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Butterfly Diversity in Lateritic Biotope of Kavvayi River Basin, Kerala, India

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ABSTRACT

A study on butterfly diversity of lateritic biotopes of Kavvayi River Basin was conducted during February 2013 to January 2015. The study area represents diverse habitats that include sacred groves, laterite hills, riparian ecosystem, and kanams. A total of 140 species butterflies were recorded from the study area, among which the highest number of butterfly species were from the family Nymphalidae (48 species), followed by Hesperiidae (32 species), Lycaenidae (27 species), Papilionidae and Pieridae with 16 species each and 1 from the family Riodinidae. The present study revealed the faunal richness of the unique ecosystems and microhabitats in lateritic biotopes in terms of butterfly diversity. The study also highlights conservation significance of the area which is under severe human pressure including mining, habitat fragmentation and change in the land-use system.

Keywords: Laterite ecosystem, Host plant, Butterfly diversity, Northern Kerala.

INTRODUCTION

The midland exposed laterite biotope associated with diverse ecosystems and microhabitats represents the most imposing and extremely threatened topographical floristic and faunistic features in the northern part of Kerala. Lateritic hills of the study area are unique with high microhabitat diversity and associated rich floral components[1]. The diversity of plants, habitats, topography and climates influence distribution, diversity and abundance of butterflies[2, 3] and they are good biological indicators of habitat quality as well as general environmental health[4, 5, 6, 7]. Butterflies play a major role in the ecosystem as they interact with the environment as pollinators, seed dispersers, herbivores, predators and prey[8, 9]. Out of the 334 reported butterfly species of Western Ghats, 316 species of butterflies were recorded from Kerala[10]. As per the review of literature, a large number of studies on diversity and distribution of butterflies were done in the protected areas of Kerala includes; Mathew & Rahmathulla[11] who reported 100 species from Silent Valley National Park, Sudheendrakumar[12] reported of 124 species from Parambikulam Wildlife Sanctuary, Shamsudheen and Mathew[13] reported 73 species Shendurney Wildlife Sanctuary, Mathew[14] reported 71 species from Peechi - Vazhani Wildlife Sanctuary, Mathew[15] reported 53 species from Neyyar Wildlife Sanctuary. Other than protected areas, human dominated non-protected natural habitats like sacred groves, home gardens, and countryside city gardens are also important in terms of butterfly diversity[9, 17] as Kunte[18] recorded 104 butterfly species from

Pune city along with the human impact gradient, and recently Gaude[17] reported 33 species of butterflies from four selected sacred groves of Goa. As far as Kerala is concerned, Aneesh[19] reported 139 species of butterflies from Kerala Agricultural University Campus, Prasad[20] recorded 52 species from Kerala University campus. There is very little information available on the ecology and biodiversity of laterite hills in which Palot and Radhakrishnan[21] reported 111 species of butterflies from madayippara. The current study focused on butterfly diversity of Midland laterite biotope of Kavvayi river basin, North Kerala. This landscape includes lateritic hills, sacred groves, mangroves, riparian vegetation and locally conserved vegetations such as kaanam. As studies revealed the distribution patterns of many of the organisms that are currently of the greatest international conservation concern don't coincide with broader diversity patterns like protected areas, parks and sanctuaries[22, 23, 24, 25]. Hence diversity assessment in non-protected areas such as laterite hills, Kanams and sacred grooves are also significant.

Study Area

The mid land laterite hills of Kavvayi river basin is located between 12^0 05' to 12^0 15' North latitude and 75^0 05' to 75^0 20' East longitude (Fig 1). It spread over an area of 164.76 km^2 covering 14 villages and spreads over nine local bodies in the districts of Kannur and Kasargod.

The selected ecosystems include Lateritic hills (IT Park, Ariyittapara and Madayippara); Sacred Groves (Edayilakkadu Kavu, Mappittassery Kavu and Chamakkavu) and 'Kaanam' (Vattapoyil Kaanam and Vannathikaanam) which are distributed in Lateritic biotopes of Kannur and Kasargod Districts (Fig 1).

MATERIALS AND METHODS

Butterflies were observed for a period two year from February 2013 to January 2015. The observations were made randomly from 0800 hr to 1100 hr, which is the peak time of butterfly activity and also they were observed from 1530 hr to 1730

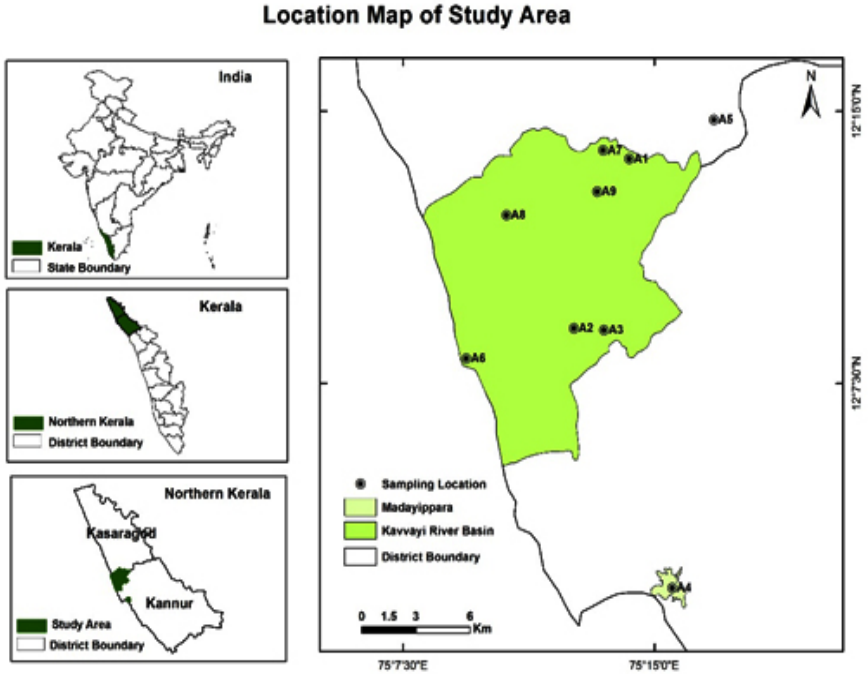


Fig.1: Showing the study area(A1: IT Park, A2: Chamakkavu, A3: Riparian Ecosystem, A4: Madayippara, A5: Ariyittapara, A6: Edayilakkadu Kavu, A7: Vannathikanam, A8: Mappittassery Kavu, A9: Vattappoyi Kanam.

hr. Butterflies were identified directly from the field and in difficult cases, they were photographed and identified using the field guides[26, 27]. Taxonomy and nomenclature have been updated after[28]. Butterflies observed were categorized into three groups based on their occurrence in selected study areas. Accordingly, those observed in 7-9 locations were listed as very common (VC), 4-6 as common (C),

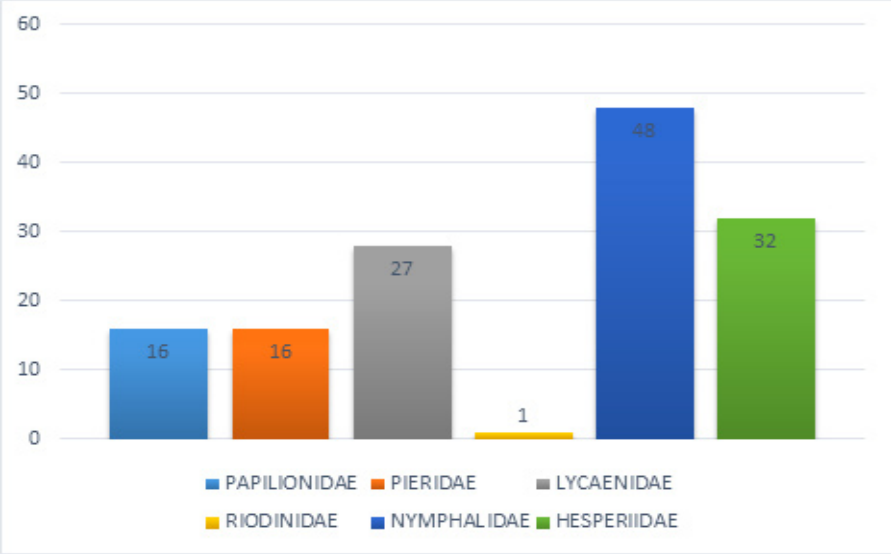


Fig. 2: Family wise distribution of butterfly species in lateritic biotope of Kavvai River basin

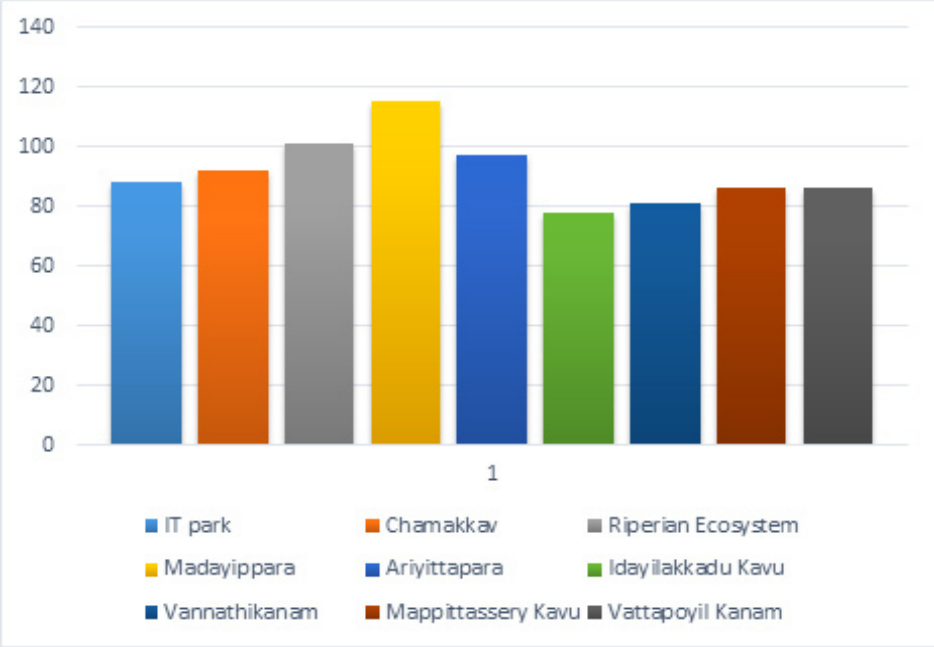


Fig. 3: Diversity of butterflies in different ecosystems

1-3as rare (R).Data were further analysed by cluster analysis based on squared Euclidean distance using SPSS 20 version.

RESULTS AND DISCUSSION

The study reports a total of 140 species butterflies from lateritic biotopes of Kavvayi river basin. Among which the highest number of butterfly species were from the family Nymphalidae (48 species) with three Western Ghat endemic butterflies (*Cirrochroa thais, Kallima horsfieldii* and *Mycalesis junonia*) followed by Hesperiidae (32 species) with one Western Ghat endemic (*Oriens concinna*), Lycaenidae (27 species) with one Western Ghat endemic (*Curetis siva*), Papilionidae (16 species) with two Western Ghat endemics (*Papilio dravidarum, Papilio liomedon*), Pieridae(16 species)with one Western Ghat endemic (*Pareronia ceylonica*), and one butterfly from the family Riodinidae. Family wise distribution of butterflies is represented in the Fig. 2. The study area hosts eight butterflies which are protected under various schedules of the Indian Wildlife (Protection) Act, 1972 (Table 1).

Butterfly diversity in different laterite ecosystems is varied in terms of a number of species (Fig. 3). The distribution of a butterfly species in a definite area is mainly based on the diversity of plants, habitats, topography and climates[2]. Other than the environmental conditions diversity of butterflies in sacred groves is also influenced by the presence of surrounded human settlements and home gardens. The presence of home gardens has a positive influence in Mappittassery and Chamakkavu in terms of a number of butterfly species, whereas in Edayilakkadu Kavu the diversity is comparatively lesser than the other two. The newly proposed IT park area is having a total of 88 species of butterfly among which *Pachliopta hector, Papilio clytia, Hypolimnas misippus* and *Castalius rosimon* are protected species under the Schedule I and *Appias lyncida* is protected species under Schedule II of Indian Wildlife Protection Act of 1972. Madayippara

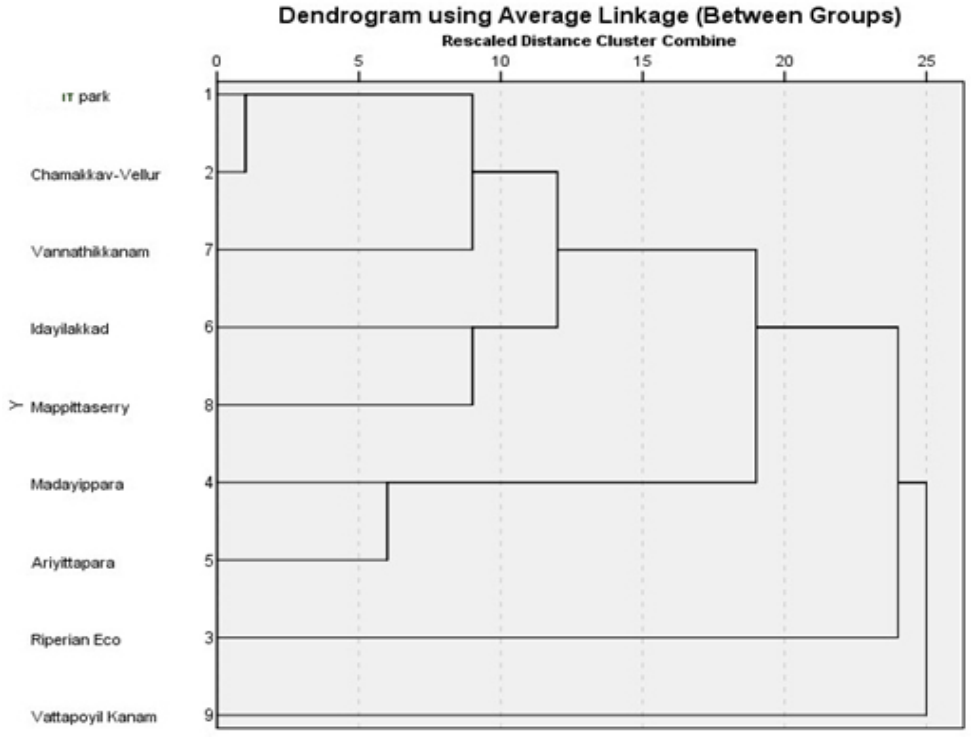


Fig. 4: Dendrogram depicting the clustering of different laterite ecosystems.

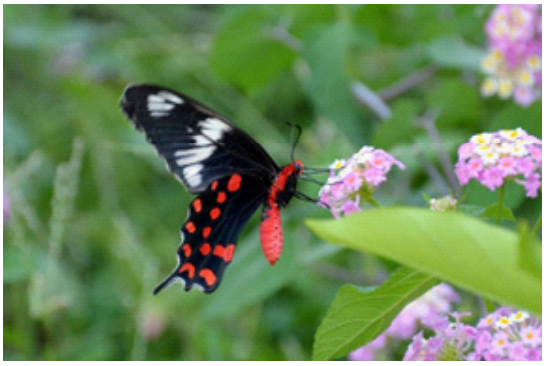
Table 1: Butterfly checklist of Laterite ecosystems of Kavvayi river basin, Kerala, India.

#	Scientific name	Common name	Status	A1	A2	A3	A4	A5	A6	A7	A8	A9
Family: PAPILIONIDAE												
1	Troides minos	Sahyadri Birdwing	VC	+	+	+	+	+	+	+	+	+
2	Pachliopta aristolochiae	Common Rose	VC	+	+	-	+	+	+	-	+	+
3	Pachliopta pandiyana Moore	Malabar Rose	C,E	+	-	+	-	-	+	-	-	+
4	Pachliopta hector	Crimson Rose	C,									
SchI	+	+	+	+	+	+	+	+	-			
5	Papilio clytia clytia	Oriental Common Mime	VC, Sch I	+	+	+	+	+	+	+	+	+
6	Papilio demoleus	Lime Butterfly	VC	+	+	+	+	+	+	+	+	+
7	Papilio liomedon	Malabar Banded Swallowtail	R, E									
Sch I	-	-	-	+	-	-	-	-	-			
8	Papilio dravidarum	Malabar Raven	VC, E	+	+	-	+	+	+	+	+	+
9	Papilio helenus	Red Helen	VC	+	+	+	+	+	+	+	+	+
10	Papilio polytes	Common Mormon	VC	+	+	+	+	+	+	+	+	+
11	Papilio polymnestor	Blue Mormone	VC	+	+	+	+	+	+	+	+	+
12	papilio paris	Paris Peacock	VC	+	+	+	+	+	+	+	+	+
13	Papilio buddha	Malabar Banded Peacock	C	-	+	-	+	+	-	-	-	+
14	Graphium sarpedon	Common Bluebottle	VC	+	+	+	+	+	+	+	+	+
15	Graphium doson	Common Jay	R	-	-	+	-	-	+	-	+	-
16	Graphium agamemnon	Tailed Jay	VC	+	+	+	+	+	+	+	+	+
Family: PIERIDAE												
17	Delias eucharis	Common Jezebel	VC	+	+	+	+	+	+	+	+	+
18	Prioneris sita	Painted Sawtooth	VC	+	+	+	+	+	+	+	+	+
19	Leptosia nina	Psyche	VC	+	+	+	+	+	+	+	+	+
20	Cepora nerissa	Common Gull	C,									
Sch II	-	-	+	+	+	+	-	+	-			
21	Cepora nadina	Lesser Gull	R,									
Sch II	-	-	+	-	-	-	-	-	-			
22	Belenois aurota aurota	Pioneer	R	-	-	+	+	-	-	-	-	-
23	Appias lyncida	Chocolate Albatross	VC, Sch II	+	+	+	+	+	+	+	+	+
24	Appias albina	Common Albatross	VC	+	+	+	+	+	+	+	+	+
25	Ixias pyrene	Yellow Orange Tip	C	-	+	+	-	-	+	-	+	-
26	Hebomoia glaucippe	Sahyadri Great Orange Tip	VC	-	+	+	+	+	-	+	+	+
27	Pareronia ceylonica	Dark Wanderer	VC, E	+	+	+	+	+	+	-	+	+
28	Catopsilia pomona	Lemon Emigrant	VC	+	+	+	+	+	+	+	+	+
29	Catopsilia pyranthe pyranthe	Mottled Emigrant	VC	+	+	+	+	+	+	+	+	+
30	Eurema brigitta	Small Grass Yellow	VC	+	+	+	+	+	+	-	+	-
31	Eurema hecabe	Common Grass Yellow	VC	+	+	+	+	+	+	+	+	-
32	Eurema blanda	Three-spot Grass Yellow	VC	+	+	+	+	+	+	+	-	-
Family: LYCAENIDAE												
33	Spalgis epeus	Apefly	C	+	-	-	+	-	-	+	-	+
34	Castalius rosimon	Common Pierrot	VC, Sch I	+	+	-	+	+	+	+	+	-
35	Caleta decidia decidia	Angled Pierrot	VC	+	+	-	+	+	+	+	+	+
36	Discolampa ethion ethion	Oriental Banded Blue Pierrot	R	-	-	-	+	+	-	-	-	-

37	Acytolepis puspa felderi	Malabar Common Hedge Blue	R	+	-	-	-	-	-	-	-	-
38	Neopithecops zalmora	Quaker	VC	+	+	+	+	+	+	+	-	-
39	Megisba malaya	Malyan	VC	+	+	+	+	+	+	+	+	+
41	Euchrysops cnejus	Gram Blue	R	+	-	-	+	+	-	-	-	-
41	Lampides boeticus	Pea Blue	R	-	-	-	+	+	-	-	-	-
42	Jamides bochus	Dark Cerulean	R	-	+	-	+	+	-	-	-	-
43	Jamides celeno	Common Cerulean	VC	+	+	+	+	+	+	+	+	+
44	Prosotas nora	Common Lineblue	R	-	-	-	+	-	-	-	-	-
45	Talicada nyseus	Red pierrot	VC	+	+	+	+	+	+	+	+	+
46	Thaduka multicaudata	Many-Tailed Oak Blue	C	-	-	-	+	+	-	+	+	+
47	Arhopala centaurus pirama	Tamil Centaur Oakblue	R	-	-	-	+	+	-	-	-	-
48	Surendra quercetorum	Common Acacia Blue	R	-	-	-	+	-	-	-	+	-
49	Spindasis vulcanus	Common Sliver Line	C	+	-	-	+	-	-	-	+	+
50	Loxura atymnus atymnus	Sahyadri Yamfly	VC	+	+	+	+	+	+	+	+	+
51	Cheritra freja	Common Imperial	R	-	-	-	+	-	-	-	-	+
52	Rathinda amor	Monkey Puzzle	VC	+	+	+	+	+	-	+	+	+
53	Zesius chrysomallus	Red spot	R	-	-	-	+	+	-	-	-	-
54	Zeltus amasa	Indian Fluffy Tit	C	+	+	-	-	-	-	-	+	+
55	Virachola isocrates	Common Guava Blue	R	+	-	+	-	-	-	-	-	-
56	Rapala manea	Slate Flash	R	-	-	-	+	+	-	-	-	-
57	Rapala lankana	Malabar Flash	R	-	-	-	+	+	-	-	-	-
58	Curetis thetis	Indian Sun Beam	R	-	-	-	+	+	-	-	+	-
59	Curetis siva	Shiva Sun Beam	R, E	-	+	+	-	-	-	-	-	-
Family: RIODINIDAE												
60	Abisara echerius	Plum Judy	VC	+	+	+	+	+	-	+	+	+
Family: NYMPHALIDAE												
61	Danaus chrysippus	Oriental Plain Tiger	VC	+	+	+	+	+	+	+	+	+
62	Danaus genutia	Stripped Tiger	VC	+	+	+	+	+	+	+	+	+
63	Tirumala limniace	Blue Tiger	VC	+	+	+	+	+	+	+	+	+
64	Tirumala septentrionis	Dark Blue Tiger	VC	-	+	+	+	+	+	+	+	+
65	Parantica aglea	Glassy Blue Tiger	VC	+	+	+	+	+	+	+	+	+
66	Euploea core	Common Crow	VC	+	+	+	+	+	+	+	+	+
67	Ariadne ariadne	Angled Castor	VC	+	+	+	+	+	-	+	+	+
68	Ariadne merione	Common Castor	VC	+	+	+	+	+	+	+	-	+
69	Cupha erymanthis	Sahyadri Rustic	VC	+	+	+	+	+	+	+	+	+
70	Phalanta phalantha	Common Leopard	VC	+	+	+	+	+	+	+	+	+
71	Cirrochroa thais	Tamil Yeoman	VC, E	+	+	+	+	+	+	+	+	+
72	Vindula erota	Sahyadri Cruiser	VC	+	+	+	+	+	+	-	+	+
73	Junonia hierta	Oriental Yellow Pansy	VC	+	+	+	+	+	+	+	+	+
74	Junonia orithya	Blue Pansy	VC	+	+	+	+	+	-	+	+	+
75	Junonia lemonias	Lemon Pansy	VC	+	+	+	+	+	+	+	+	+
76	Junonia almana	Oriental Peacock Pansy	VC	+	+	+	+	+	+	+	+	+
77	Junonia atlites	Oriental Grey Pansy	VC	+	+	+	+	+	+	+	+	+
78	Junonia iphita	Oriental Chocolate Pansy	VC	+	+	+	+	+	+	+	+	+
79	Kaniska canace	Sahyadri Blue Admiral	R	-	+	+	-	-	-	-	-	-
80	Hypolimnas misippus	Danaid Eggfly	VC, Sch I	+	+	+	+	+	+	-	+	+
81	Hypolimnas bolina	Great Eggfly	VC	+	+	+	+	+	+	-	+	-

82	Kallima horsfieldi	Sahyadri Blue oakleaf	C, E	-	+	+	-	-	+	-	+	+
83	Doleschallia bisaltide malabarica	Malabar Autumn Leaf	R	-	-	-	+	+	-	-	-	-
84	Cyrestis thyodamas	Map Butterfly	VC	+	+	+	+	+	+	+	+	+
85	Neptis jumbah	Chestnut-Streaked Sailer	R	-	-	-	+	-	-	-	+	+
86	Neptis hylas	Indian Common Sailor	VC	+	+	+	+	+	+	+	+	+
87	Pantoporia hordonia	Oriental Common Lascar	VC	+	+	+	+	+	+	+	+	-
88	Athyma inara	Colour Sergeant	C	-	+	+	-	-	+	+	-	-
89	Athyma ranga	Blackvein Sergeant	C	-	-	-	+	+	+	+	-	-
90	Athyma perius	Common Sergeant	R	-	-	-	+	-	-	-	-	-
91	Moduza procris	Sahyadri Commander	VC	+	+	-	+	+	+	+	+	+
92	Parthenos sylvia	Sahyadri Clipper	VC	+	+	+	+	+	+	+	+	+
93	Tanaecia lepidea	Grey Count	VC	+	+	+	+	+	+	+	+	+
94	Euthalia lubentina	Gaudy Baron	R	-	-	-	+	-	-	+	-	+
95	Charaxes athamas	Common Nawab	C	+	+	+	-	-	-	+	-	+
96	Charaxes solon	Pale Black Rajah	R	-	-	+	-	-	-	-	-	-
97	Acraea terpsicore	Tawny Coster	VC	+	+	+	-	+	+	+	+	+
98	Melanitis leda	Common Evening Brown	VC	+	+	+	-	+	+	+	+	+
99	Melanitis zitenius	Sahyadri Great Evening Brown	R	-	-	-	-	-	-	-	-	+
100	Elymnias hypermnestra	Common Palmfly	C	-	-	+	+	-	+	+	+	-
101	Lethe europa	Dakhan Bamboo Treebrown	C	-	-	+	+	-	+	+	-	-
102	Lethe rohria	Dakhan Common Tree Brown	C	+	+	+	-	-	-	-	-	+
103	Mycalesis perseus	Common Bushbrown	C	+	+	+	+	+	-	-	+	-
104	Mycalesis mineus	Dark-Brand Bushbrown	R	-	+	+	+	-	-	-	-	-
105	Mycalesis junonia	Malabar Glad-eye-Bushbrown	VC, E	+	+	+	+	+	+	+	+	+
106	Orsotriaena medus	Sahyadri Medus Brown	VC	+	+	+	+	+	+	+	+	+
107	Ypthima baldus	Sahyadri Common Fivering	VC	+	+	+	+	+	+	+	+	+
108	Ypthima huebneri	Common Fourring	VC	+	+	+	+	+	+	+	-	+
Family: HESPERIIDAE												
109	Bibasis sena	Orange-tail Awl	R	-	-	+	+	+	-	-	-	-
110	Choaspes benjaminii	Indian Awlking	R	-	-	+	-	-	-	-	-	-
111	Hasora chromus	Common Banded Awl	C	+	-	-	+	+	+	-	-	-
112	Hasora taminatus	White-Banded Awl	R	-	-	+	-	-	-	-	-	+
113	Hasora badra	Common Awl	R	-	-	+	-	-	-	-	-	-
114	Badamia exclamationis	Brown Awl	R	-	-	-	+	-	-	-	-	+
115	Celaenorrhinus ambareesa	Dakhan Spotted Flat	R	-	-	+	+	-	-	-	-	-
116	Tagiades gana silvia	Snuffused Snow Flat	VC	+	+	+	+	+	+	+	+	+
117	Gerosis bhagava	Common Yellow-breasted Flat	R	-	-	-	+	+	-	-	-	-
118	Tagiades japetus	Common Snow Flat	VC	-	+	+	-	+	+	+	+	+
119	Tagiades litigiosa	Water Snow Flat	VC	-	+	+	+	+	+	+	+	+
120	Sarangesa dasahara	Common Small Flat	VC	+	+	+	+	+	-	+	+	+
121	Sarangesa purendra pandra	Spotted small Flat	R	-	-	-	+	-	-	-	-	-
122	Pseudocoladenia dan	Fulvious Pied Flat	VC	+	+	+	+	+	+	+	+	-
123	Coladenia indrani indra	Tricolor Pied Flat	VC	+	+	+	+	+	+	+	+	+
124	Iambrix salsala	Chestnut Bob	VC	+	+	+	+	+	+	+	+	+
125	Notocrypta curvifascia	Restricted Demon	VC	+	+	+	+	+	+	+	-	-
126	Matapa aria	Common Redeye	R	-	-	+	-	-	-	-	-	+
127	Borbo cinnara	Rice Swift	VC	+	+	+	+	-	-	+	+	+
128	Aeromachus pygmaeus	Pygmy scrub Hopper	VC	+	+	+	-	-	-	+	-	+
129	Ampittia dioscorides	Bush Hopper	R	-	-	+	+	+	-	-	-	-

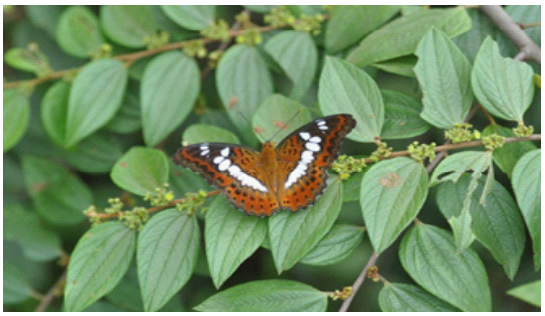
130	Psolos fuligo	Coon	VC	+	+	+	+	+	+	+	+	+
131	Notocrypta paralysos	Common Banded Demon	R	-	-	+	-	-	-	-	+	+
132	Udaspes folus	Grass Demon	VC	+	+	+	+	+	-	+	+	-
133	Suastus gremius	Indian Palm Bob	C	-	-	+	+	+	-	+	-	-
134	Gangara thyrsis	Giant Redeye	R	-	-	-	+	+	-	-	-	-
135	Telicota bambusae	Dark Palm Dart	R	+	-	-	-	-	-	-	+	+
136	Oriens concinna	Tamil Dartlet	C, E	+	+	+	+	-	-	+	+	-
137	Oriens goloides	Smaller Dartlet	R	+	+	+	-	-	-	-	-	-
138	Taractrocera maevius	Oriental Grass Dart	R	-	-	-	+	+	-	-	-	-
139	Pelopidas mathias	Dakhan Small Branded Swift	R	+	+	-	+	-	-	-	-	-
140	Erionota thrax	Palm Redeye	R	-	-	-	+	-	-	-	-	+



Selected species from the study area

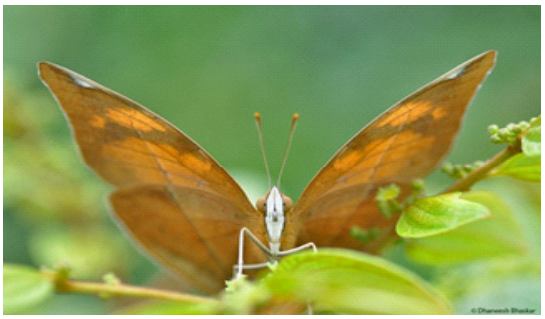
Rathinda amor

Pachliopta hector



Rapala manea

Moduza procris



Doleschallia bisaltide malabarica

and Ariyittapara are two open laterite hills along with riparian ecosystem having the highest number of butterfly species among the other laterite ecosystems respective to the high diversity of host plant species. The high diversity of butterflies in lateritic hills may be due to the presence large number of microhabitats within the system[1].

Dendogram depicting the similarity in species composition between different selected study areas (Fig. 4) showed more similarity between IT park and Chamakkavu followed by Madayippara and Ariyttapara. Madayippara and ariyittapara are open laterite hill top with almost same vegetation, where as in the case of IT park and Chamakkavu both are different in their topography and plant distribution the presence of home gardens around the chamakkav is one the main reason for similarity of butterfly species with the laterite hills of IT park area.

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A1 IT park, **A2** Chamakkavu, **A3** Riparian Ecosystem, **A4** Madayippara, **A5** Ariyittapara, **A6**Edayilakkadu kavu, **A7** Vannathikkanam, **A8** Mappittasserry Kavu, **A9** Vattappoyil kanam. **VC** very common, **C** common, **R** rare, **E** endemic to Western Ghats, **Sch I, Sch II,Sch IV**: Species protected under schedule I, Schedule II and Schedule IV of Indian Wildlife Protection Act of 1972). + and – are used to represent the presence and absence of butterflies.

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