1887 are yet unrecorded inside SVNP. In the nearby shola-grasslands, *udara akasa mavisa* (Fruhstorfer, 1917) (Image 3F) was widespread. Out of the 82 Hesperidae species found in Kerala and the Western Ghats, 77 were found in SVNP. Both the endemic *Baracus hampsoni* Elwes & Edwards, 1897, and *B. subditus* Moore, [1884] hedgehoppers, which are dependent on grassland habitats, were noted. It was not unusual to find the grassland species *Arnetta mercara* Evans, 1932. The wetter north-western slopes were home to *Thoressa honorei* (de Nicéville, 1887), *Thoressa astigmata* (Swinhoe, 1890), *Halpemorpha hyrtacus* (de Nicéville, 1897), *Quedara basiflava* (de Nicéville, [1889]), *Halpe hindu* Evans, 1937, and *Thoressa astigmata* (Swinhoe, 1890). The *Thoressa sitala* (de Nicéville, 1885) and *Caltoris canaraica* (Moore, [1884]) (Image 3H) were discovered in the upper altitudes >1200 m ASL. *Aeromachus dubius dubius* Elwes & Edwards, 1897, *Sarangesa purendra hopkinsi* Evans, 1921, and *Caprona alida vespa* Evans, 1949 were not present. While *Gomalia elma albofasciata* (Moore, 1879) and *Gerosis bhagava bhagava* (Moore, [1866]) were discovered in the dry zone, other species included *Spialia galba* (Fabricius, 1793), *Zographetus ogygia* (Hewitson, [1866]), *Cephrenes acalle oceanica* (Mabille, 1904), *Taract.*

Endemicity

Out of the 290 species found in SVNP and its surroundings, 60 species possessed some degree of endemicity, with 31 species being wholly unique to the Western Ghats.

Therefore, 11% of the butterflies in the SVNP are indigenous to the WG (Figure 3A). Out of the 38 species that are presently thought to be wholly exclusive to the Western Ghats, this is one. As a result, 82% of all butterflies designated as strictly unique to the Western Ghats are found there. Among them, the Western Ghats' Nilgiris-Coorg region is home to the montane endemics *Telinga adolphei*, *Mycalasis igilia*, *Argynnis hybrida*, and *Thoressa sitala* and *Mycalasis orcha*, (Table 1). They must be regarded as super-endemics because they are geographically limited to a relatively tiny area of the WG.

IUCN Red List

19 species, or 6.55 percent of the local butterfly fauna, were found in the SVNP and its surroundings (Figures 1C and 2B). Two species, *Idea malabarica* and *Parantica nilgiriensis*, are designated as Near Threatened, and seventeen species are classified as Least Concern. All others were listed in the buffer zone, with the exception of *Gomalia elma albofasciata* (See Appendix I).

WPA 1972

SVNP had 63 species listed under the schedules out of the 69 species of butterflies protected under the WPA 1972 in Kerala and the 70 species in WG (Figure 1B). Therefore, the WPA covers 21.72% of the butterfly fauna there. In addition, 90% of the species listed under WG and 91% of those classified under WPA are found in this area. Four species are included under Schedule I, one species is listed under Schedules I and II, and 58 species are listed under Schedule II (See Appendix I).

Conclusions

SVNP is one of the butterfly-richest areas with 269 species inside the core and 290 species overall, including the adjacent buffer zones' (21 species) species. 89% of Kerala's (326 species) and 87% of the Western Ghats' (335 species) butterflies are found in the area. One-eleventh of its butterfly species are unique to the Western Ghats. It is home to 82% of all butterflies designated as Western Ghats endemics. The region is also home to almost 96% of all the IUCN Red-listed species in Kerala and WG, 90% of species listed in WPA from WG, and 91% of those from Kerala. With 290 species, the area has a higher diversity than states around the Western Ghats like Goa (267 species), Maharashtra (257) and Gujarat (169 species). SVNP and its surroundings offer a wide variety of butterflies. The butterfly fauna in the core of SVNP is greatly increased by the buffer zone's diversity and richness. The surviving southern Indian benchmark evergreen forest tracts may be preserved by adding more areas from the drier southeast and the wetter evergreen region to the northwest to the National Park.

Abbreviations

ASL— IWG—Western Ghats I Above sea level TLRG— TNHS Lepidoptera Research Group | | IUCN— The International Union for Conservation of Nature | TNHS—Travancore Nature History Society | SVNP—Silent Valley National Park | | WPA—Indian Wildlife (Protection) Act 1972.

Table 1: Family-wise list of endemic species and their known distribution.

	Family	Taxon	Endemicity*
1	Pieridae	<i>Appias wardii</i> (Moore, 1884)	WG
2	Pieridae	<i>Pareronia ceylanica ceylanica</i> (Felder & Felder, 1865)	WG & SL
3	Nymphalidae	<i>Discophora lepida lepida</i> (Moore, 1857)	SI & SL
4	Nymphalidae	<i>Elymnias caudata</i> Butler, 1871	SI & SL
5	Nymphalidae	<i>Zipetis saitii</i> Hewitson, 1863	WG
6	Papilionidae	<i>Troides minos</i> (Cramer, [1779])	WG & SI
7	Pieridae	<i>Prioneris sita</i> (Felder & Felder, 1865)	SI & SL
8	Pieridae	<i>Colias nilagiriensis</i> Felder & Felder, 1859	WG
9	Pieridae	<i>Eurema (Terias) nilgiriensis</i> (Yata, 1990) ^[15]	WG
10	Papilionidae	<i>Pachliopta pandiyana</i> (Moore, 1881)	WG
11	Hesperiidae	<i>Thoressa honorei</i> (de Nicéville, 1887)	WG
12	Hesperiidae	<i>Oriens concinna</i> (Elwes & Edwards, 1897)	WG
13	Hesperiidae	<i>Potanthus diana</i> (Evans, 1932)	PI
14	Hesperiidae	<i>Caltoris canaraica</i> (Moore, [1884])	SI
15	Hesperiidae	<i>Celaenorrhinus ambareesa</i> (Moore, [1866])	PI
16	Lycaenidae	<i>Nacaduba calauria evansi</i> Toxopeus, 1927	WG & SL
17	Lycaenidae	<i>Cigaritis schistacea</i> (Moore, [1881])	PI & SL
18	Lycaenidae	<i>Ionolyce helicon viola</i> (Moore, 1877)	WG & SL
19	Lycaenidae	<i>Nacaduba berenice plumbeomicans</i> (Wood-Mason & de Nicéville, 1881)	WG & SL
20	Lycaenidae	<i>Celatoxia albidisca</i> (Moore, [1884])	WG

*WG—Western Ghats | PI—Peninsular India | SL—Sri Lanka | SI—Southern India.

Appendix 1: Checklist of butterflies of Silent Valley National Park and Its environs, Kerala.

	Common name-Subspecies scientific name	POP*	END**	IUCN+	WPA#	Source@
	Papilionidae					
1	<i>Graphium teredon</i> (Felder & Felder, 1865) — Narrow-banded Bluebottle	C	SI		(Sch II)	H, C
2	<i>Graphium nomius nomius</i> (Esper, 1799) – Indian Spot Swordtail	NR				C
3	<i>Graphium agamemnon menides</i> (Fruhstorfer, 1904) — Dakhan Tailed Jay	C				H, C
4	<i>Graphium doson eleius</i> (Felder & Felder, 1864) — Dakhan Common Jay	C				H, C
5	<i>Graphium antiphates naira</i> (Moore, [1903]) — Sahyadri Five-bar Swordtail	NR				C
6	<i>Papilio clytia clytia</i> Linnaeus, 1758 — Oriental Common Mime	NR			(Sch II)	H, C
7	<i>Pachliopta aristolochiae aristolochiae</i> (Fabricius, 1775) — Indian Common Rose	VC		LC		H, C

8	<i>Pachliopta pandiyana</i> (Moore, 1881) — Malabar Rose	NR	WG	LC		H, C
9	<i>Troides minos</i> (Cramer, [1779]) — Sahyadri Birdwing	NR	WG & SI	LC	Sch II	H, C
10	<i>Pachliopta hector</i> (Linnaeus, 1758) — Crimson Rose	C	PI & SL	LC	Sch II	H, C

Pieridae						
11	<i>Eurema laeta laeta</i> (Boisduval, 1836) — Indian Spotless Grass Yellow	NR				C
12	<i>Eurema brigitta rubella</i> (Wallace, 1867) — Small Grass Yellow	NR		LC		H, C
13	<i>Colias nilagiriensis</i> Felder & Felder, 1859 — Nilgiri Clouded Yellow	NR	WG			C
14	<i>Delias eucharis</i> (Drury, 1773) — Indian Jezebel	C				H, C
15	<i>Prioneris sita</i> (Felder & Felder, 1865) — Painted Sawtooth	R	SI & SL			C
16	<i>Pteris canidia canis</i> Evans, 1912 — Sahyadri Cabbage White	C				C
17	<i>Catopsilia pomona pomona</i> (Fabricius, 1775) — Oriental Lemon Emigrant	VC				H, C
18	<i>Catopsilia pyranthe pyranthe</i> (Linnaeus, 1758) — Oriental Mottled Emigrant	VC				H, C
19	<i>Eurema (Terias) andersoni shimai</i> Yata & Gaonkar, 1999 ^[15] — Sahyadri One-spot Grass Yellow	R		LC	Sch II	C
20	<i>Eurema (Terias) nilgiriensis</i> (Yata, 1990) ^[15] — Sahyadri Grass Yellow/Nilgiri grass yellow	R	WG			C
21	<i>Eurema (Terias) blanda silhetana</i> (Wallace, 1867) — Sylhet Three-spot Grass Yellow	C				H, C
22	<i>Eurema (Terias) hecabe hecabe</i> (Linnaeus, 1758) — Oriental Common Grass Yellow	VC				H, C
23	<i>Cepora nadina remba</i> (Moore, [1858]) — Sahyadri Lesser Gull	R			Sch II	H, C
24	<i>Cepora nerissa phryne</i> (Fabricius, 1775) — Dakhan Common Gull	C				H, C
Nymphalidae						
25	<i>Melanitis zitenius gokala</i> Moore, 1857 — Sahyadri Great Evening Brown	NR			Sch II	C
26	<i>Parantirrhoea marshalli</i> Wood-Mason, 1881 — Travancore Evening Brown	R	WG		Sch II	C
27	<i>Lethe drypetis todara</i> Moore, 1881 — Dakhan Treebrown	NR	SI & SL			C
28	<i>Lethe europa europa</i> (Fabricius, 1775) — Dakhan Bamboo Treebrown	NR			Sch I & II	H, C
29	<i>Lethe rohria neelgheriensis</i> (Guérin-Méneville, 1843) — Common Treebrown	C				H, C
30	<i>Discophora lepida lepida</i> (Moore, 1857) — Sahyadri Duffer	R	SI & SL			C
31	<i>Elymnias caudata</i> Butler, 1871 — Tailed Palmfly	C	SI & SL			H, C
32	<i>Melanitis leda leda</i> (Linnaeus, 1758) — Oriental Common Evening Brown	VC		LC		H, C
33	<i>Melanitis phedima varaha</i> Moore, 1857 — Sahyadri Dark Evening Brown	C				H, C
Riodinidae						
34	<i>Abisara bifasciata suffusa</i> Moore, 1882 — Suffused Double-banded Judy	NR				H, C
Lycaenidae						
35	<i>Anthene emolus emolus</i> (Godart, [1824]) — Bengal Common Ciliate Blue	NR				C
36	<i>Spalgis epius epius</i> (Westwood, 1852) — Oriental Apefly	C				C
37	<i>Acytolepis puspa felderi</i> Toxopeus, 1927 — Malabar Common Hedge Blue	VC				C
38	<i>Caleta decidia</i> (Hewitson, 1876) — Angled Pierrot	NR				H, C
39	<i>Anthene lycaenina lycaenina</i> (Felder, 1868) — Dakhan Pointed Ciliate Blue	C			Sch II	C
40	<i>Acytolepis lilacea lilacea</i> (Hampson, 1889) — Sahyadri Lilac Hedge Blue	R			Sch II	C
Hesperiidae						
41	<i>Burara jaina fergusonii</i> (de Nicéville, [1893]) — Sahyadri Orange Awlet	NR				C
42	<i>Choaspes benjaminii benjaminii</i> (Guérin-Méneville, 1843) — Sahyadri Indian Awlking	R				C
43	<i>Hasora badra badra</i> (Moore, [1858]) — Oriental Common Awl	R				C
44	<i>Badamia exclamationis</i> (Fabricius, 1775) — Brown Awl	C				C
45	<i>Bibasis sena sena</i> (Moore, [1866]) — Indian Orange-tail Awl	R			Sch II	C
46	<i>Burara gomata kanara</i> (Evans, 1926) — Sahyadri Pale Green Awlet	R				C

The following terms are used to describe population status: *POP—Population status as VC—Very Common | C—Common | NR—Not Rare | R—Rare | VR—Very Rare | **END—Endemicity as WG—Western Ghats | PI—Peninsular India | SL—Sri Lanka | SI—Southern India | +IUCN—IUCN Red List Status | #WPA—Indian Wildlife Protection Act and its amendments until 20 H stands for historical works (Mathew & Rahmathulla 1993^[10]; Mathew 1994 & 1999) while C stands for current research.

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