

Altitudinal Variation In Species Composition Of Family- Pieridae And Nymphalidae (Lepidoptera) In The State Of Uttarakhand (India)

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Abstract: Present study was conducted at six sites with different altitudes Viz. Raja Ji National Park (300 m), Kaladhungi (610 m), Jeliokot (1370 m), Kailakhan (1820 m), Snow view (2252 m) and China Peak (2611m) in Garhwal and Kumaun region of Uttarakhand (India). A total of 322 individuals of 29 species belonging to two families were identified. Family Pieridae was found dominant with 19 species while 10 species belonged to family Nymphalidae. The dominant species in the family Pieridae included *Pieris brassicae*, while in Nymphalidae the dominant species was *Vanessa cardui*. *Pieris brassicae* was found dominant at lower altitude while *Aglais cashmiriensis* was found dominant at higher altitude. As many as 6 species of Pieridae and 4 species of Nymphalidae were common at all the sites while 26 species were recorded at lower altitude and 21 at higher altitude. The maximum Shannon Diversity (H') 0.2077 was recorded for the species *Pieris brassicae* and minimum value was recorded for *Vanessa cardui* (0.03109). The mean Shannon diversity (H') recorded was 2.9513. While the evenness ranged between 0.8850 to 0.2940.

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Key words: Altitudinal variation, Species composition, Pieridae and Nymphalidae

1. Introduction

Lepidopterans are regarded as one of the most important component of biodiversity (New and Collins, 1991) and are the second largest order among insects made up of approximately 1, 50,000 species so far known to the literature. The butterflies are very well known for their beauty as they bear beautiful wings of various colours. They have slender bodies, the wings are held vertically when at rest, and the antennae are slender and club-like at the tips. They are day fliers. The degree of diversity depends upon the adaptability of a species to a particular micro habitat. Butterflies are sensitive biota which gets severely affected by the environmental variation and changes in the forest structure as they are closely dependent on plants (Pollard, 1990 and Blair, 1999). They also react quickly to any kind of disturbance and changes in the habitat quality making a good indicator to study changes in the habitat and landscape structure variations (Blair, 1999). 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 (Sidhu, 2011).

Morphological identification of butterflies is usually based on the wing patterns (Evans 1932; Wynter-Blyth 1957; Kunte 2000). Joshi, 2007 also

studied the habitat selection and community structure of butterflies in a moist deciduous forest of Uttarakhand. Butterfly communities have also been studied along altitudinal gradients in the Pindari area of the Nanda Devi Biosphere Reserve in the Bageshwar district of Uttaranchal (Joshi, *et al.* 2007). In India about 1,501 species of butterflies are present (Kehimkar, 2008). The biodiversity, taxonomy, geographic distribution and status of many species of butterflies are relatively well known. Further, butterflies are good biological indicators of habitat quality as well as general environmental health (Larsen 1988; Kocher and Williams 2000; Sawchik, *et al.*, 2005), as many species are strictly seasonal and prefer only particular set of habitats (Kunte, 1997). Kumar, *et al.*, (2013) has made entomological survey at Gurukul Kangri University Campus, Haridwar to record the species composition of butterflies. During this study a total of 179 individuals belonging to 25 species and 04 families were reported. The Nymphalidae was the most dominant family in terms of number of species and represented by 10 species followed by Pieridae (09), Danaidae (04) and Papilionidae (02). Kumar and Joshi 2010 worked out on taxonomy of butterflies in fruit orchard and recorded 72 species of 12 families and in their study they found the family Nymphalidae as dominant (15 species). Butterflies and moths offer good opportunities for studies on population and community ecology (Pollard, 1991). An attempt is

made to understand how the distribution and variation in butterfly diversity changes in heterogeneous habitats in various sites in the western Himalayan region.

2. Material And Methodology

The present study was carried out to record the abundance, species diversity and evenness of butterflies in following study sites, located in Uttarakhand.

1. Study Area:

Following study sites located at different altitudes have been selected for the present study:

1. SITE-1 RAJA JINATIONAL PARK (300m.)
2. SITE-2 KALADHUNGI (610m.)
3. SITE-3 JELIOKOT (1370m.)
4. SITE-4 KAILAKHAN (1820m.)
5. SITE-5 SNOW VIEW (2252m.)
6. SITE-6 CHINA PEAK/ NAINA PEAK (2611m.)

Sampling of butterflies: Species of butterflies belonging to families Pieridae and Nymphalidae of the order Lepidoptera are collected from the selected study sites (with altitudinal variations) during 2014-15.

The butterflies' were collected by "Sweep Sampling Method", as per Gadagkar *et al.*, 1990. The net sweeps were carried to collect the butterflies. The collection of butterflies was carried out in the early

hours of the day because butterflies are usually active at early sunrise, therefore, it was easy to observe and collect them. Butterflies were primarily identified directly in the field and in difficult cases specimen were identified with the help of scientists of different institutions.

Calculation of species diversity of butterflies: The diversity was calculated by using "Shannon Wiener Index", which is defined as,

A. Species Diversity

$$H' (S) = - \sum_{i=1}^S p_i \log p_i$$

Where, $P_i = n_i/N$ and $q_j = n_j/N$

n_i = Number of individual of a species at a time i , n_j = Number of individual present in a season j , N = Size of whole community, Σ = Number of species/ Number of seasons, S = Total number of species, P = Number of seasons

B. Evenness of butterflies: Evenness of species was calculated by using the Pielou's Evenness Index,

$$J' = H' / \ln S$$

Where, S is the number of species present in the site and H' is the diversity index. The value of J' ranges from 0 to 1. Lesser the variation in the communities between the species, the higher the value of J' .

Table 1: Butterfly Species recorded from selected study sites during 2014-15.

S.N.	Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
	1.Family-Pieridae						
1	<i>Pieriscanida</i>	+	+	+	+	+	+
2	<i>Pierisbrassicae</i>	+	+	+	+	+	+
3	<i>Delias eucharis</i> (Drury)	+	+	+	+	-	-
4	<i>Teriashecabehcab</i>	+	+	+	-	-	+
5	<i>Anopheis aurora aurora</i>	+	+	+	-	-	+
6	<i>Pareroniavaleria hippie</i> (Fabr)	+	+	-	+	-	+
7	<i>Appiasindramoore</i>	+	+	+	-	+	+
8	<i>Coliasselectofieldi</i>	+	+	+	+	+	+
9	<i>Catopsiliapyranthe</i> (Linn)	+	+	+	+	+	+
10	<i>Catopsiliapomana</i>	+	+	+	-	+	+
11	<i>Catopsiliacrocale</i>	+	+	+	+	-	-
12	<i>Phalentaalcippe</i> (Drury)	-	-	+	-	+	-
13	<i>Euremahecabehcab</i>	+	+	+	+	+	+
14	<i>Liptosianina</i>	+	+	+	-	+	-
15	<i>Coliaserate</i>	+	+	+	+	+	+
16	<i>Aporiaagathoncaphisa</i> (Moore)	+	-	-	+	+	+
17	<i>Euremahecab</i> (Linn.)	+	+	+	+	+	+
18	<i>Pontiadaplidicemorri</i>	+	+	+	-	-	+
19	<i>Coliascrocerus</i>	+	+	+	+	+	-

S.N.	Species	Site 1	Site2	Site 3	Site 4	Site 5	Site 6
	2.Family-Nymphalidae						
1	<i>Vanessa cardui</i>	+	+	+	+	+	+
2	<i>Vanessa cashmirensis</i> (Fru.)	-	-	+	+	+	+
3	<i>Vanessa indicaindica</i> (Herb)	+	+	+	+	+	+
4	<i>Atellaphalantaphalanta</i> (Drury)	+	-	+	+	+	+
5	<i>Précis almanaalmana</i> (Linn.)	+	+	+	+	-	-
6	<i>Ariadne merione</i>	+	+	-	-	+	-
7	<i>Junonialemorias</i>	-	+	+	+	+	+
8	<i>Junoniaiphita</i> (Cramer)	+	+	+	+	+	+
9	<i>Junoniaalmana</i> (Linn.)	+	+	+	+	+	+
10	<i>Aglaiscashmirensis</i> (Kollar)	+	-	+	+	+	+

Table 2: Number of individuals of families, Pieridae and Nymphalidae recorded from selected sites during 2014-15.

S.N.	Species	Site1	Site2	Site3	Site4	Site5	Site6	Total
	1.Family-Pieridae							
1	<i>Pieris canida</i>	10	3	2	1	2	3	21
2	<i>Pieris brassicae</i>	11	3	3	4	2	4	27
3	<i>Delias eucharis</i> (Drury)	2	1	2	1	-	-	6
4	<i>Teriashecabehcab</i>	2	1	2	-	-	1	6
5	<i>Anopheis aurora aurora</i>	2	1	1	-	-	1	5
6	<i>Pareroniavaleria hippie</i> (Fabr)	3	1	-	2	-	1	7
7	<i>Appiasindramoore</i>	4	2	1	-	1	1	9
8	<i>Coliasselectofieldi</i>	10	3	2	1	2	3	21
9	<i>Catopsiliapyranthe</i> (Linn)	8	3	1	1	1	-	14
10	<i>Catopsiliapomana</i>	6	1	1	-	1	1	10
11	<i>Catopsiliacrocale</i>	4	3	1	2	-	-	10
12	<i>Phalentaalcippe</i> (Drury)	-	-	2	-	1	-	3
13	<i>Euremahecabehcab</i>	8	3	2	2	3	1	19
14	<i>Liptosianina</i>	2	3	1	-	1	-	7
15	<i>Coliaserate</i>	3	2	1	2	1	1	10
16	<i>Aporiaagathoncaphisa</i> (Moore)	2	-	-	2	1	1	6
17	<i>Euremahecab</i> (Linn.)	6	3	2	1	2	2	16
18	<i>Pontiadaplidicemorri</i>	7	2	2	-	-	1	12
19	<i>Coliascrocerus</i>	3	2	1	1	1	-	8
	2.Family-Nymphalidae							
1	<i>Vanessa cardui</i>	5	3	4	2	3	2	19
2	<i>Vanessa cashmirensis</i> (Fru.)	-	-	2	1	2	3	8
3	<i>Vanessa indicaindica</i> (Herb)	4	2	3	2	4	2	17
4	<i>Atellaphalantaphalanta</i> (Drury)	2	-	1	1	2	1	7
5	<i>Précis almanaalmana</i> (Linn.)	2	1	1	1	-	-	5
6	<i>Ariadne merione</i>	6	2	-	-	1	-	9
7	<i>Junonialemorias</i>	-	1	1	2	3	1	8
8	<i>Junoniaiphita</i> (Cramer)	3	1	4	1	2	1	12
9	<i>Junoniaalmana</i> (Linn.)	3	1	3	2	1	1	11
10	<i>Aglaiscashmirensis</i> (Kollar)	1	-	2	1	3	2	9
	TOTAL	119	48	48	33	40	34	322

Table 3: Relative abundance, species composition and species diversity of butterflies recorded From different sampling sites in Uttarakhand during 2014-15.

Family	No individuals	% of total individuals	No species	% of species	Species diversity (H')	Evenness (J')
Pieridae	217	67.39	19	65.51	1.990	0.5910
Nymphalidae	105	32.60	10	34.48	0.941	0.2940
Total	322	100.00	29	100.00	2.951	0.8850

The data on abundance and species composition of butterflies in different study sites has been presented in Tables 1 and 2. During present study a total of 322 individuals of 29 species, belonging to two families were identified during one year study period (2014-15) from six different study sites. Family Pieridae was the dominant in terms of number of species (19) and number of individuals (217). The dominant species in the family Pieridae include *Pieris brassicae*, while in Nymphalidae the dominant species were *Vanessa cardui*. The value of total species diversity was 2.951. The maximum value was 1.990 for family Pieridae, while the value for Nymphalidae was 0.941. The maximum abundance (119 individuals) was recorded from Site-1 (Raja ji National Park) and minimum abundance was recorded from Site-4 (Kailakhan). Kumar *et al.*, 2013 has made entomological survey at Gurukul Kangri University Campus, Haridwar to record the species composition of butterflies. During this study a total of 179 individuals belonging to 25 species and 04 families were reported. The Nymphalidae was the most dominant family in terms of number of species and represented by 10 species followed by Pieridae (09), Danaidae (04) and Papilionidae (02). A detailed study on the butterfly species diversity was also carried out by Joshi and Sharma (2009). They recorded a total of 41 butterfly species belonging to 5 families of order Lepidoptera during the study period. The family Nymphalidae, represented by 19 species was the most dominant followed by Pieridae (10 species), Lycaenidae (8 species), Papilionidae (3 species) and Hesperidae (1 species). *Eurema hecabe* (Linn.) was the most dominant species of Butterfly in terms of number of individuals followed by *Danaus chrysippus* (Linn.), *Euchryops nejeus* (Fabr.), *Euploea core* (Cramer), *Junonia lemonias* Linn., *Catopsilia pyranthe* Linn.

Kumar and Joshi 2010 worked out on taxonomy of butterflies in fruit orchard and recorded 72 species of 12 families and in their study they found the family Nymphalidae as dominant (15 species).

Species diversity and evenness were shown in Table 3. During this study, the maximum Shannon Diversity (H') was recorded (0.2072) for the species *Pieris brassicae* and minimum value was recorded (0.03109) for *Vanessa cardui*. The mean Shannon diversity (H') recorded was 2.9513. During this study the value for total evenness is 0.8850. The maximum value (0.5910) was recorded for family Pieridae, while the minimum value (0.2940) for Nymphalidae.

Kaushal and Vats (1981) reported that the species diversity of insects in tropical grassland for two different habitats was 1.0836 and 1.0856 respectively. Ent and Shaw (1998) reported the alpha diversity of Hymenoptera, which was 1.665 in both

U.S.A. and Canada, 5.291 and 20.822 in Mexico and Costa Rica.

Kumar (2014) has worked out on species diversity and evenness of different insect groups in mango orchards of Uttarakhand and found that during winter season diversity was 0.2425 (2009-2010) and 0.2489 (2010-2011), during summer season it was 0.3535 (2009-2010) and 0.3513 (2010-2011) and during rainy season it was 0.3650 (2009-2010) and 0.3664 (2010-2011). Similarly evenness was maximum (0.3336) for the rainy season and the abundance was maximum (2347) in summer season in year 2009-2010 and minimum (542) in winter of 2010-2011.

Pieris brassicae was found dominant at lower altitude and *Aglais cashmirensis* was found dominant at higher altitude while its number reduces at lower altitudes. The recorded variations in the population of these families are possibly dependent on the environmental factors of that area.

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