



Changing biodiversity scenario in the Himalayan ecosystem: Mussoorie, Uttarakhand, India, as revealed by the study of blue butterflies (Lycaenidae)

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An area rich in biodiversity is of great importance for conservation. Butterflies form an important component of biodiversity. Apart from their aesthetic appeal, they are good pollinators. As butterflies are highly sensitive to any environmental change and are delicate creatures, they act as good bio-indicators of the health of a habitat. However these creatures are under a real threat due to various developmental activities leading to habitat changes. The protection of these creatures should be given priority. Since the conservation of butterflies essentially means the conservation of their habitat, the spots rich in butterfly diversity are high conservation priority areas.

In general, areas with undisturbed vegetation and high floral diversity support large butterfly communities. Few places in India can rival the abundance, both in

terms of species and sheer numbers of individuals, of butterflies as found in Mussoorie. Mussoorie is located at 30°27'N and 78°05'E in the Garhwal Hills and is known as the 'Queen of Hills' for its immense natural beauty. In 1820, Captain Young was enchanted by its beauty and made it his home. Mussoorie is named after the Mansur shrub, which used to grow in abundance here. Mussoorie is at a height of 2112m. It is rich in flora and fauna.

Mackinnon & de Nicéville (1897), Ollenbach (1929), Shull (1958, 1962), and Rose & Sidhu (1994) made checklists of butterflies of Mussoorie and reported it as one of the richest areas in butterfly diversity. But due to excessive tourism coupled with various developmental activities, this hill station in recent times has undergone severe environmental degradation. In the present paper, a checklist of 66 species of lycaenid butterflies of Mussoorie, Uttarakhand has been prepared and compared with the lists made by the above mentioned earlier workers (Table 1). The nomenclature for naming various taxa, has been followed from Bridges (1988) and Varshney (1997).

Material and Methods

A literature search resulted in the collation of the various lists mentioned above. Mussoorie was visited by the author from June 2005 to September 2006. During this period, a total of 25 days was spent observing butterflies in the area. During these visits, 38 species of butterflies were recorded (Sidhu & Narender 2010). These specimens are presently in the collection of the Zoological Survey of India, Kolkata.

Observations and Discussion

The checklist of lycaenid butterflies has been made from the collections made by different Zoological Survey of India workers between 2000 and 2006. The observations and studies were made in Mussoorie in the first week of June 2006 and again in September 2006 in areas like Bhilaru Pumping Station (30°28.068'N and 78°04.095'E), one of the richest butterfly spots in India (located at 1737.4m) (Ollenbach 1929).

While listing butterflies of Mussoorie, Mackinnon and de Nicéville (1897) reported 316 species of butterflies from Mussoorie and its neighbouring

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Table 1. Checklist of lycaenid butterflies of Mussoorie, Uttarakhand

	Species of Lycaenidae	Ollenbach (1929)	Shull (1962)	Rose & Sidhu (1994)	In Uttarakhand other than Mussoorie (2000-2006)	In Mussoorie (Presently 2005-2006)
1.	<i>Curetis bulis</i> (Westwood)	+	-	-	-	-
2.	<i>Horaga albimacula viola</i> Moore	-	-	-	+	-
3.	<i>Horaga onyx</i> (Moore)	+	-	-	+	-
4.	<i>Chrysozephyrus ataxus</i> (Westwood)	+	-	+	+	-
5.	<i>Chrysozephyrus birupa</i> (Moore)	+	-	+	-	-
6.	<i>Chrysozephyrus syla</i> (Kollar)	-	+	-	-	-
7.	<i>Esakiozephyrus icana</i> (Moore)	+	-	-	-	-
8.	<i>Eusapa ziha</i> (Hewitson)	-	+	+	-	-
9.	<i>Euaspa milionia</i> (Hewitson)	+	+	+	-	-
10.	<i>Chaetoprocta odata</i> (Hewitson)	+	+	+	+	-
11.	<i>Spindasis vulcanus</i> (Fabricius)	+	-	-	+	-
12.	<i>Spindasis nipalicus</i> (Moore)	+	+	-	-	-
13.	<i>Iraota timoleon</i> (Stoll)	+	-	-	-	-
14.	<i>Surendra vivarna</i> (Horsfield)	+	-	-	-	-
15.	<i>Arhopala pseudocentaurus</i> (Doubleday)	+	-	-	-	-
16.	<i>Arhopala rama</i> (Kollar)	+	+	+	-	-
17.	<i>Arhopala dodonaea</i> (Moore)	+	+	+	-	-
18.	<i>Arhopala atrax</i> (Hewitson)	+	-	-	-	-
19.	<i>Arhopala amantes</i> (Hewitson)	-	+	-	+	-
20.	<i>Panchala ganesa</i> (Moore)	+	+	+	-	-
21.	<i>Deudorix epijarbas</i> (Moore)	+	-	+	+	-
22.	<i>Deudorix isocrates</i> (Fabricius)	+	-	-	-	-
23.	<i>Deudorix perse</i> (Hewitson)	+	-	-	-	-
24.	<i>Rapala selira</i> (Moore)	+	+	-	+	-
25.	<i>Rapala nissa</i> (Kollar)	+	+	+	+	-
26.	<i>Rapala manea schistacea</i> (Moore)	+	-	+	-	-
27.	<i>Rapala iarbus</i> (Fabricius)	+	-	-	-	-
28.	<i>Tajuria diaeus</i> (Hewitson)	+	-	-	-	-
29.	<i>Tajuria illurgis</i> (Hewitson)	+	-	-	-	-
30.	<i>Loxura atymnus</i> (Cramer)	+	-	-	-	-
31.	<i>Pratapa icetas</i> (Hewitson)	-	+	+	-	-
32.	<i>Pratapa ctesia</i> (Hewitson)	-	-	+	-	-
33.	<i>Lycaena pavana</i> (Westwood)	-	+	+	+	-
34.	<i>Lycaena phlaeas</i> (Linnaeus)	-	+	+	+	-
35.	<i>Heliophorus androcles</i> (Westwood)	-	-	+	-	-
36.	<i>Heliophorus sena</i> (Kollar)	+	+	+	+	-
37.	<i>Heliophorus oda</i> (Hewitson)	-	-	-	+	-
38.	<i>Udara albocaerulea</i> (Moore)	+	-	-	-	-
39.	<i>Celastrina argiolus</i> (Linnaeus)	+	-	+	+	+
40.	<i>Celastrina huegeli</i> (Moore)	+	+	+	+	+
41.	<i>Celastrina gigas</i> (Hemming)	-	-	+	+	-
42.	<i>Acytolepis puspa</i> (Horsfield)	+	+	-	+	-
43.	<i>Celatobia marginata</i> (de Nicéville)	-	-	+	+	-
44.	<i>Arletta vardhana</i> (Moore)	-	+	-	-	-
45.	<i>Chilades lajus</i> (Cramer)	+	+	+	+	-
46.	<i>Chilades pandava</i> (Horsfield)	-	-	+	+	-
47.	<i>Catochrysops strabo</i> (Fabricius)	+	-	-	+	-

	Species of Lycaenidae	Ollenbach (1929)	Shull (1962)	Rose & Sidhu (1994)	In Uttarakhand other than Mussoorie (2000-2006)	In Mussoorie (Presently 2005-2006)
48.	<i>Castalius rosimon</i> (Fabricius)	+	-	-	+	-
49.	<i>Lampides boeticus</i> (Linnaeus)	+	+	+	+	+
50.	<i>Aricia agestis</i> (Denis & Schiffermüller)	-	+	+	+	-
51.	<i>Zizina otis</i> (Fabricius)	-	+	-	+	-
52.	<i>Zizeeria karsandra</i> (Moore)	-	-	+	-	-
53.	<i>Zizula hylax</i> (Fabricius)	-	-	-	+	-
54.	<i>Pseudozizeeria maha</i> (Kollar)	-	-	+	+	-
55.	<i>Everes argiades</i> (Pallas)	-	-	+	+	-
56.	<i>Everes lacturnus</i> (Godart)	-	-	-	+	-
57.	<i>Everes huegellii</i> (Gistel)	-	-	+	+	+
58.	<i>Jamides bochus</i> (Stoll)	-	+	-	-	-
59.	<i>Tarucus hazara</i> Evans	-	-	-	+	-
60.	<i>Tarucus alteratus</i> Moore	-	-	-	+	-
61.	<i>Leptotes plinius</i> (Fabricius)	-	-	+	+	-
62.	<i>Azonus ubaldus</i> (Stoll)	-	-	-	+	-
63.	<i>Prosotas nora ardates</i> (Moore)	-	-	+	+	-
64.	<i>Euchrysops cnejus</i> (Fabricius)	-	-	-	+	-
65.	<i>Freyeria putli</i> (Kollar)	-	-	+	+	-
66.	<i>Freyeria trochylus</i> (Freyer)	-	+	+	+	-

areas. Ollenbach (1929) while listing 144 species of butterflies, described in detail the butterfly-rich spots of Mussoorie. It includes the Electric Pumping Station (1671.5m); Mossy Falls (1676.2m); Bhilaru Pumping Station; a spring on the eastern slope of Vincent's Hill (1981.2m) and a spring on the eastern side of the Kinraig Estate (1706.9m). While describing the pumping station spots, Ollenbach (1929) reported, "In my collection trips throughout India, Burma and the Andaman Islands, I have come across places where butterflies were to be seen in large numbers, but these could not approach the multitudes that visit the pumping station". Shull (1958) reported 68 species from Mussoorie. Subsequently, Shull (1962) published a paper on butterflies of Mussoorie in which he reported five persons with nets catching 101 species in a single day (03 June 1961), the majority of them from Bhilaru Pumping Station and a few from the Municipal Park. On that day, 26 species of lycaenids were recorded, mostly from Bhimaru Pumping Station. These species are compared with the lycaenids recorded in the same location in June and September 2006, when only four of these species were recorded (Table 2). According to Shull (1962), "The hill station of Mussoorie in north-west India is probably one of the best places in the world for collecting a large number of species".

Rose & Sidhu (1994) while listing the 34 species of lycaenid butterflies from Mussoorie collected from different spots, namely, Bhilaru Pumping Station, Murray Pumping Station, Mossy Falls, Savoy Hotel and Municipal Park in the first weeks of June 1992 and 1993, commented on the state of butterfly rich spots of Mussoorie reported by Ollenbach (1929) and Shull (1962). They observed that the springs on the eastern slope of Vincent's Hill (Image 1) and on east of the Kinraig Estate have dried up due to urbanization and other developmental activities; Mossy Falls was not very rich in butterfly species diversity but the Murray Pumping Station was comparatively better. According to Shull (1962) and Rose & Sidhu (1994), the Bhilaru Pumping Station is the richest in butterfly species diversity as well as in number of individuals. Rose & Sidhu (1994) commented that the butterfly habitat around Bhilaru Pumping Station was shrinking and needed to be effectively conserved. They also added that this spot was being contaminated and was stinking due to sewage effluents, besides blocking of water flow by the accumulation of waste, mainly polythene bags. H.S. Rose, who was a member of the party during the 1992-1993 visits (Rose & Sidhu 1994) to various butterfly collecting spots in Mussoorie, had observed that a fairly large number of individuals belonging to a

Table 2. List of lycaenids recorded from Bhilaru Pumping Station in a single day by Schull (1962) and the present survey between 2005 and 2006

	Species of Lycaenidae	In Mussoorie (Presently 2005-2006)	Schull (1962)
1.	<i>Chrysozephyrus syla</i> (Kollar)	-	+
2.	<i>Eusapa ziha</i> (Hewitson)	-	+
3.	<i>Euaspa milionia</i> (Hewitson)	-	+
4.	<i>Chaetoprocta odata</i> (Hewitson)	-	+
5.	<i>Spindasis nipalicus</i> (Moore)	-	+
6.	<i>Arhopala rama</i> (Kollar)	-	+
7.	<i>Arhopala dodonaea</i> (Moore)	-	+
8.	<i>Arhopala amantes</i> (Hewitson)	-	+
9.	<i>Panchala ganesa</i> (Moore)	-	+
10.	<i>Rapala selira</i> (Moore)	-	+
11.	<i>Rapala nissa</i> (Kollar)	-	+
12.	<i>Pratapa icetas</i> (Hewitson)	-	+
13.	<i>Lycaena pavana</i> (Westwood)	-	+
14.	<i>Lycaena phlaeas</i> (Linnaeus)	-	+
15.	<i>Heliophorus sena</i> (Kollar)	-	+
16.	<i>Celastrina argiolus</i> (Linnaeus)	+	-
17.	<i>Celastrina huegelli</i> (Moore)	+	+
18.	<i>Acytolepis puspa</i> (Horsfield)	-	+
19.	<i>Arletta vardhana</i> (Moore)	-	+
20.	<i>Chilades lajus</i> (Cramer)	-	+
21.	<i>Lampides boeticus</i> (Linnaeus)	+	+
22.	<i>Aricia agestis</i> (Denis & Schiffermüller)	-	+
23.	<i>Zizina otis</i> (Fabricius)	-	+
24.	<i>Everes huegelli</i> (Gistel)	+	-
25.	<i>Jamides bochus</i> (Stoll)	-	+
26.	<i>Freyeria trochylus</i> (Freyer)	-	+

variety of species were seen engaged in mud-puddling near the spring of Bhilaru Pumping Station from 0930 to 1400 hr and the spot was full of butterflies (Images 2 & 3).

In the first week of June, 2006 and again in the second week of September, 2006, the Bhilaru Pumping Station, was visited by the present author. This spot was on the outskirts of Bhilaru Village in 1993 and a narrow unpaved foot path connected it to the main Mussoorie road. But now the spot has been totally devastated from the point of view of butterfly habitats. Bhilaru Village has expanded. The spring has dried up (Image 4). The paved road has been built up to the Pumping Station. Bordering the favourite butterfly spot, shops have been built and are conducting business (Image 5). Only four species viz., *Celastrina argiolus*,



Image 1. Vincents Hills Spring, Mussoorie 1994

Celastrina huegelli, *Everes huegelli* and *Lampides boeticus* could be collected from this spot.

Keeping in view the richness of the butterfly diversity of this spot noted by previous workers, it is brought to the notice of concerned authorities that these butterfly rich spots should be conserved on a priority basis or else the provisions of the Wildlife (Protection) Act, 1972 will be meaningless, for while many of the wildlife species that inhabit the vicinity of Bhilaru Pumping Station are protected under provisions of the Act, the extermination of entire populations of these species is being countenanced in the ongoing developmental activities in the area and a unique heritage site is being lost due to ignorance on the part of the authorities, despite being well recorded in the literature (Mackinnon & de Nicéville 1897; Ollenbach 1929; Schull 1962; Rose & Sidhu 1994). Mussoorie and especially the vicinity of Bhilaru Pumping Station, being a good habitat for a great variety of butterflies in particular and biodiversity in general, must be given special status and care for conservation. This will also ensure a pure drinking water supply for Mussoorie in the years to come.



Image 2. Bhilaru Pumping Station spring, Mussoorie, 1994



Image 3. Butterflies mud-puddling site close to Bhilaru Pumping Station spring, 1994

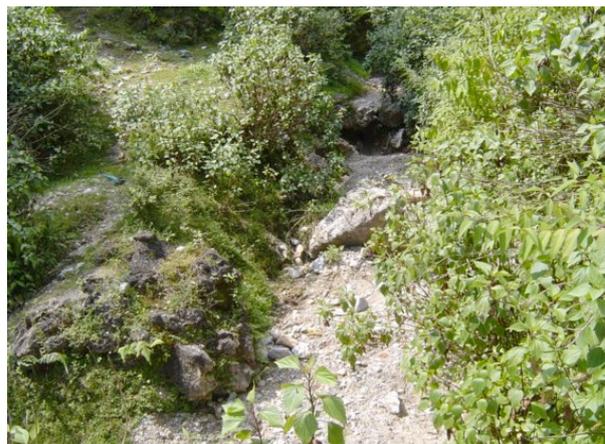


Image 4. Dried up Bhilaru Pumping Station spring, Mussoorie, 2006



Image 5. Shops bordering Bhilaru Pumping Station spring, Mussoorie, 2006

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