



A primary checklist of the butterflies of Pawalgarh conservation reserve, Ramnagar, Nainital, India

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Abstract

The diversity of Butterflies in Pawalgarh Conservation Reserve (henceforth PCR), Ramnagar, Uttarakhand, India was studied with periodically filed exploration from April 2022 to August 2025. Nearly 93 butterfly species were recorded from 6 families in the PCR. The number of species recorded from the family Nymphalidae (48.38%) with highest followed by Lycaenidae (23.65%), Pieridae (15.05%), Hesperidae (10.75%), Papilionidae (8.60%) and least number of population was recorded from Riodinidae (2.15%).

Keywords: Pawalgarh Conservation Reserve, Ramnagar, Nainital, Uttarakhand, butterflies.

Introduction

Butterflies constitute one of the best-known groups of insects and are widely used as model organisms for studying speciation, community ecology, biogeography, climate change, and insect-plant interactions¹. Owing to their sensitivity to environmental changes, butterflies are considered effective indicators of habitat quality and biodiversity². Limited studies have been conducted on the butterfly fauna of Uttarakhand³⁻⁶. Kumar *et al.* reported the presence of One-spot Grass Yellow *Eurema andersonii* Moore and Common Shot Silverline *Spindasis ictis* Hewitson from Pawalgarh Conservation Reserve (PCR) in the Kumaon region of Uttarakhand¹. However, comprehensive documentation of butterfly diversity from PCR is still lacking. Therefore, the present study aims to prepare a checklist of butterfly species occurring in PCR, which may provide baseline data for future monitoring and conservation planning.

Pawalgarh Conservation Reserve (PCR) is the third conservation reserve of Uttarakhand and is situated in Nainital district along the Ramnagar-Haldwani highway⁷⁻¹⁰. The landscape is bounded by the River Kosi in the west and River Baur in the east, while the River Dabka flows east to west in the northern part before turning south and dividing the landscape into two sections. The reserve comprises biodiversity-rich Terai-Bhabhar forests and includes forest patches such as Pawalgarh, Sitabani, Kaladhungi, and Kotabagh, which support diverse butterfly assemblages^{11,12}.

Study area: The Pawalgarh area notified as conservation reserve in December 2012 encompasses an area of 5824.76 ha of Reserve Forest, and is part of the Terai Arc Landscape in Ramnagar Forest Division in Uttarakhand (29.36 N and 79.24 E). The altitude of the area varies from 300 to 700 msl. Total

three sites were selected to monitor diversity and abundance of butterflies: i. Dense forest, ii. Open grass forest, iii. Grass land forest.

Methodology

Seasonal availability was determined by presence-absence scoring method and by percentage calculation to determine the status. The butterflies were observed and recorded directly in the field following "Pollard Walk" method¹²⁻¹³ with necessary modifications. There were a total 25 transect paths (1000m each) in 500m gap. Individuals were counted on either side of the path (at a distance of 2.5m). No physical sampling of the butterflies was done. Photographic documentation was done by Canon EOS 200DII camera. They were identified using suitable keys and photographs provided in various books¹⁴⁻¹⁷. Species were observed in situ while perching, foraging, nectaring, puddling, or during mate selection. No floral and faunal species were harmed during the survey.

Results and Discussion

In PCR during the study period a total of 93 species of butterflies were recorded (Appendix-1). The family-wise butterfly species percentage has noticed as Nymphalidae (48.38%), Lycaenidae (23.65%), Hesperidae (10.75%), Pieridae (15.05%), Papilionidae (8.60%) and Riodinidae (2.15%). Total 52,068 individuals were recorded in the study area. Nymphalidae (26.07%) was shown in high population rather than other families. Further Lycaenidae (22.90%), Pieridae (21.37%), Hesperidae (16.01%), Papilionidae (13.33%), and Riodinidae (2.949%) was revealed in the least population when compare to other butterfly population (Table 1).

Shannon diversity index value 1.67 indicates moderate diversity, whereas Simpson index value 0.79 indicates even distribution of species. Similarly Dominance index value 0.20 and Shannon evenness value 0.93 indicates low dominance and relatively high species evenness. Highest abundance was observed during monsoon followed by summer and winter.

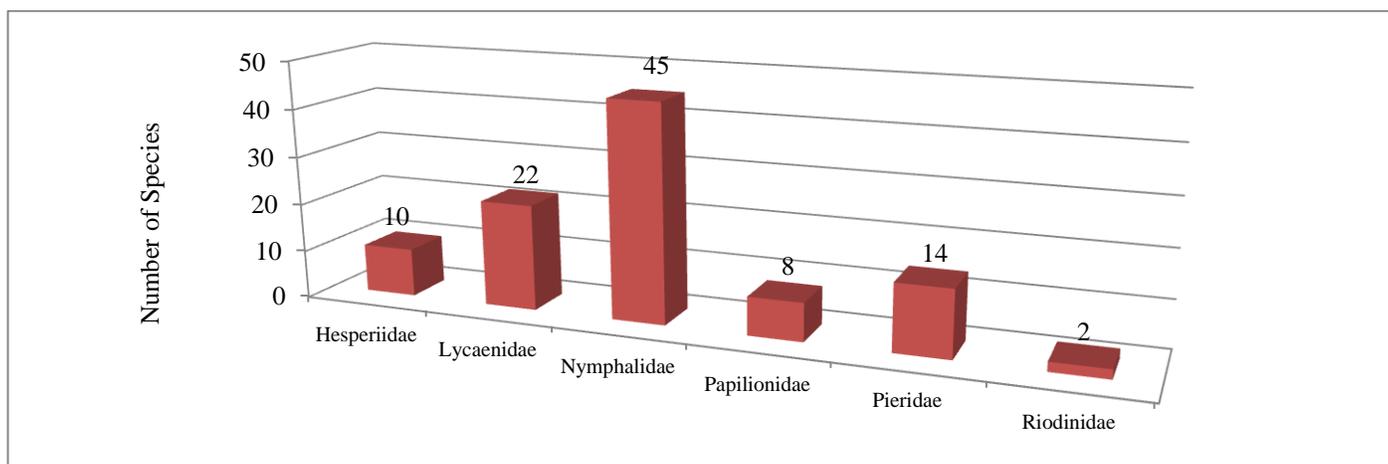


Figure-1: Family wise diversity in the Butterflies of PCR.

Table-1: Abundance of butterfly fauna observed in different season in PCR.

Family	2022			2023			2024			Total
	S	W	M	S	W	M	S	W	M	
Hesperidae	998 (15.83%)	372 (15%)	1404 (15.08%)	977 (15.62%)	389 (15.51%)	1415 (15.54%)	978 (15.59%)	384 (15.25%)	1424 (15.73%)	8,341 (16.01%)
Lycaenidae	1376 (21.82%)	558 (22.50%)	2055 (22.08%)	1367 (21.86%)	567 (22.60%)	2016 (22.14%)	1356 (21.62%)	584 (23.19%)	2045 (22.59%)	11,924 (22.90%)
Nymphalidae	1566 (24.84%)	768 (30.98%)	2216 (23.81%)	1540 (24.63%)	760 (30.30%)	2194 (24.09%)	1558 (24.84%)	765 (30.38%)	2208 (24.39%)	13,575 (26.07%)
Papilionidae	884 (14.02%)	209 (8.4%)	1213 (13.03%)	879 (14.06%)	219 (8.73%)	1221 (13.41%)	890 (14.19%)	215 (8.53%)	1215 (13.42%)	6,945 (13.33%)
Pieridae	1308 (20.74%)	509 (20.53%)	1899 (20.40%)	1310 (20.95%)	511 (20.37%)	1879 (20.63%)	1321 (20.92%)	505 (20.05%)	1888 (20.85%)	11,130 (21.37%)
Riodinidae	172 (2.7%)	63 (2.54%)	259 (2.7%)	178 (2.84%)	62 (2.47%)	289 (3.17%)	176 (2.80%)	65 (2.58%)	272 (3%)	1,536 (2.949%)
Total	6,304	2,479	9,037	6,251	2,508	9,104	6,270	2,518	9,052	52,068

Table-2: Diversity indices of butterfly fauna in different season.

Number of individuals	52,068
Richness (α -diversity)	93
Shannon's (α -diversity)	1.67
Simpson's (α -diversity)	0.79
Dominance (dominance)	0.204
Shannon evenness (evenness)	0.936

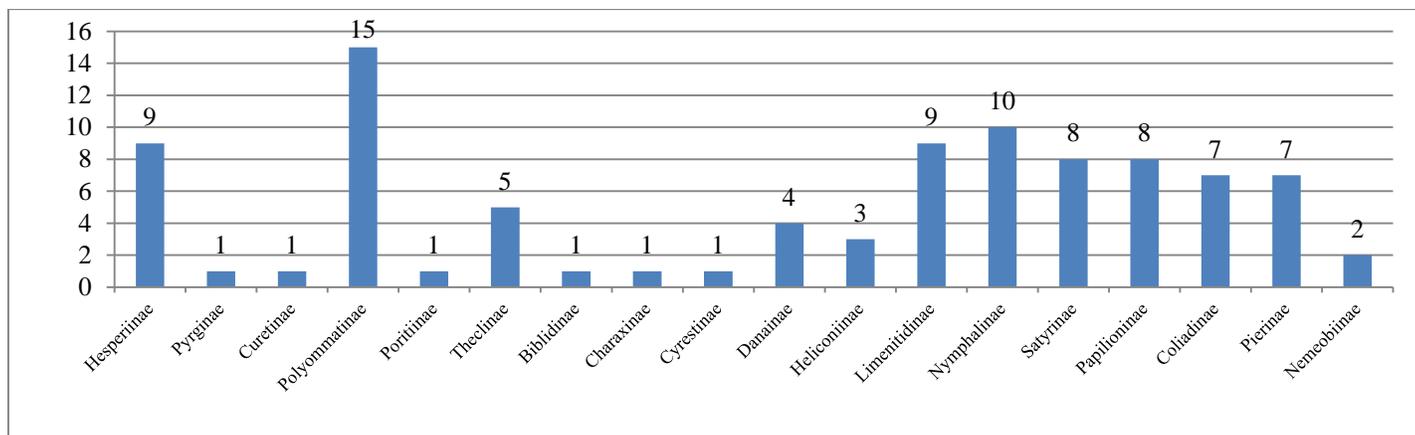


Figure-2: Sub family wise richness in the Butterflies of PCR.

Conclusion

Total 93 butterfly species were recorded from 6 families in the PCR during April 2022 to August 2025. The number of population recorded from the family Nymphalidae (48.38%) with highest and least number of population was recorded from Riodinidae (2.15%). Highest butterfly species monitored in open grass forest followed by dense forest and Grassland forest,

whereas seasonality wise highest abundance recorded during rainy season followed by summer, winter. Limited works have been done in PCR on butterfly fauna of Uttarakhand. So the present study on the diversity of butterfly may be supportive for creating a conservation strategy for their protection in this locality and provided data support further studies in butterfly fauna in study site.

Appendix-1: Preliminary checklist of Butterflies recorded in Pawalgarh Conservation Reserve (April 2022 to August 2025).

S.No.	Species scientific name	Common English name	Relative abundance	Wildlife Protection Amendment Act 2022	Comments
1. Superfamily: Papilionoidea					
1.1. Family: Hesperidae					
1.1.1. Subfamily: Hesperinae					
1	<i>Borbo bevani</i> (Moore, 1878)	Bevan's Swift	Common	–	
2	<i>Borbo cinnara</i> (Wallace, 1866)	Rice Swift	Common	–	
3	<i>Matapa aria</i> Moore, [1866]	Common Redeye	Uncommon	–	
4	<i>Pelopidas assamensis</i> (de Nicéville, 1882)	Great Swift	Uncommon	–	1 individuals observed on foliage.
5	<i>Pelopidas mathias mathias</i> (Fabricius, 1798)	Small Branded Swift	Common	–	
6	<i>Taractrocera maevius</i> (Fabricius, 1793)	Common Grass Dart	Uncommon	–	
7	<i>Telicota bambusae bambusae</i> (Moore, 1878)	Dark Palm- Dart	Uncommon	–	
8	<i>Telicota colon colon</i> (Fabricius, 1775)	Pale Palm-Dart	Rare	–	
9	<i>Udaspes folus</i> (Cramer, [1775])	Grass Demon	Common	–	-
1.1.2. Subfamily: Pyrginae					
10	<i>Tagiades litigiosa litigiosa</i> Möschler, 1878	Water Snow Flat	Uncommon	–	
1.2. Family: Lycaenidae					
1.2.1. Subfamily: Curetinae					
11	<i>Curetis acuta</i> Moore, 1879	Angled Sunbeam	Uncommon	–	
1.2.2. Subfamily: Polyommatinae					
12	<i>Acytolepis puspa gisca</i> (Fruhstorfer, 1910)	Common Hedge Blue	Common	–	
13	<i>Anthene emolus</i> (Godart, [1824])	Common Ciliate Blue	Common	–	
14	<i>Castalius rosimon rosimon</i> (Fabricius, 1775)	Common Pierrot	Common	–	
15	<i>Catochrysops Strabo</i> (Fabricius, 1793)	Forget-me-not	Common	–	
16	<i>Celastrina lavendularis limbata</i> (Moore, 1879)	Plain Hedge Blue	Unommon	–	
17	<i>Euchrysops cnejus cnejus</i> (Fabricius, 1798)	Gram Blue	Common	–	3 individuals observed in shady area

18	<i>Lampides boeticus</i> (Linnaeus, 1767)	Pea Blue	Common	–	4 individuals observed puddling
19	<i>Leptotes plinius plinius</i> (Fabricius, 1793)	Zebra Blue	Common	–	
20	<i>Neopithecops zalmora zalmora</i> (Butler, [1870])	Common Quaker	Common	–	
21	<i>Prosotas dubiosa indica</i> (Evans, [1925])	Tailless Line blue	Common	Schedule II	
22	<i>Prosotas nora airdates</i> (Moore, [1875])	Common Line blue	Very Common	–	
23	<i>Pseudozizeeria maha maha</i> (Kollar, [1844])	Pale Grass Blue	Very Common	–	
24	<i>Zizeeria karsandra</i> (Moore, 1865)	Dark Grass Blue	Very Common	–	
25	<i>Zizina oits oits</i> (Fabricius, 1787)	Lesser Grass Blue	Common	–	
26	<i>Zizula hylax hylax</i> (Fabricius, 1775)	Tiny Grass Blue	Common	–	
1.2.3. Subfamily: Poritiinae					
27	<i>Poritia hewitsoni hewitsoni</i> Moore, [1866]	Common Gem	Uncommon	Schedule II	1 individual observed near the river line
1.2.4. Subfamily: Theclinae					
28	<i>Arhopala amantes amantes</i> (Hewitson, 1862)	Large Oakblue	Locally Common		
29	<i>Arhopala atrax</i> (Hewitson, 1862)	Indian Oakblue	Common	–	
30	<i>Loxura atymnus continentalis</i> Fruhstorfer, [1912]	Yamfly	Common	–	
31	<i>Rapala nissa nissa</i> (Kollar, [1844])	Common Flash	Common	–	
32	<i>Spindasis vulcanus vulcanus</i> (Fabricius, 1775)	Common Silverline	Common	–	
1.3. Family: Nymphalidae					
1.3.1. Subfamily: Biblidinae					
33	<i>Ariadne merione tapestrina</i> (Moore, 1884)	Common Castor	Very Common	–	
1.3.2. Subfamily: Charaxinae					
34	<i>Charaxes bharata</i> Felder & Felder, [1867]	Common Nawab	Common	Schedule II	
1.3.3. Subfamily: Cyrestinae					
35	<i>Cyrestis thyodamas ganescha</i> Doyere, [1840]	Map Butterfly	Common	–	
1.3.4. Subfamily: Danainae					
36	<i>Danaus chrysippus chrysippus</i> (Linnaeus, 1758)	Plain Tiger	Very Common	–	
37	<i>Danaus genutia genutia</i> (Cramer, [1779])	Striped Tiger	Very Common	–	
38	<i>Euploea core core</i> (Cramer, [1780])	Common Crow	Common	–	
39	<i>Euploea mulciber mulciber</i> (Cramer, [1777])	Striped Blue Crow	Common		1 individual observed sitting on the foliage.
1.3.4. Subfamily: Heliconiinae					
40	<i>Acraea issoria issoria</i> (Hübner, [1819])	Yellow Coster	Locally Common	–	
41	<i>Cupha erymanthis lotis</i> (Drury, [1773])	Rustic	Very Common	–	
42	<i>Phalanta phalantha phalantha</i> (Drury, [1773])	Common Leopard	Very Common	–	
1.3.5. Subfamily: Limenitidinae					
43	<i>Athyma perius perius</i> (Linnaeus, 1758)	Common Sergeant	Common	–	
44	<i>Euthalia aconthea garuda</i> (Cramer, [1777])	Baron	Locally Common	–	
45	<i>Euthalia lubentina lubentina</i> (Cramer, [1777])	Gaudy Baron	Uncommon		2 individual observed near the river edge.
46	<i>Neptis clinia praedicta</i> Smetacek, 2011	Sullied Sailer	Common	–	
47	<i>Neptis hylas varmona</i> (Linnaeus, 1758)	Common Sailer	Common	–	
48	<i>Neptis nata yerburyii</i> Moore, [1858]	Clear Sailer	Common	Schedule II	
49	<i>Neptis sappho astola</i> Moore, 1872	Rusty Sailer	Very Common	–	
50	<i>Pantoporia hordonia hordonia</i> (Stoll, [1790])	Common Lascar	Common	–	
51	<i>Symphaedra nais</i> (Forster, 1771)	Baronet	Locally Common	–	
1.3.6. Subfamily: Nymphalinae					
52	<i>Aglais caschmirensis aesis</i> (Fruhstorfer, 1912)	Himalayan Tortoiseshell	Very Common	–	
53	<i>Hypolimnas bolina jacintha</i> (Drury, 1773)	Oriental Great Egg fly	Very Common	–	
54	<i>Junonia almana almanac</i> (Linnaeus, 1758)	Peacock Pansy	Very Common	–	
55	<i>Junonia atlites atlites</i> (Linnaeus, 1763)	Grey Pansy	Common	–	
56	<i>Junonia hierta hierta</i> (Fabricius, 1798)	Yellow Pansy	Common	–	
57	<i>Junonia iphita iphita</i> (Cramer, [1779])	Chocolate Pansy	Very Common	–	

58	<i>Junonia lemonias lemonias</i> (Linnaeus, 1758)	Lemon Pansy	Very Common		
59	<i>Symbrenthia lilaea khasiana</i> Moore, [1875]	Khasi Common Jester	Very Common		
60	<i>Vanessa cardui</i> (Linnaeus, 1758)	Painted Lady	Common		
61	<i>Vanessa indica indica</i> (Herbst, 1794)	Indian Red Admiral	Common		
1.3.7. Subfamily: Satyrinae					
62	<i>Elymnias hypermnestra undularis</i> (Drury, 1773)	Himalayan Common Palmfly	Common		
63	<i>Melanitis leda leda</i> (Linnaeus, 1758)	Common Evening Brown	Very Common		
64	<i>Melanitis phedima bela</i> Moore, [1858]	Dark Evening Brown	Uncommon		
65	<i>Mycalesis perseus blasius</i> (Fabricius, 1798)	Common Bush brown	Common		
66	<i>Ypthima asterope mahratta</i> Moore, 1884	Indian Common Three ring	Uncommon		
67	<i>Ypthima baldus baldus</i> (Fabricius, 1775)	Common Five ring	Very Common		
68	<i>Ypthima huebneri</i> Kirby, 1871	Common Four ring	Common		
69	<i>Ypthima inica</i> Hewitson, [1865]	Lesser Three ring	Very Common		
1.4. Family: Papilionidae					
1.4.1. Subfamily: Papilioninae					
70	<i>Graphium cloanthus cloanthus</i> (Westwood, 1841)	Glassy Bluebottle	Common	Schedule II	
71	<i>Graphium doson axionides</i> (Page & Treadaway, 2014)	Himalayan Common Jay	Uncommon		
72	<i>Graphium sarpedon sarpedon</i> (Linnaeus, 1758)	Common Bluebottle	Very common	Schedule II	
73	<i>Papilio agester govindra</i> Moore, 1864	West Himalayan Tawny Mime	Uncommon		
74	<i>Papilio clytia clytia</i> Linnaeus, 1758	Common Mime	Common	Schedule II	
75	<i>Papilio demoleus demoleus</i> Linnaeus, 1758	Lime Butterfly	Very Common		
76	<i>Papilio paris paris</i> Linnaeus, 1758	Paris Peacock	Common		
77	<i>Papilio polytes Romulus</i> Cramer, [1775]	Common Mormon	Very Common		
1.5. Family: Pieridae					
1.5.1. Subfamily: Coliadinae					
78	<i>Catopsilia pomona pomona</i> (Fabricius, 1775)	Lemon/Common Emigrant	Very Common		
79	<i>Catopsilia pyranthe pyranthe</i> (Linnaeus, 1758)	Mottled Emigrant	Common		
80	<i>Eurema andersonii jordani</i> Corbet & Pendlebury, 1932	One Spot/Jordan's Grass Yellow	Uncommon	Schedule II	
81	<i>Eurema blanda silhetana</i> (Wallace, 1867)	Sylhet Three-spot Grass Yellow	Common		
82	<i>Eurema brigitta rubella</i> (Wallace, 1867)	Red-line Small Grass Yellow	Common		
83	<i>Eurema hecabe hecabe</i> (Linnaeus, 1758)	Common Grass Yellow	Common		
84	<i>Eurema laeta laeta</i> (Boisduval, 1836)	Spotless Grass Yellow	Common		
1.5.2. Subfamily: Pierinae					
85	<i>Belenois aurota aurota</i> (Fabricius, 1793)	Pioneer	Very Common		
86	<i>Cepora nerissa phryne</i> (Fabricius, 1775)	Common Gull	Very Common		
87	<i>Delias eucharis</i> (Drury, 1773)	Common Jezebel	Very Common		
88	<i>Leptosia nina nina</i> (Fabricius, 1793)	Psyche	Very Common		
89	<i>Pareronia hippia</i> (Fabricius, 1787)	Common Wanderer	Very Common		
90	<i>Pieris brassicae nepalensis</i> Gray, 1846	Large Cabbage White	Very Common		
91	<i>Pieris canidia indica</i> Evans, 1926	Indian Cabbage White	Very Common		
1.6. Family: Riodinidae					
1.6.1. Subfamily: Nemeobiinae					
92	<i>Abisara bifasciata suffuse</i> Moore, 1877	Double-banded Judy	Common		
93	<i>Zemeros flegyas flegyas</i> (Cramer, [1780])	Punchinello	Common		

			
<i>Papilio clytia</i>	<i>Graphium doson</i>	<i>Heliophorus sena</i>	<i>Junonia atlites</i>
			
<i>Catopsilia pomona</i>	<i>Catopsilia pyranthe</i>	<i>Eurema hecabe</i>	<i>Graphium sarpedon</i>
			
<i>Euploea mulciber</i>	<i>Junonia lemonias</i>	<i>Acraea issoria issoria</i>	<i>Junonia almana</i>
			
<i>Junonia iphita</i>	<i>Junonia hierta</i>	<i>Junonia orithya</i>	<i>Ypthima huebneri</i>
			
<i>Melanitis leda,</i>	<i>Pelopidas mathias</i>	<i>Neptis hylas</i>	<i>Neptis sankara</i>

			
<i>Symphaedra nais</i>	<i>Phalanta phalantha</i>	<i>Aglais caschmirensis</i>	<i>Tirumala limniace</i>
			
<i>Vanessa cardui</i>	<i>Pantoporia hordonia</i>	<i>Symbrenthia lilaea</i>	<i>Tagiades latigiosa</i>
			
<i>Cepora nerissa</i>	<i>Delias eucharis</i>	<i>Leptosia nina nina</i>	<i>Pareronia hippia</i>
			
<i>Eurema laeta</i>	<i>Pieris canidia</i>	<i>Jamides celeno</i>	<i>Pseudozizeeria maha</i>
			
<i>Arhopala atrax</i>	<i>Flos asoka</i>	<i>Castalius rosimon rosimon</i>	<i>Callerebia nirmala</i>

			
<i>Euchrysops cnejus cnejus</i>	<i>Papilio demoleus</i>	<i>Cyrestis thyodamas</i>	<i>Danaus genutia</i>
			
<i>Elymnias hypermnestra</i>	<i>Matapa aria</i>	<i>Euploea core</i>	<i>Freyeria putli</i>
			
<i>Hypolimnas bolina</i>	<i>Euthalia aconthea</i>	<i>Euthalia lubentina</i>	<i>Poritia hewitsoni</i>
			
<i>Abisara bifasciata</i>	<i>Melanitis leda</i>	<i>Mycalesis perseus</i>	<i>Zemeros flegyas</i>

Figure-3: Photograph of butterflies recorded from the study area.

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