



Butterflies in the Great Himalayan Conservation Landscape in Himachal Pradesh, Western Himalaya

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ABSTRACT: Seventy five species of butterflies belonging to 48 genera and five families were documented from different forest types and watershed in the Great Himalayan Conservation Landscape area of Himachal Pradesh. The butterfly composition (richness and diversity) was significantly higher in broad leaved forest compared to other forested habitats. Sub-alpine habitat had the most dissimilar butterfly species. The richness pattern also showed a positive trend with an increase in altitudinal gradient.

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KEYWORDS: butterfly diversity, Himachal Pradesh, India

INTRODUCTION

The butterfly fauna of Indian sub-continent have been mainly studied by Talbot (1939), Wynter-Blyth (1957), D'Abrera (1982, 1985), Mani (1986), Haribal (1992), and Kunte (2000). However, detailed assessments based on different bio-geographical regions, national parks and sanctuaries, forest types and landscapes were mainly undertaken by Singh (1999), Singh and Bhandari (2003), Joshi *et al.* (1999), and Uniyal (2004). Various studies on insects and status of butterflies of Great Himalayan National Park, Himachal Pradesh were mainly conducted by Uniyal and Mehra (1996), Uniyal and Nagesh Kumar (1997), Uniyal and Mathur (1998), and Uniyal (1996, 1999).

The present study is the first attempt to document the butterfly diversity at the landscape level in the Great Himalayan Conservation Landscape (GHCL) in the districts Kullu and Kinnaur of Himachal Pradesh. The GHCL constitutes areas of the mountainous landscape covering the Great Himalayan National Park, Kanawar, Tirthan, and Rupi Bhaba Wildlife Sanctuary including managed forests of the Parbati Forest Division, Kullu. The study was conducted from March 2002 to July 2003.

Study area – The Great Himalayan Conservation Landscape

The GHCL represents the 2A-North West Himalayas Biotic Province of the 2-Himalayan Biogeographic Zone (Rodgers and Panwar, 1988). The area of GHCL lies in the districts of Kullu and Kinnaur of Himachal Pradesh. The area lies between Latitude 31° 32' and 32° 14' 30" N and Longitude 77° 1' 30" to 78° 6' 30" E covering 4,854.89 sq km. The constituent areas of the mountainous landscape are the Great Himalayan National Park (754.4 sq km), Pin valley National Park (675 sq km); four Wildlife Sanctuaries viz., Kanawar (63 sq km), Sainj (90 sq km), Tirthan (61 sq km), and Rupi Bhaba (738 sq km); and managed forests of the Parbati Forest Division (2,047 sq km); Ecozone of GHNP (265.49 sq km); and parts of Rampur and Kinnaur Divisions (161 sq km). Thus, GHCL represents one of the largest contiguous tracts under the wildlife protected areas along with adjacent managed forests in the state of Himachal Pradesh (Wildlife Institute of India, 2005).

The landscape features

The terrain in the landscape is characterized by numerous high ridges (>4,000 m), snow capped peaks, large glaciers, deep gorges and precipitous cliffs, and narrow valleys. The GHCL constitutes significant and valuable catchments of two regionally important major rivers viz., Beas and Satluj in the state and its important tributaries are the Parbati, Jiva, Sainj, and Tirthan that drain the landscape. The northern and northeastern parts of the landscape cover several prominent glaciers while the rest of the area is criss-crossed with streams.

An unnamed highest peak is located in the Parbati sub-watershed while the minimum altitude is closer to southern boundary of the landscape i.e. river Satluj. This vast altitudinal gradient along with multiplicity of different landforms, slopes, aspects and past management has provided diversity of forests and other wildlife habitats. Bulk of the temperate forests occurs in lower altitudes (1,300–3,200 m). A narrow belt of sub-alpine forests occurs at >3,200–3,600 m elevation. Alpine pastures at >3,600 m dots the landscape. The landscape is highly significant from biodiversity point of view with a high level of rare and endangered floral and faunal species.

Floral diversity

The flora of GHCL exhibits characteristics of temperate – alpine type (Rawat, 2003). However, the low-lying river valleys and grassy slopes are characterized by sub-tropical elements such as *Toona ciliata*, *Dalbergia sissoo*, *Carissa carandas*, *Woodfordia fruticosa*, and *Ficus* spp. Coniferous trees such as *Pinus roxburghii*, *Pinus wallichiana*, *Cedrus deodara*, *Taxus wallichiana*, *Picea smithiana*, *Abies pindrow* and *Abies spectabilis* characterize the temperate belt. Oaks (*Quercus* spp.) form important floral elements in the temperate broadleaf forests. In the sub-alpine zone, *Prunus cornuta*, *Betula utilis* and *Rhododendron campanulatum* are the important floral elements. The temperate and sub-alpine regions of GHCL also exhibit high diversity of shrub species. Common genera of shrubs in the region are *Berberis*,

Daphne, *Desmodium*, *Deutzia*, *Hypericum*, *Lonicera*, *Indigofera*, *Prinsepia*, *Ribes*, *Rhamnus*, *Rhododendron*, *Rubus*, *Sarcococca*, *Sorbaria* and *Viburnum*. Two species of hill bamboo viz., *Arundinaria falcata* and *Thamnocalamus spathiflorus* were also found in the study area.

METHODS

The survey was conducted using Pollard walk on fixed transects (Pollard and Yates, 1993) to enumerate the butterfly species in different habitats of GHCL. Existing patrolling paths were used as transects with a minimum of 1 km distance. All flying butterflies on these selected transects were recorded between 0800 to 1000 h. A reference collection was maintained and butterflies that could not be identified were collected and identified later following Evans (1932), Talbot (1939), Wynter-Blyth (1957), Mani (1986) and reference collection at Zoological Survey of India. To control sample size effects, Shannon index was used to calculate species diversity, to emphasize the richness component of butterfly diversity. Species presence/absence data in five different habitat types were analyzed using cluster analysis (Sorensen distance) to reveal similarities between habitat types.

RESULTS AND DISCUSSION

A total of 75 species of butterflies belonging to 48 genera were documented from different altitude and watershed of GHCL (Table 1). Ten species belonging to five genera of family Papilionidae were recorded in different vegetation and forest community. The Common blue apollo (*Parnassius hardwicki*) and Regal apollo (*Parnassius charltonius*) were recorded from the alpine areas above 3,500 m altitude. Fourteen species belonging to ten genera of family Pieridae were recorded from broad leaved forest areas between 1,000 to 2,500 m altitude. Only four species viz. Dark clouded yellow (*Colias electo fieldii*); Pale clouded yellow (*Colias erate*); Himalayan blackvein (*Aporia leucodyce*) and Lesser brimstone (*Gonepteryx aspasia*) were found in sub alpine to alpine areas. Family Nymphalidae with 37 species of 23 genera had the largest representation. Most of the species of Nymphalidae were documented from broad leaved forest areas in the landscape. The Indian red admiral (*Vanessa indica*), Painted lady (*Vanessa cardui*), Eastern comma (*Vanessa egea*), Indian tortoise shell (*Aglaia cashmiriensis*), Queen of Spain fritillary (*Issoria lathonia*), Large silver strip (*Argynnis childreni*), Comma (*Polygonia c-album*), Great satyr (*Aulocera padma*), Common satyr (*Aulocera swaha*), etc. were the species observed in broad leaved and sub-alpine and alpine area. Ten species belonging to seven genera of family Lycaenidae were documented in broad leaved to mixed broad leaved areas. Four species belonging to three genera of family Hesperidae were documented in mixed broad leaved forest areas.

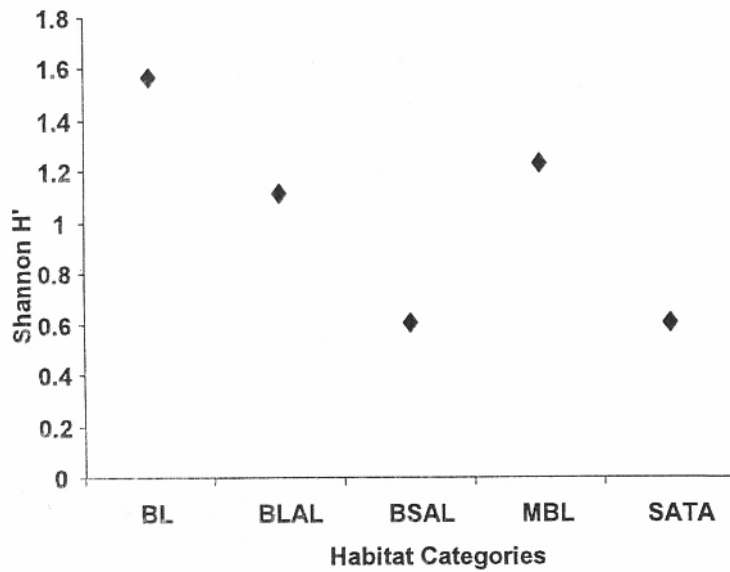


FIGURE 1. Diversity index of butterfly assemblage for different habitats along elevation zones. BL, broad leaved; BLAL, broad leaved to alpine; BSAL, broad leaved to subalpine; MBL, mixed broad leaved; SATA, subalpine to alpine.

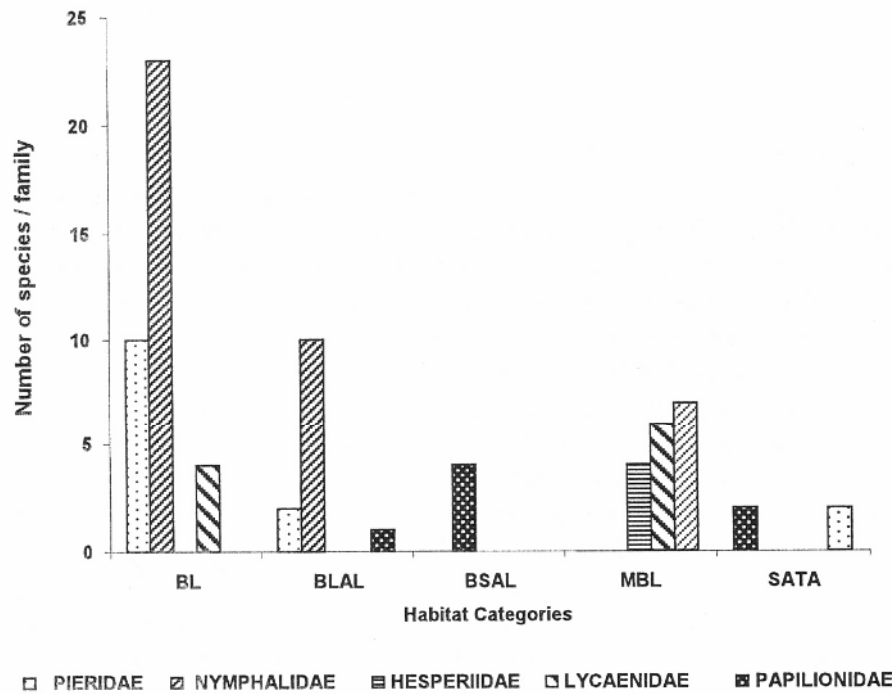


FIGURE 2. Family composition of butterfly assemblage in different habitat categories

TABLE 1. Butterfly species recorded from Great Himalayan Conservation Landscape

Family/species	Common name	Habitat	Altitude (m)
Papilionidae			
<i>Atrophaneura polyeuctes</i> Doubleday	Common Windmill	MBL	1000–2500
<i>Graphium cloanthus</i> Westwood	Glassy Blue Bottle	MBL	1000–2500
<i>Papilio machaon</i> L.	Yellow swallowtail	BLAL	2000–3500
<i>Parnassius charltonisus</i> Gray	Regal Apollo	SATA	3000 & above
<i>P. hardwickei</i> Gray	Common Blue Apollo	SATA	3000 & above
<i>Princeps polyctor</i> Boisduval	Common Peacock	MBL	1000–2500
<i>P. arcturus</i> Westwood	Blue Peacock	MBL	1000–2500
<i>P. demoleus</i> L.	Lime Butterfly	MBL	1000–2500
<i>P. krishna</i> Moore	Krishna Peacock	MBL	1000–2500
<i>P. polytes</i> L.	Common Mormon	MBL	1000–2500
Pieridae			
<i>Anapheis aurota aurota</i> Fabricius	Pioneer	BL	1000–2000
<i>Aporia leucodyce</i> Eversmann	Himalayan Blackvein	BLAL	2000–3500
<i>Catopsilia pomona</i> Fabricius	Lemon Emigrant	BL	1000–2500
<i>Colias electo fieldii</i> Menetries	Dark Clouded Yellow	SATA	2000 & above
<i>C. erate</i> Esper	Pale Clouded Yellow	SATA	2000 & above
<i>Delias belladonna</i> Fabricius	Hill Jezebel	BL	1000–2500
<i>Gonepteryx aspasia</i> Menetries	Lesser Brimstone	BLAL	1000–3500
<i>G. rhamni</i> L.	Common Brimstone	BL	1000–2500
<i>Parenonia valeria hippie</i> Fabricius	Common Wanderer	BL	1000–2000
<i>Pieris brassicae</i> L.	Large Cabbage White	BL	1000–2000
<i>P. canidia indica</i> Evans	Indian Cabbage White	BL	1000–2000
<i>P. dubernardi chumbiensis</i> De Niceville	Chumbi White	BL	1000–2000
<i>Pontia daplidice</i> L.	Bath White	BL	1000–2000
<i>Prioneris thestylis thestylis</i> Doubleday	Spotted Sawtooth	BL	1000–2000
Nymphalidae			
<i>Abisara echerius</i> Stoll	Plum Judy	BL	1000–2500
<i>A. fylla</i> Doubleday	Dark Judy	BL	1000–2500
<i>Acraea violae</i> Horsfield	Tawny Coster	BL	1500–2500
<i>Aglais cashmiriensis</i> Kollar	Indian Tortoiseshell	BLAL	1000 & above
<i>Argynnis childreni</i> Gray	Large Silver Stripe	BLAL	2000–3500
<i>A. hyperbius</i> Johanssen	Indian Fritillary	BL	1000–2500
<i>Aulocera padma</i> Kollar	Great Satyr	BSAL	1000–3000
<i>A. saraswati</i> Kollar	Striated Satyr	BSAL	1000–3000
<i>A. swaha</i> Kollar	Common Satyr	BSAL	1000–3000
<i>Cynthia erota</i> Fabricius	Cruiser	BL	1000–2500
<i>Danaus aglea</i> Cramer	Glassy Tiger	BL	1500–2500
<i>D. chrysippus</i> L.	Plain Tiger	BL	1000–2500
<i>D. genutia</i> Cramer	Common Tiger	BL	1000–2500
<i>Dodona durga</i> Kollar	Common Punch	BL	1000–2500
<i>Issoria lathonia issaea</i> Doubleday	Queen of Spain Fritillary	BLAL	2000 & above
<i>Lassiommata schakra</i> Kollar	Common Wall	BSAL	1000–2500
<i>Lethe nicetas</i> Hewitson	Yellow Woodbrown	BLAL	1000–3500

contd...

TABLE 1. (contd...)

Family/species	Common name	Habitat	Altitude (m)
Nymphalidae			
<i>L. pulaha</i> Moore	Veined Labyrinth	BLAL	1500–3500
<i>L. verma</i> Fruhstorfer	Straight-Banded Tree Brown	BL	1000–2500
<i>Mycalasis francisca</i> Cramer	Lilacine Bush brown	BL	1500–2500
<i>Neptis hylas varmona</i> Moore	Common Sailer	BL	1000–2500
<i>Parantica sita sita</i> Kollar	Chestnut Tiger	BL	1000–2500
<i>Parathyma perius</i> L.	Common sergeant	BL	1000–2500
<i>Pareba vesta</i> Fabricius	Yellow Coster	BL	1500–2500
<i>Polygonia c-album</i> L.	Comma	BLAL	2000–3500
<i>Precis hierta lemonias</i> L.	Lemon Pansy	BL	1000–2500
<i>P. hierta magna</i> Fabricius	Yellow Pansy	BL	1000–2500
<i>P. iphita iphita</i> Cramer	Chocolate Pansy	BL	1000–2500
<i>P. orithyia</i> L.	Blue Pansy	BL	1000–2500
<i>Raphicera moorei</i> Butler	Small Tawny Wall	BLAL	1000–3000
<i>Sephisa dichroa</i> Kollar	Western Courtier	BL	1000–2500
<i>Symbrenthia hypselis</i> Godart	Himalayan Jester	BL	1000–2500
<i>Vanessa canace</i> Johanssen	Blue Admiral	BL	2000–2500
<i>V. cardui</i> L.	Painted Lady	BLAL	2000 & above
<i>V. egea</i> Cramer	The Eastern Comma	BLAL	2000 & above
<i>V. indica indica</i> Herbst	Indian Red Admiral	BLAL	2000 & above
<i>Ypthima baldus</i> Fabricius	Common Five ring	BL	1000–2500
Lycaenidae			
<i>Acetolepsis puspa gisca</i> Fruhstorfer	Common Hedge Blue	MBL	1000–2500
<i>Deudoryx epijarbas</i> Moore	Cornelian	MBL	1000–2500
<i>Heliophorus androcles</i> Hewitson	Green Sapphire	BL	1000–2500
<i>H. bakeri</i> Evans	Western Blue Sapphire	MBL	1000–2500
<i>H. sena</i> Evans	Sorrel Sapphire	MBL	1000–2500
<i>Lampides boeticus</i> L.	Common Pea blue	MBL	1000–2500
<i>Loxura atymnus</i> Cramer	Yam fly	BL	1000–2500
<i>Lycaena phleas</i> L.	Common Copper	BL	1000–2000
<i>Zizeeria lysimon</i> Hubner	Dark Grass Blue	BL	1000–2500
<i>Z. maha</i> Kollar	Pale Grass Blue	MBL	1000–2500
Hesperiidae			
<i>Celaenorrhinus leucocera</i> Kollar	Common Spotted Flat	MBL	1000–2500
<i>Pelopidas sinensis</i> Moore	Large Branded Swift	MBL	1000–2500
<i>Tagiades litigiosa</i> Möschler	Water Snow Flat	MBL	1000–2500
<i>T. menaka</i> Moore	Spotted Snow Flat	MBL	1000–2500

BL, Broad leaved; BLAL, Broad leaved to alpine; MBL, Mixed broad leaved;
BSAL, Broad leaved to sub alpine; SATA, Sub alpine to alpine

Habitat heterogeneity and butterfly assemblage

Of the 75 species documented during the survey, 49.3% of species were encountered in broad leaved habitat, which is significantly higher compared to other habitat categories

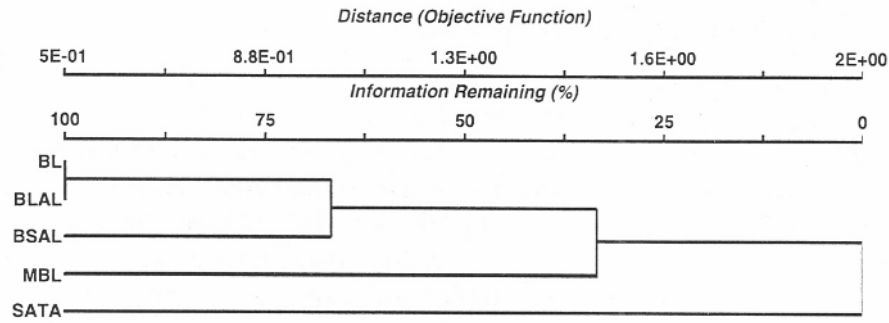


FIGURE 3. Clusters of different butterfly assemblages along elevational gradient based on similarity in butterfly species composition at regional level

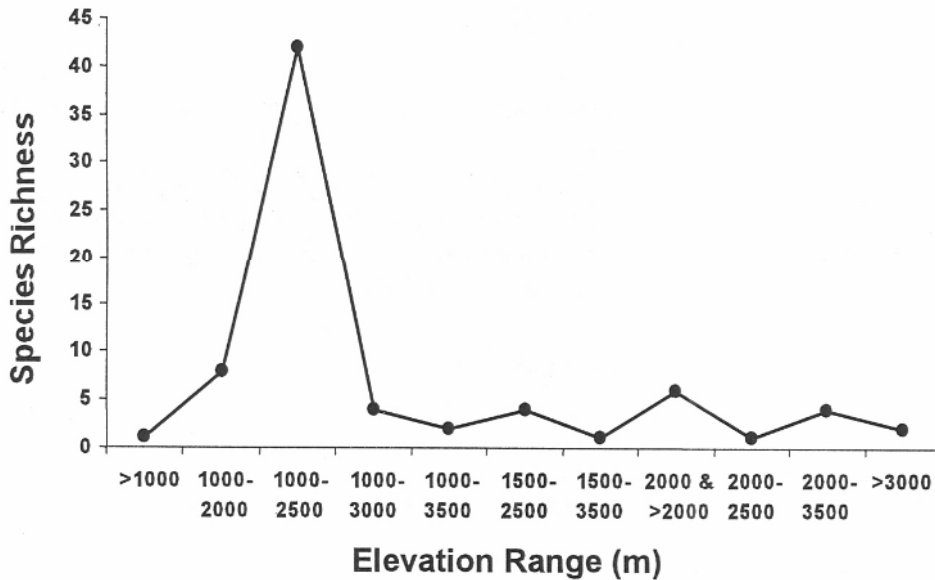


FIGURE 4. Species Richness of butterfly assemblages along 11 elevation zones

viz. broad leaved to alpine, mixed broad leaved, broad leaved to sub alpine and sub alpine to alpine. Shannon index ranked broad leaved habitat as the most diverse and broad leaved to sub alpine as least diverse for butterfly assemblage (Fig. 1). Family Nymphalidae represented highest number of species (37) followed by Pieridae (14), Lycaenidae (10) and Papilionidae (10) (Fig. 2). The cluster analysis of the butterfly assemblage for each habitat (Fig. 3) showed that sub alpine to alpine habitat has the most dissimilar butterfly species followed by mixed broad leaved habitat. The other two main clusters are broad leaved to sub alpine and broad leaved–broad leaved to alpine.

Altitudinal gradient and butterfly assemblage

The empirical species richness did not exhibit a mid-elevation peak for alpha diversity. There was a unimodal pattern, with the peak between 1000–2500 m (Fig. 4). The first peak with respect to other shallower peaks depicts the overall linear increase in species richness with elevation. The elevation zone 1000–2500 m, was found richest in butterfly species representing 56% of total species. Based on species presence/absence data in 11 different elevation zones, cluster analysis (Sorensen distance) was performed to reveal similarities between elevation zones. Cluster analysis identified three broad butterfly assemblages one at 3000 m and above, second at 2500–3000 m and last one grouped all of the remaining nine elevation zones. Elevation zones adjacent to each other had similar species pool and hence the compositions.

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