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SHORT COMMUNICATION

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M.N. Harisha, Harish Prakash, B.B. Hosetti & Vijaya Kumara

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DIVERSITY OF BUTTERFLIES OF THE SHETTIHALLI WILDLIFE SANCTUARY, SHIVAMOGGA DISTRICT, KARNATAKA, INDIA

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Abstract: A study was conducted on the diversity of butterflies by using the pollard walk method in the tropical dry deciduous habitats of Shettihalli Wildlife Sanctuary, Shivamogga District, Karnataka, from February 2010 to January 2011. A total of 151 species of butterflies belonging to 99 genera and five families was recorded. The family Nymphalidae was the most dominant with the highest number of species (52 species; 35%), followed by Lycaenidae (33 species; 22%), Hesperidae (25 species; 17%), Pieridae (24 species; 16%), and Papilionidae (15 species; 10%). The study also revealed 24 species of butterflies which are protected under various schedules of Indian Wildlife Protection Act, 1972, and 13 species as being endemic to the Western Ghats, peninsular India and Sri Lanka.

Keywords: Diversity, endemism, southern Western Ghats.

The Western Ghats is a prominent globally recognized biodiversity hotspot (Myers et al. 2000; Gunawardene et al. 2007), which covers about 60% of the forest area of Karnataka and one among the 36 biodiversity hotspots of the World.

There are a few reports available until date on the butterflies of the Western Ghats (e.g., Gaonkar 1996; Kunte 2000, 2008; Kehimkar 2008; Padhye et al. 2012; Kasambe 2018). Some examples of earlier documentation on butterflies from the Western Ghats protected areas include: 100 species from Silent Valley National Park

(Mathew & Rahamathulla 1993), 124 species from Parambikulam Wildlife Sanctuary (Sudheendrakumar et al. 2000), 139 species from Kudremukh National Park (Radhakrishnan 2007), 74 species from Peechi-Vazhani Wildlife Sanctuary (Mathew et al. 2005), 53 species from Neyyar Wildlife Sanctuary (Mathew et al. 2007), 115 species from Gudavi Bird Sanctuary (Dayanand 2014), and 85 species from the montane forests of Eravikulam National Park (Sreekumar et al. 2018); and non-protected areas: 75 species from Siruvani Reserve Forests (Arun 2003), 282 species from the Kerala part of Nilgiri Biosphere Reserve (Mathew 2016), and 172 species from Dakshina Kannada District (Naik & Mustak 2016). The present study was conducted to examine the status, endemism, and abundance of butterflies from Shettihalli Wildlife Sanctuary, Shivamogga, Karnataka.

MATERIAL AND METHODS

Study area

The Shettihalli Wildlife Sanctuary (SWS) located between 13.8873°N and 75.3879°E occupies an area about 395.6 km² (Fig. 1). It is spread over parts of three taluks of Shivamogga District: Shivamogga, Hosanagara, and Thirthahalli. The terrain in the sanctuary is plain

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Competing interests: The authors declare no competing interests.

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to undulating with a few pockets consisting of very steep terrains and hillocks. The temperature within the sanctuary varies from 15°C to 39°C and the average rainfall varies around 2000mm dominated by the southwest monsoon during July to September. It covers dry deciduous, moist deciduous and semi evergreen forests of the Western Ghats. The sanctuary is rich in both floral and faunal diversity.

Sampling method

Butterfly survey was carried out from February 2010 to January 2011 to record their status and abundance. The line transect method developed by the Institution of Terrestrial Ecology (Pollard 1979) was followed to monitor the diversity. Butterflies were recorded by direct visual observation along the three fixed transect routes, each of 2km long and 10m wide, passing through the different landscape elements like dry deciduous, semi evergreen and scrub forest and walked at a constant pace for approximately one to one and half an hour. The data collection carried out in a bi-weekly random survey in the whole study period. Observations were made between 07.30hr to 11.00hr, when butterflies are most active. Butterflies were identified by using various field guides (Kunte 2000; Sharma & Radhakrishna 2005; Kasambe 2018) and the nomenclature followed is as per Kasambe (2018). Butterflies observed in this study were categorized into five categories on the basis of their abundance under different score classes such as:

very common (VC) 80–100%, common (C) 60–80%, occasional (O) 40–60%, rare (R) 20–40% and very rare (VR) below 20% (Aneesh et al. 2013).

RESULTS AND DISCUSSION

The study revealed the presence of 151 species of butterflies, belonging to five families. The checklists of all the species observed with their status are given in Table 1. Family-wise distribution of butterflies species showed that, Nymphalidae was the most dominant with 52 species (35% of total species), followed by Lycaenidae with 33 species (22%), Hesperidae with 25 species (17%), Pieridae with 24 species (16%), and Papilionidae with 15 species (10%). On the basis of the frequency of occurrence of each butterfly species' abundance, we calculated that 68 (46%) species were common followed by 35 (23%) rare, 30 (20%) very common, 13 (9%) occasional, and 3 (2%) very rare species (Fig. 2).

Thirteen taxa listed in SWS were found to be endemic species of which six species are endemic to the Western Ghats, viz.: *Pachliopta pandiyana*, *Papilio dravidarum*, *Troides minos*, *Kallima horsfieldi*, *Idea malabarica*, and *Caltores canaraica* (Kunte 2008); five species, viz.: *Discophora lepida*, *Cirrochroa thais*, *Mycalesis patina*, *Cethosia mahratta*, and *Pareronia ceylanica* endemic to the Western Ghats and Sri Lanka (Kasambe 2018); and two species, viz.: *Prioneris sita* and *Papilio polymnestor* endemic to peninsular India and Sri Lanka (Kunte 2008; Kasambe 2018).

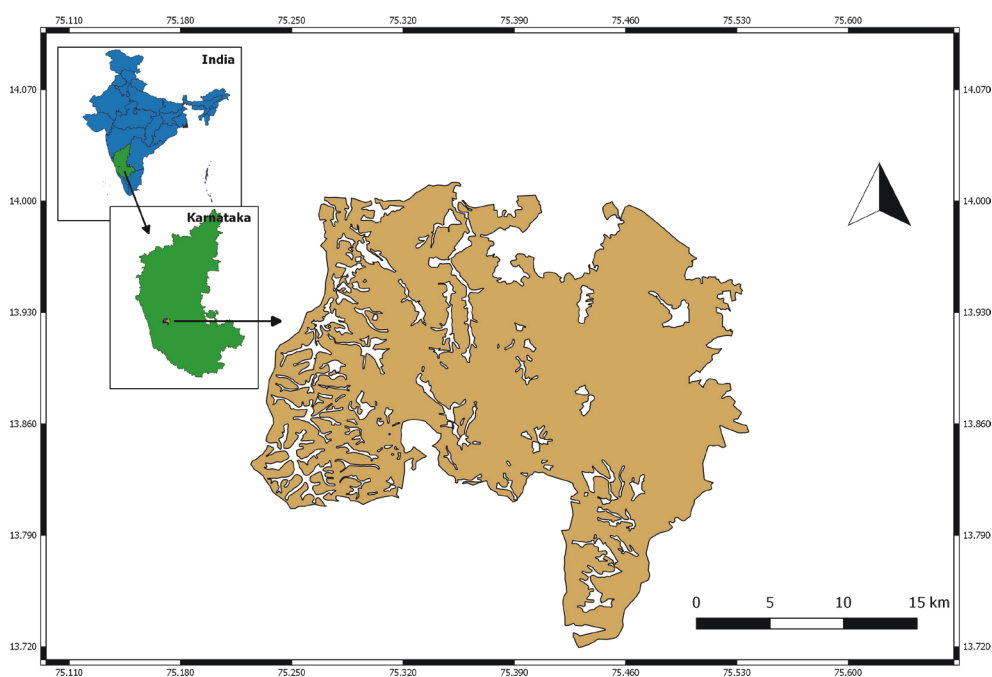


Figure 1. Shettihalli Wildlife Sanctuary.

Table1. Checklist of butterflies along with their conservation status in Shettihalli Wildlife Sanctuary, Shivamogga, Karnataka.

	Common name	Scientific name	Status	WPA 1927
Family: Papilionidae				
1	Crimson Rose	<i>Pachliopta hector</i> Linnaeus, 1758	VC	Sch. I
2	Common Rose	<i>Pachliopta aristolochiae</i> Fabricius, 1775	R	
3	Malabar Rose*	<i>Pachliopta pandiyana</i> Moore, 1881	R	
4	Common Jay	<i>Graphium doson</i> C. & R. Felder, 1864	C	
5	Tailed Jay	<i>Graphium agamemnon</i> Linnaeus, 1758	C	
6	Spot Swordtail	<i>Graphium nomius</i> Esper, 1799	C	
7	Southern Bluebottle	<i>Graphium teredon</i> C. & R. Felder, 1865	R	
8	Common Mime	<i>Papilio clytia</i> Linnaeus, 1758	VC	Sch. I
9	Lime Butterfly	<i>Papilio demoleus</i> Linnaeus, 1758	C	
10	Common Mormon	<i>Papilio polytes</i> Linnaeus, 1758	VC	
11	Blue Mormon***	<i>Papilio polymnestor</i> Cramer, 1775	VC	
12	Common Banded Peacock	<i>Papilio crino</i> Fabricius, 1792	R	
13	Red Helen	<i>Papilio helenus</i> Linnaeus, 1758	O	
14	Malabar Raven*	<i>Papilio dravidarum</i> Wood-Mason, 1880	C	
15	Southern Birdwing*	<i>Troides minos</i> Cramer, 1779	C	
Family: Lycaenidae				
16	Common Silverline	<i>Spindasis vulcanus</i> Fabricius, 1775	C	
17	Common Pierrot	<i>Castalius rosimon</i> Fabricius, 1775	VC	Sch. I
18	Banded Blue Pierrot	<i>Discolampa ethion</i> Westwood, 1851	VC	
19	Dark Pierrot	<i>Tarucus ananda</i> de Niceville, 1883	C	Sch. IV
20	Striped Pierrot	<i>Tarucus nara</i> Kollar, 1848	R	
21	Red Pierrot	<i>Talicauda nyseus</i> Guerin-Meneville, 1843	C	
22	Common Cerulean	<i>Jamides celeno</i> Cramer, 1775	C	
23	Dark Cerulean	<i>Jamides bochus</i> Stoll, 1782	VR	
24	Lime Blue	<i>Chilades lajus</i> Stoll, 1780	C	
25	Gram Blue	<i>Euchrysops cnejus</i> Fabricius, 1798	C	Sch. II
26	Zebra Blue	<i>Leptotes plinius</i> Fabricius, 1793	C	
27	Pea Blue	<i>Lampides boeticus</i> Linnaeus, 1767	C	Sch. II
28	Tiny Grass Blue	<i>Zizula hylax</i> Fabricius, 1775	R	
29	Dark Grass Blue	<i>Zizeeria karsandra</i> Moore, 1865	R	
30	Common Hedge Blue	<i>Acytolepis puspa</i> Horsfield, 1828	C	Sch. I
31	Lesser Grass Blue	<i>Zizina otis</i> Fabricius, 1787	VC	
32	Plain Hedge Blue	<i>Celastrina lavendularis</i> Moore, 1877	C	
33	Large Oakblue	<i>Arhopala amantes</i> Hewitson, 1862	R	
34	Indian Oakblue	<i>Arhopala atrax</i> Hewitson, 1862	R	
35	Common Ciliate Blue	<i>Anthene emolus</i> Godart, 1824	C	
36	Pointed Ciliate Blue	<i>Anthene lycaenina</i> C. Felder, 1868	C	Sch. II
37	Indian Red Flash	<i>Rapala iarbus</i> Fabricius, 1787	C	
38	Indigo Flash	<i>Rapala varuna</i> Horsfield, 1829	C	Sch. II
39	Slate Flash	<i>Rapala manea</i> Hewitson, 1863	C	
40	Yamfly	<i>Loxura atymnus</i> Stoll, 1780	C	
41	Plum Judy	<i>Abisara echerius</i> Stoll, 1790	VC	
42	Monkey Puzzle	<i>Rathinda amor</i> Fabricius, 1775	C	

	Common name	Scientific name	Status	WPA 1927
43	Plains Cupid	<i>Chilades pandava</i> Horsfield, 1829	VC	
44	Grass Jewel	<i>Freyeria trochylus</i> Freyer, 1845	C	
45	Forget-Me-Not	<i>Catochrysops strabo</i> Fabricius, 1793	C	
46	Common Apefly	<i>Spalgis epius</i> Westwood, 1852	C	
47	Common Lineblue	<i>Prosotas nora</i> Felder, 1860	VC	
48	Indian Sunbeam	<i>Curetis thetis</i> Drury, 1773	R	
Family: Nymphalidae				
49	Club Beak	<i>Libythea myrrha</i> Godart, 1819	R	
50	Common Castor	<i>Ariadne merione</i> Cramer, 1777	C	
51	Angled Castor	<i>Ariadne ariadne</i> Linnaeus, 1763	R	
52	Tawny Coster	<i>Acraea violae</i> Fabricius, 1793	VC	
53	Blue Tiger	<i>Tirumala limniace</i> Cramer, 1775	VC	
54	Dark Blue Tiger	<i>Tirumala septentrionis</i> Butler, 1874	C	
55	Plain Tiger	<i>Danaus chrysippus</i> Linnaeus, 1758	R	
56	Striped Tiger	<i>Danaus genutia</i> Cramer, 1779	C	
57	Glassy Tiger	<i>Parantica aglea</i> Stoll, 1782	R	
58	Grey Count	<i>Cynitia lepidea</i> Butler, 1868	R	Sch. II
59	Common Crow	<i>Euploea core</i> Cramer, 1780	VC	Sch. IV
60	Danaid Eggfly	<i>Hypolimnas misippus</i> Linnaeus, 1764	C	Sch. I
61	Great Eggfly	<i>Hypolimnas bolina</i> Linnaeus, 1758	C	
62	Southern Blue Oakleaf*	<i>Kallima hirsfieldi</i> Kollar, 1844	O	
63	Autumn Leaf	<i>Doleschallia bisaltide</i> Cramer, 1777	R	Sch. I
64	Lemon Pansy	<i>Junonia lemonias</i> Linnaeus, 1758	VC	
65	Peacock Pansy	<i>Junonia almana</i> Linnaeus, 1758	C	
66	Yellow Pansy	<i>Junonia hierta</i> Fabricius, 1798	C	
67	Chocolate Pansy	<i>Junonia iphita</i> Cramer, 1779	C	
68	Gray Pansy	<i>Junonia atlites</i> Linnaeus, 1763	R	
69	Blue Pansy	<i>Junonia orithya</i> Linnaeus, 1758	VC	
70	Rustic	<i>Cupha erymanthis</i> Drury, 1773	C	
71	Baronet	<i>Symphaedra nais</i> Forster, 1771	R	
72	Nigger	<i>Orsotriaena medus</i> Fabricius, 1775	C	
73	Commander	<i>Moduza procris</i> Cramer, 1777	R	
74	Common Sailer	<i>Neptis hylas</i> Linnaeus, 1758	VC	
75	Common Leopard	<i>Phalanta phalantha</i> Drury, 1773	VC	
76	Common Five-ring	<i>Ypthima baldus</i> Fabricius, 1775	C	
77	Common Three-ring	<i>Ypthima asterope</i> Klug, 1832	C	
78	Common Four-ring	<i>Ypthima huebneri</i> Kirby, 1871	VC	
79	Common Baron	<i>Euthalia aconthea</i> Cramer, 1777	C	
80	Common Lascar	<i>Pantoporia hordonia</i> Stoll, 1790	R	
81	Common Nawab	<i>Polyura athamas</i> Drury, 1773	R	
82	Cruiser	<i>Vindula erota</i> Fabricius, 1793	O	
83	Clipper	<i>Parthenos sylvia</i> Cramer, 1775	VC	Sch. II
84	Southern Duffer**	<i>Discophora lepida</i> Moore, 1857	O	Sch. II
85	Tamil Yeoman**	<i>Cirrochroa thais</i> Fabricius, 1787	R	
86	Indian Red Admiral	<i>Vanessa indica</i> Herbst, 1794	R	

	Common name	Scientific name	Status	WPA 1927
87	Painted Lady	<i>Vanessa cardui</i> Linnaeus, 1758	O	
88	Blue Admiral	<i>Kaniska canace</i> Linnaeus, 1763	O	
89	Common Evening Brown	<i>Melanitis leda</i> Linnaeus, 1758	VC	
90	Dark Evening Brown	<i>Melanitis phedima</i> Cramer, 1780	C	
91	Common Bushbrown	<i>Mycalesis perseus</i> Fabricius, 1775	C	
92	Glad-eye Boshbrown**	<i>Mycalesis patnia</i> Moore, 1857	R	
93	Dark-branded Bushbrown	<i>Mycalesis mineus</i> Linnaeus 1758	C	Sch. II
94	Tamil Treebrown	<i>Lethe drypetis</i> Hewitson, 1863	O	
95	Bamboo Treebrown	<i>Lethe europa</i> Fabricius, 1775	O	Sch. I
96	Tailed Palmfly	<i>Elymnias caudata</i> Butler, 1871	C	
97	Common Palmfly	<i>Elymnias hypermnestra</i> Linnaeus, 1763	C	
98	Common Map	<i>Cyrestis thyodamas</i> Boisduval, 1846	VR	
99	Tamil Lacewing**	<i>Cethosia mahratta</i> Moore, 1872	O	
100	Malabar Tree Nymph*	<i>Idea malabarica</i> Moore, 1877	VR	
Family: Pieridae				
101	Indian Cabbage White	<i>Pieris canidia</i> Linnaeus, 1768	C	
102	Common Albatross	<i>Appias albina</i> Boisduval, 1836	R	Sch. II
103	Pioneer	<i>Anaphaeis aurota</i> Fabricius, 1793	VC	
104	Common Emigrant	<i>Catopsilia pomona</i> Fabricius, 1775	C	
105	Mottled Emigrant	<i>Catopsilia pyranthe</i> Linnaeus, 1758	C	
106	Common Jezebel	<i>Delias eucharis</i> Drury, 1773	C	
107	Painted Sawtooth***	<i>Prioneris sita</i> C. & R. Felder, 1865	R	Sch. IV
108	Common Grass Yellow	<i>Eurema hecabe</i> Linnaeus, 1758	VC	
109	Small Grass Yellow	<i>Eurema brigitta</i> Stoll, 1780	C	
110	One-Spot Grass Yellow	<i>Eurema andersoni</i> Moore, 1886	C	
111	Three-spot Grass Yellow	<i>Eurema blanda</i> Boisduval, 1836	C	
112	Great Orange Tip	<i>Hebomoia glaucippe</i> Linnaeus, 1758	R	
113	White Orange Tip	<i>Ixias marianne</i> Cramer, 1779	R	
114	Yellow Orange Tip	<i>Ixias pyrene</i> Linnaeus, 1764	R	
115	Crimson Tip	<i>Colotis danae</i> Fabricius, 1775	C	
116	Plain Orange Tip	<i>Colotis aurora</i> Cramer, 1780	C	
117	Small Orange Tip	<i>Colotis etrida</i> Boisduval, 1836	C	
118	Large Salmon Arab	<i>Colotis fausta</i> Olivier, 1804	R	
119	Small Salmon Arab	<i>Colotis amata</i> Cramer, 1775	R	
120	Common Wanderer	<i>Pareronia hippia</i> Cramer, 1776	C	Sch. II
121	Dark Wanderer**	<i>Pareronia ceylanica</i> C. & R. Felder, 1865	O	
122	Common Gull	<i>Cepora nerissa</i> Fabricius, 1775	C	Sch. II
123	Lesser Gull	<i>Cepora nadina</i> Lucas, 1852	C	Sch. II
124	Psyche	<i>Leptosia nina</i> Fabricius, 1793	R	
Family: Hesperidae				
125	Chestnut Bob	<i>Iambrix salsala</i> Moore, 1865	VC	
126	Indian Palm Bob	<i>Suastus gremius</i> Fabricius, 1798	C	
127	Indian Skipper	<i>Spialia galba</i> Fabricius, 1793	R	
128	Common Grass Dart	<i>Taractrocera maevius</i> Fabricius, 1793	R	
129	Tamil Grass Dart	<i>Taractrocera ceramas</i> Hewitson, 1868	VC	

	Common name	Scientific name	Status	WPA 1927
130	Common Palm Dart	<i>Telicota colon</i> Fabricius, 1775	VC	
131	Dark Palm Dart	<i>Telicota bambusae</i> Moore, 1878	VC	
132	Indian Dartlet	<i>Oriens goloides</i> Moore, 1881	C	
133	Tamil Dartlet	<i>Oriens concinna</i> Elwes & Edwards, 1897	R	Sch. IV
134	White Banded Awl	<i>Hasora badra</i> Hubner, 1818	C	
135	Common Banded Awl	<i>Hasora chromus</i> Cramer, 1780	VC	
136	Brown Awl	<i>Badamia exclamations</i> Fabricius, 1775	O	
137	Common Snow Flat	<i>Tagiades japetus</i> Stoll, 1781	C	
138	Water Snow Flat	<i>Tagiades litigiosa</i> Moeschler, 1878	VC	
139	Common Yellow-breasted Flat	<i>Gerosis bhagava</i> Moore, 1866	C	
140	Tricoloured Pied Flat	<i>Coladenia indrani</i> Moore, 1866	C	
141	Fulvous Pied Flat	<i>Pseudocoladenia dan</i> Fabricius, 1787	C	
142	Common Redeye	<i>Matapa aria</i> Moore, 1866	O	
143	Variable Swift	<i>Pelopidas mathias</i> Fabricius, 1798	VC	
144	Rice Swift	<i>Borbo cinnara</i> Wallace, 1866	VC	
145	Kanara Swift*	<i>Caltoris canaraica</i> Moore, 1884	C	
146	Dingy Scrub Hopper	<i>Aeromachus dubius</i> Elwes & Edwards, 1897	R	
147	Bush Hopper	<i>Ampittia dioscorides</i> Fabricius 1793	C	
148	Common Banded Demon	<i>Notocrypta paralysos</i> Wood-Mason & de Niceville, 1881	C	
149	Grass Demon	<i>Udaspes folus</i> Cramer, 1775	O	
150	Indian Ace	<i>Halpe hindu</i> Evans, 1937	C	Sch. II
151	Southern Spotted Ace	<i>Thoressa astigmata</i> Swinhoe, 1890	VR	

Endemism: *—Endemic to Western Ghats | **—Endemic to Western Ghats and Sri Lanka | ***—Endemic to Peninsular India and Sri Lanka. Legal Status: IWPA, 1972, Schedules I to IV. Status: VC—Very common | C—Common | O—Occasional | R—Rare | VR—Very Rare.

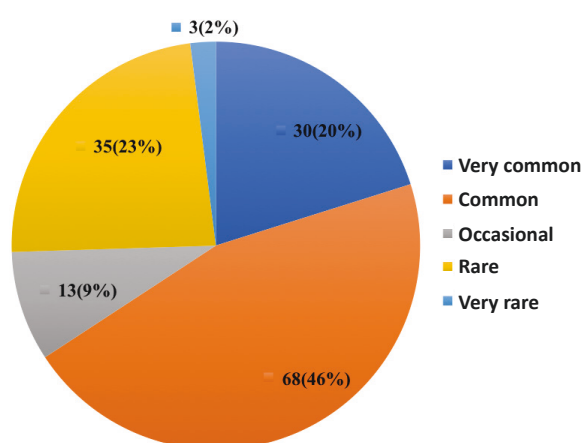


Figure 2. Species frequency of occurrence of butterflies in Shettihalli Wildlife Sanctuary, Shivamogga District.

Butterflies are sensitive to changes in the habitat and climate, which influence their distribution and abundance (Wynter-Blyth 1957). The study area hosts 24 scheduled butterfly species: seven species under

Schedule I Part IV, 13 species under Schedule II, and four species under Schedule IV of the Indian Wildlife (Protection) Act 1972 (Arora 2003; Gupta & Mondal 2005) (Table 1).

The present study reports for the first time preliminary information on the butterfly species diversity of Shettihalli Wildlife Sanctuary, which can be used in monitoring ecosystem health, stability and functioning of the study area (Mandal 2016). Occurrence of the schedule and endemic species in the study area indicates that SWS is home to a rich diversity of butterflies.

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Image 1. Great Eggfly *Hypolimnas bolina*
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Image 2. Grey Count *Cynitia lepidea*
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Image 3. Palm Judy *Abisara echerius*
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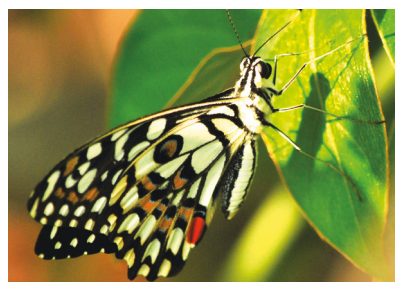


Image 4. Lime Butterfly *Papilio demoleus*
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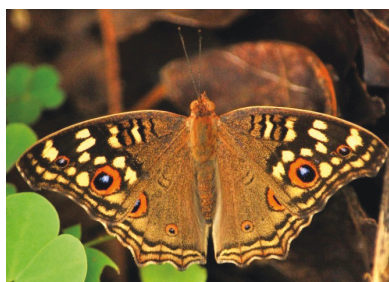


Image 5. Lemon Pansy *Junonia lemonias*
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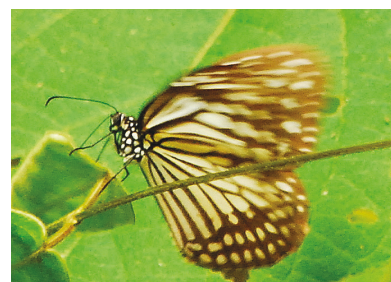


Image 6. Glassy Tiger *Parantica aglea*
© Harish Prakash.



Image 7. Psyche *Leptosia nina*
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Image 8. Rustic *Cupha erymanthis*
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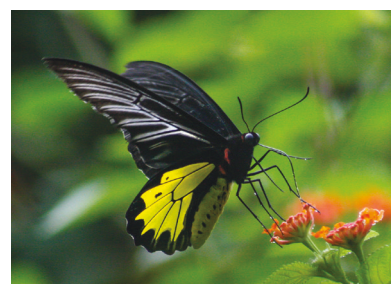


Image 9. Southern Birdwing *Troides minos*
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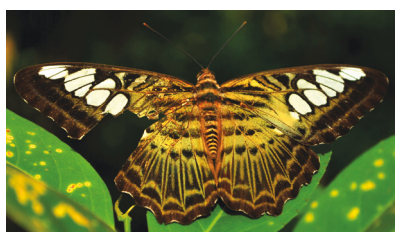


Image 10. Clipper *Parthenos sylvia*
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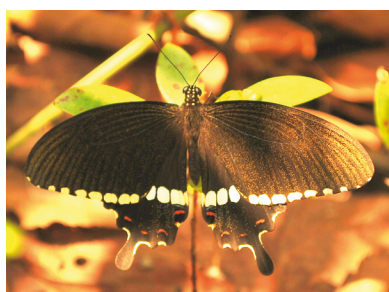


Image 11. Common Mormon *Papilio polytes* © Harish Prakash.

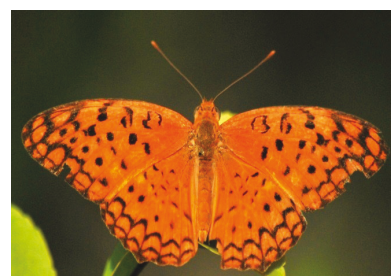


Image 12. Common Leopard *Phalanta phalantha* © Harish Prakash.



Image 13. Common Snow Flat *Tagiades japetus* © Harish Prakash.



Image 14. Glad-eye Boshbrown *Mycalesis patnia* © Harish Prakash.

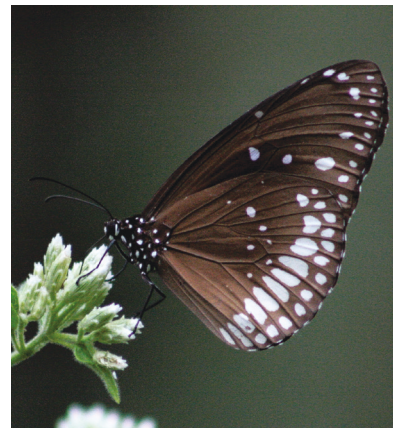


Image 15. Common Crow *Euploea core* © M.N. Harisha.



Image 16. Tamil Yeoman *Cirrochroa thais* © Harish Prakash.



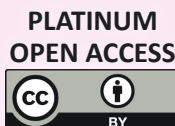
Image 17. Common Sailer *Neptis hylas* © Harish Prakash.

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