

DIVERSITY AND SPECIES RICHNESS OF BUTTERFLY IN AN AGRI-HORTI HABITAT IN ASSAM, INDIA

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ABSTRACT

An effort was made to investigate butterfly diversity at College Campus, AAU, Jorhat during June, 2013 to May, 2014. Two different habitat viz., Horticultural Experimental (HE) and Instructional Cum Research (ICR) Farm were selected for the investigation. Total of 933 butterflies were observed out of which, Nymphalidae (46.67%) dominated by, *Ariadne ariadne* and *Melanitis leda*, in HE & ICR Farm respectively. Similarly, Pieridae contributed 20.00 per cent individuals with dominant species *Hebomoia glaucippe* and *Delias eucharis* followed by Lycaenidae (16.67%), *Castalius rosimon* and *Hypolycaena erylusin* in both habitats respectively. The diversity complex of butterfly was 3.32 with highest seasonal diversity in rainy season (1.37). The Simpson dominance index was more or less similar in HE (0.960) and ICR, Farm (0.961). Dominance of butterflies in both habitats might be due to the availability of flora along with favourable climatic conditions throughout the study period.

INTRODUCTION

Butterflies are considered to be one of the important ecological service providers. Many native flowering plants are pollinated through their proboscis which has long pistillate flowers. Some butterflies are recognized as potential predators to many agriculturally important insects pests, *Maconellicoccus hirsutus*, prey of *Spaligis epius* (Dinesh and Venkatesha, 2011), while most of them are chief component of the food chain supporting a wide range of predators and parasites. Indication of vegetation in terrestrial ecosystem is influenced by butterflies as they are frequent visitors of native floral plants. Sensitivity of butterflies towards change in biotic and abiotic environment, made them recognized as model organism to study the diversity and climate change (Addai and Baidoo, 2013). With intensification of agriculture and repeated cropping pattern along with increase in use of agricultural chemicals, has led to destruction of butterflies' habitat and some might extinct in near future. The Indian subcontinent bearing a diverse terrain, climate and vegetation hosts about 1,504 species of butterflies (Tiple, A.D, 2011). The northeastern region of India is home to a rich diversity of butterflies and other insects due to vegetative richness (Majumder, et al., 2011) and also globally recognized as one of 25th biodiversity hotspots (Myers, et al., 2000). In northeastern states, particularly Assam, 962 species of butterflies from 78, 438 sq. km have been recorded (Lodh and Agarwala, 2016). The area of the Jorhat district is 2851 Sq. Km consisting of crop and forest diversity (Mulai Forest

along with, the Hollongapar Gibbon wildlife sanctuary, having more than 200 species of butterfly (Neog, 2015). Diversity of butterfly has been mostly studied in forest areas but limited to Agri-Horticulture habitat. Therefore, an attempt has been made to estimate the diversity and unique species richness of butterflies in Agri-Horti habitat of college campus, AAU.

MATERIALS AND METHODS

The present study was conducted at Assam Agricultural University (A.A.U), (Fig.1) Jorhat located at 26.75°N and 94.22°E and has an average elevation of 116 Meters (381 ft). Jorhat is also surrounded by many forest areas located in neighboring districts. Jorhat district falls under semi-arid condition having summer temperature 25°–35°C and winter temperature 22°–10°C with mean annual rainfall 2029 mm. The place is lush with wide types of agricultural land and forest areas. Considering the migratory behavior of butterflies two habitats (HE & ICR, Farm) were selected in the college campus of Assam Agricultural University, Jorhat. Visual Countand Line Transect Method were used to record the butterfly existence in both the habitats. Observations were recorded from 08.00 hr to 11.00hrs per the methodology adopted by Gupta et al. (2012) and bi-weekly random survey was carried out at 25 different location following 500 meter transect line with 10 meter on either sides at Instructional Cum Research (ICR) & Horticultural Experimental (HE) Farm respectively. Butterflies were primarily identified directly in the field and photographed, whereas in some cases captured

with sweep net and released after identification. Specimens were identified with the help of taxonomic studies and field guide book (Wynter-Blyth 1957; Haribal 1992; Kunte 2000).

Species diversity, Seasonal diversity and dominance

Species diversity

The diversity was calculated by using "Shannon Wiener Index (1949)", which is defined as

$$H' (S) = -\sum p_i \ln p_i$$

Seasonal diversity is written as

$$H' (P) = -\sum q_j \ln q_j$$

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.

Species dominance

Species dominance was calculated by Simpson's dominance index (1949), which is defined as,

$$D_s = \sum_{i=1}^s [n_i (n_i - 1)] / [N (N - 1)]$$

where, n_i is the population

density of the i^{th} species, and N is the total population density of all component species in each site.

Evenness of butterflies

Evenness of species was calculated by using the Pielou's Evenness Index, which is defined as,

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

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.

RESULTS AND DISCUSSION

Species composition of butterflies

A total 933 individuals of butterflies belonging to 30 species (Fig. 2) and 5 families were recorded during the study period (Table 1). On the basis of number of collected species family Nymphalidae was the most dominant with 14 species, followed by Pieridae (6), Lycaenidae (5), Hesperidae (3) and Papilionidae (2). Percent contribution of the relative number of individuals and species of different families of butterflies collected from study area are presented in Table 2. Nymphalidae consisted of 46.67 per cent of butterflies, followed by Pieridae (20.00%), Lycaenidae (16.67%), Hesperidae (10.00%) and Papilionidae

Table 1: Different species of butterflies in HE & ICR Farm respectively, Assam Agricultural University, Jorhat during June, 2013-May, 2014

Sl. No	Species	Common name	HE, Farm	ICR, Farm	Total
Nymphalidae					
1	<i>Mycalesis perseus</i>	Common Bush Brown	12	9	21
2	<i>Ariadne ariadne</i>	Angled Castor	25	10	35
3	<i>Ypthima huebneri</i>	Common Four Ring	11	7	18
4	<i>Ypthima asterope</i>	Common Three Ring	5	0	5
5	<i>Euploea core</i>	Common Crow	19	21	40
6	<i>Tirumala limniace</i>	Blue Tiger	15	17	32
7	<i>Orsotriaena medus</i>	Nigger	10	15	25
8	<i>Neptis hylas</i>	Common Sailer	21	11	32
9	<i>Junonia lemonias</i>	Lemon Pansy	25	13	38
10	<i>Parantica aglea</i>	Glassy Tiger	13	15	28
11	<i>Junonia almana</i>	Peacock Pansy	25	27	52
12	<i>Phalanta phalantha</i>	Common Leopard	24	13	37
13	<i>Melanitis leda</i>	Oriental Common Evening Brown	16	26	42
14	<i>Junonia atlite</i>	Grey Pansy	18	0	18
Pieridae					
15	<i>Pieris rapae</i>	Small cabbage white	31	15	46
16	<i>Appias libythea</i>	Striped albtross	0	17	17
17	<i>Catopsilia pomona</i>	Common Emigrant	26	11	37
18	<i>Delias eucharis</i>	Common Jezebel	15	20	35
19	<i>Gandaca harina</i>	Tree Yellow	24	18	42
20	<i>Hebomoia glaucippe</i>	Great Orange Tip	35	7	42
Lycaenidae					
21	<i>Chliaria othona</i>	Orchid Tit	8	5	13
22	<i>Loxura atymnus</i>	Yamfly	10	0	10
23	<i>Hypolycaena erylus</i>	Common Tit	7	18	25
24	<i>Pseudozizeeria maha</i>	Pale Grass Blue	5	15	20
25	<i>Castalius rosimon</i>	Common Pierrot	15	12	27
Hesperidae					
26	<i>Lambrix salsala</i>	Chestnut Bob	23	15	38
27	<i>Ampittia dioscorides</i>	Bush Hopper	13	17	30
28	<i>Telicota ancilla</i>	Dark Palm Dart	29	11	40
Papilionidae					
29	<i>Papilio memnon</i>	Great Mormon	29	11	40
30	<i>Papilio polytes</i>	Common Mormon	32	16	48
Total			541	392	933

Table 2: Species diversity, Seasonal diversity and dominance

Sl. No.	Family	Total no. of species	Per cent of species	Total no. of individuals	Per cent of individuals	Dominance (D)		Diversity (H)	
						HEF	ICRF	HEF	ICRF
1	Nymphalidae	14	46.67	423	45.34	0.923	0.908	2.57	2.41
2	Pieridae	6	20.00	219	23.47	0.793	0.828	1.57	1.74
3	Lycaenidae	5	16.67	95	10.18	0.789	0.727	1.54	1.30
4	Hesperiidae	3	10.00	108	11.58	0.646	0.672	1.05	0.99
5	Papilionidae	2	6.67	88	9.43	0.507	0.501	0.692	0.660

Table 3: Species diversity, abundance and evenness of butterflies recorded in corresponding season from HE and ICR Farm respectively

Season	Abundance	Species Richness	Diversity (H)	Evenness (J)	Dominance (D)
Rainy	450	16	1.37	0.224	0.744
Winter	150	04	0.31	0.062	0.805
Summer	330	10	1.09	0.188	0.662
Across the Study	933	30	3.32	0.486	0.963
HEF	541	18	3.81	0.605	0.960
ICRF	392	12	3.11	0.521	0.961

**Figure 1: Aerial view of Horticultural Experimental and Instructional Cum research Farm, A. A. U., Jorhat**

(6.67%) respectively. Maximum (423 nos. of butterflies) was observed under the family Nymphalidae followed by Pieridae (219), Hesperidae (108) Lycaenidae (95) and Papilionidae(88) respectively.

Under Nymphalidae *Ariadne ariadne*, (71.42%) was the dominant species in HE, Farm followed by *Junonia lemonias* (65.79%), *Phalanta phalantha* (64.88%) and *Junonia almanac* (48.07%) respectively. In ICR Farm, *Melanitis leda* (61.90%) was most dominant followed by *Euploea core* (52.50%) and *Junonia almanac* (51.92%) respectively. In HE Farm 83.34 per cent butterflies were dominated by *Hebomoia glaucippe* under the family Pieridae, followed by *Pieris rapae* (67.40%), *Gandaca harina* (57.14%) whereas in ICR Farm *Delias eucharis* (57.14%) was dominant followed by *Gandaca harina* (42.85%) and *Pieris rapae* (32.60%). Under Lycaenidae, *Castalius rosimon* (55.56%) was dominant in HE Farm whereas in ICR Farm, *Hypolycaena erylus* (72.07%) was dominant species. In HE Farm under family Hesperidae, *Telicota ancilla* (72.50%) was most dominant as compared to *Lambrix salsala* (60.53%) and *Ampittia dioscorides* (43.34%), whereas in ICR Farm,

Ampittia dioscorides (56.67%), *Lambrix salsala* (39.48%) and *Telicota ancilla* (27.50%) respectively. Under Papilionidae, *Papilio polytes* and *Papilio memnon* both the species were equally dominant in both HE and ICR Farm. Nymphalids, *Ariadne merione*, *Phalantha phalantha* and *Acraea terpsicore* were recorded and breed throughout the year while *Vanessa indica* and *Atella alcippe* breed for a short period of time. Seasonal appearance of pansies like *Junonia* was found to be recorded in many flowering plants. In Lycaenidae, *Rathinda omor* and *Janides celeno* were found to breed throughout the year. Most of the Papilionid species breeds throughout the year but *Papilio polynestor* and *Pathysa nomius* breed in the months of September-November and June-July respectively. Breeding season of *Anaphaeus aurota*, *Catopsilios*, *Colotis* spp., *Eurema* of Pierids were found throughout the year in many native vegetation sites (Venkata ramana *et al.*, 2010). More or less a similar kind of observation was made by Santhos and Basavarajappa (2015) at Karnataka. They recorded five families in which individual belonging to Lycaenidae and Nymphalidae were more where as Pieridae, Hesperidae and Papilionidae individuals were not abundant and found more or less similar species compositions.

Species diversity, richness and evenness of butterflies

Diversity, richness and evenness of butterflies are represented in Table 3. Across the study period Shannon-Wiener diversity Index (H') was recorded as 3.32 for the butterfly communities. Moreover, maximum species diversity was recorded in the rainy season (1.37) and the minimum in the winter season (0.31). Maximum species richness (16) was observed in rainy season followed by summer (10) and winter season (04) respectively. Similarly the maximum species evenness (0.224) was observed in rainy season followed by summer (0.188) and winter (0.062) respectively.

Mathew *et al.* (1995) also recorded species diversity 0.40 to 3.42 in case of butterflies in Silent Valley National Park, India. Another study revealed, that mean Shannon diversity (H) ranges from 1.318 to 1.319 during first and second year respectively in Nainital, Uttarakhand, India (Tiple, *et al.*, 2007).

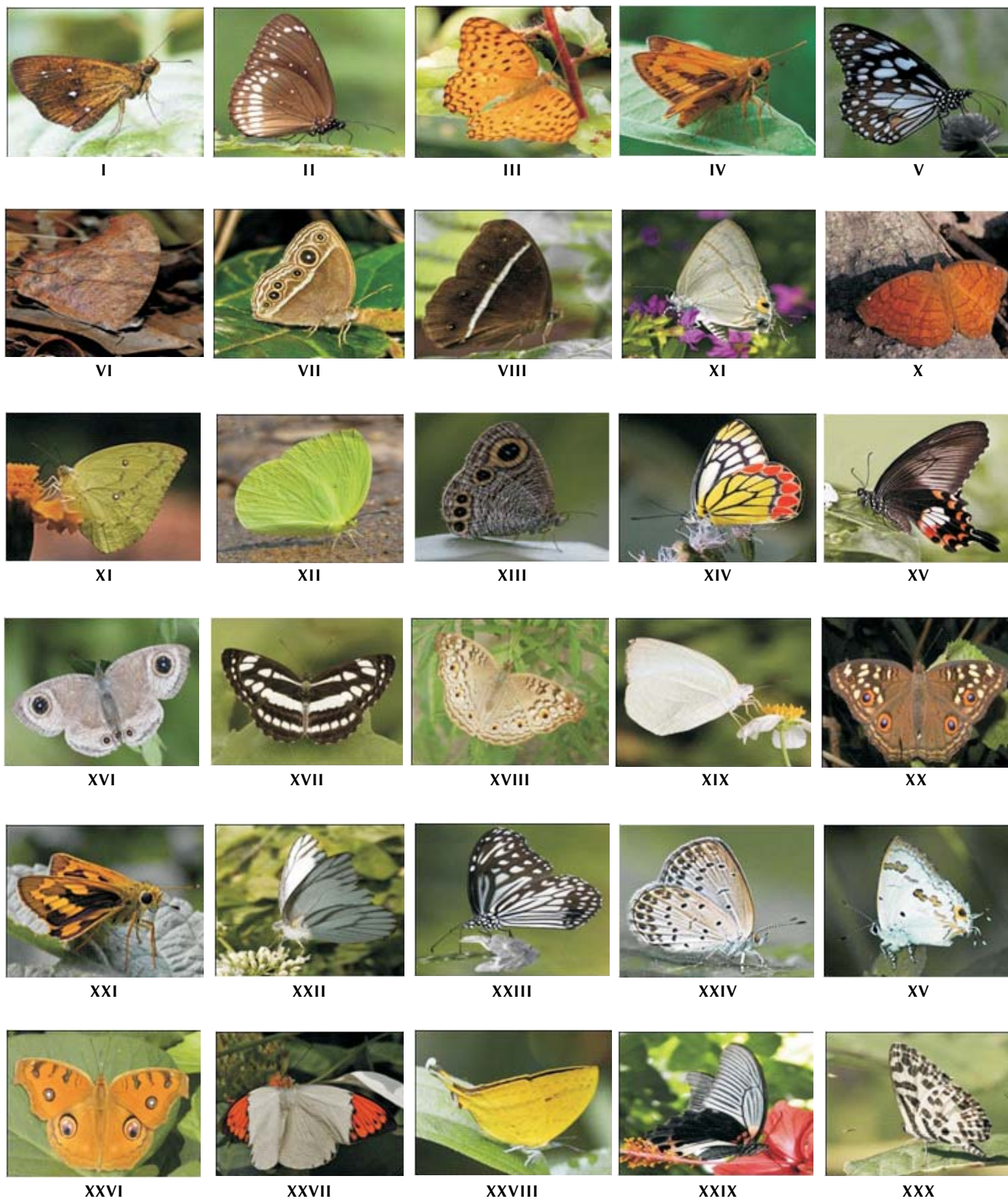


Figure 2. (i) *Lambrix salsala* (ii) *Euploea core* (iii) *Phalanta phalantha* (iv) *Ampittia dioscorides* (v) *Tirumala limniace* (vi) *Melanitis leda* (vii) *Mycalesis perseus* (viii) *Orsotriaena medus* (ix) *Hypolycaena erylus* (x) *Ariadne ariadne* (xi) *Catopsilia pomona* (xii) *Gandaca harina* (xiii) *Ypthima huebneri* (xiv) *Delias eucharis* (xv) *Papilio memnon* (xvi) *Ypthima asterope* (xvii) *Neptis hylas* (xviii) *Junonia atlite* (xix) *Pieris rapae* (xx) *Junonia lemonias* (xxi) *Helicota ancilla* (xxii) *Appias libythea* (xxiii) *Parantica aglea* (xxiv) *Pseudozizeeria maha* (xxv) *Chliaria othona* (xxvi) *Junonia lemonias* (xxvii) *Hebomoia glaucippe* (xxviii) *Loxura atymnus* (xxix) *Papilio memnon* (xxx) *Castalius rosimon*

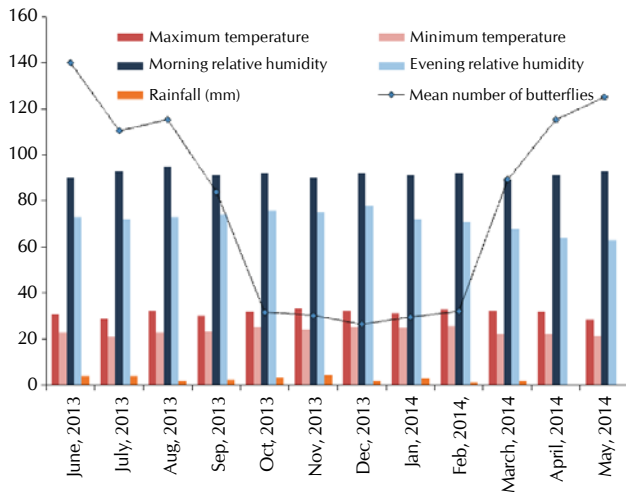


Figure 3: Seasonal distribution of butterflies in Horticulture Experimental and Instructional Cum Research Farm.

The present study is also confirmatory with the work carried out by Majumdar *et al.* (2013).

Abundance of butterflies

Among 933 individuals of butterflies, 541 numbers were recorded from HEFarm and 392 individuals from ICR Farm representing from five families. Maximum species abundance was recorded during rainy season (450) followed by summer (330) and winter (150) respectively (Fig.3). A similar observation also put forwarded by Tipel *et al.* (2007). They revealed that population of butterfly increases from the beginning of the monsoons (June-July) till early winter (August-November) and decline in late winter (January-February) to the end of summer. It was observed that 25 species were common in both habitats. *Appias libythea*, (Family:Pieridae) was the only species of butterfly absent in H.E. farm, whereas, *Ypthima asterope* (Family:Nymphalidae), *Junonia atlites* (Family:Nymphalidae) and *Loxura atymnus* (Family: Lycaenidae) were absent in ICR farm.

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