SPECIES DIVERSITY OF BUTTERFLIES IN NYAUNG SHWE ENVIRONS, SOUTHERN SHAN STATE

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Abstract

A total of 4358 butterflies representing 74 species, confined to 52 genera and five families were recorded during the study period from June 2014 to May 2015 at Nyaung Shwe environs. Among the families recorded namely, Papilionidae (10 species), Pieridae (14 species), Nymphalidae (35 species), Lycaenidae (9 species) and Hesperiidae (6 species), the highest number of species was recorded in Nymphalidae and lowest in Hesperiidae. At Nyaung Shwe environs the highest diversity indices value was found in November while the lowest indices value was occurred in June at both Site A and B. The 74 butterfly species and their host plants recorded thrive well in both the study sites. It is suggested that these butterflies should be conserved for further studies on butterflies.

Keywords: butterfly, species, Nyaung Shwe environs

Introduction

Lepidoptera means the scaly wing insects. A very large order Lepidoptera includes some of the most beautiful species and some of the economically important pests in class Insecta (Ozden, 2003).

The second largest order Lepidoptera is divided into two suborders, the butterflies (Rhopalocera) and the moths (Heterocera). The distribution of butterfly's species is subject to the availability of its preferred habitats, which are frequently determined by larval food plants, adult nectar sources and altitude or elevation above sea level (EK-Amnuay, 2012).

The degree of diversity depends upon the adaptability of a species to a particular micro habit. The dimension, population size and diversity of the species are most significant biological elements of an ecosystem (Kumar, 2013).

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Biological conservationists believe that butterflies are important as bio-indicators over all the continental land masses. Lepidopteron butterfly species are sensitive to the environmental stresses on their breeding biological situations.

Nyaung Shwe environs harbour a rich variety of butterfly species however, remained unexplored. Therefore the present study has been undertaken with the following objectives: to record the different kinds of butterfly species and to assess the diversity of the butterfly species recorded in Nyaung Shwe environs.

Materials and Methods

Study Area

Nyaung Shwe environs, the study area is located in eastern part of Nyaung Shwe Township in Southern Shan State. Two study sites were designated, Site A and B. Hta-ein-gon village (Site A), covers a land area of 0.138 square km and lies between 20º 39' 23" - 20º 39' 42" N and 96º 58' 18" - 96º 58' 48" E. The elevation is approximately 1040 m above sea level.

Kan-daw village (Site B), constitutes a land area of 0.150 square km and lies between 20º 38' 55" - 20º 39' 9" N and 96º 57' 2" - 96º 57' 25" E. The elevation is approximately 900 m above sea level (Fig. 1).

Study Period

The study period was from June 2014 to May 2015.

Collection of the Butterfly Specimen

Different habitats were selected for collection of butterflies. The foot trails in the village, the forested area and area along the bank of the stream were involved in the sites as walk transects and approximately 150 m in length. The observer travels slowly along the trails and butterflies within 5 m of both sides were counted according to Pollard (1977). Some butterflies were captured by using butterfly nets.

Butterfly collections were conducted twice a month at two study sites. Butterfly observation and collection was made between 9:00 am to 3:00 pm.

Preparation of the Specimen

The collected specimen was killed by squeezing on the thorax with the finger tip and then mounted on the setting board for a day before identification. After taking a photo, it was kept inside the insect box with the naphthalene balls to ward off ants.

For description of butterfly species and to measure the wing span five individuals were used for each species. For rare species, only one individual was used.

Identification and Classification of Collected Specimem

Identification of the butterflies was made with reference to Talbot (1939, 1947), Pinratana (1983), and classification was followed after Corbet and Pendlebury (1992). Classification of plants was followed by Hundley (1962).

Analysis of the Data

Diversity index of butterfly species were calculated by the Shannon-Wiener index (H') and Simpson index (D) and then the species richness (d) is calculated by the Margalef's index (d) as given in Ludwig and Reynolds (1988).

Shannon-Wiener's diversity index (1949) formula is given as follow:

$$H' = -\sum_{i=1}^{S}(P_i \ln P_i)$$

$$P_i = \left(\frac{n_i}{n}\right)$$

P_i = Total number of "i" species

n_i = Number of individuals in the "i^{th}" species of the sample

n = Total number of individuals of all species in the sample.

A great number of species increase species diversity, and a more even or equitable distribution among species will increase species diversity measured by Shannon-Wiener's function.

Simpson's index (1949) is given as follows;

$$D = \sum_{i=1}^{S} \frac{n_i(n_i - 1)}{n(n-1)}$$

D = Simpson's index

n_i = Number of individuals in the "i^{th}" species in the sample

n = Total number of individuals in the sample

Simpson's index is given little weight to the rare species and more weight to the common species. It value ranges from 0 to 1, where "s" is given to the number of species.

Margalef's Species Richness Index (1958) is given as follows

$$d = \frac{S-1}{\ln N}$$

d = Margalef's species richness index

S = Number of species

N = Total number of individuals

This method is incorporated to the total number of individuals and is the measure of the number of species present for a given number of individuals.

Hill's diversity numbers (1973) is given as follows:

Number 0 : $N_0 = S$

S = Total number of species

N_0 = Number of all species in the sample

Number 1 : $N_1 = e^{H'}$

H' = Shannon - Wiener's index

N_1 = Number of abundant species in the sample

Number 2 : N_2 = 1/D

D = Simpson's index

N_2 = Number of very abundant species in the sample

N_1 always intermediate between N_0 and N_2.

Effective number of species is a measure of the number of species in the sample where each species is weighted by its abundance.

Butterfly species evenness of equitability (or relative species abundance) was determined by the evenness index of modified Hill's ratio (1973), which is given as follows:

$$E = \frac{\left(1/D\right)-1}{e^{H'}-1} = \frac{N_2-1}{N_1-1}$$

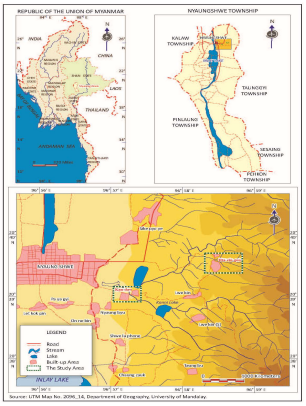
E = Hill's evenness index (which approach zero)

D = Simpson's index

H' = Shannon-Wiener's index of species diversity

N_1 = Number of abundant species in the sample

N_2 = Number of very abundant species in the sample



Result

All together 4358 butterflies accounted from 74 species and confined to 52 were recorded during the study period from June 2014 to May 2015.

The 74 butterflies species recorded during the study constitute 10 species of Papilionidae (13.51%), 14 species of Pieridae (18.92%), 35 species of Nymphalidae (43.3%), nine species of Lycaenidae (12.16%) and six species of Hesperiidae (8.11%), collected from two study sites of Hta-ein-gon village (Site A) and Kan-daw village (Site B) in Nyaung Shwe, Southern Shan State during the study period from June 2014 to May 2015 (Fig. 2).

Monthly occurrence of butterflies species and individuals were revealed to be highest in number during October and November, however only four swallowtailed butterflies *Papilio machaon* was collected in November, December and January. The genus *Pieris* was observed through the year, especially *Pieris brassicae* occurred is highest number as abundant species. Nymphalids were encountered not only in sunny places but also in shady area of trees, herbs and sometimes even on the ground. Peak number of species and individuals were significant in October, November and December at both sites (Fig. 3, 4).

Seasonal occurrence of butterfly species and individuals were observed to peak in cold season at Site A with 1268 individuals accounted from 64 species and at Site B with 1080 individuals from 61 species belonging to the families: Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperiidae (Fig. 5, 6).

Throughout the study period from June 2014 to May 2015 and the total number of species and individuals at study sites A and B and their corresponding species richness (d), diversity indices of Shannon-Wiener index (H') and Simpson's index (D) and evenness (E) were shown in Tables.

Comparison on the diversity indices and the seasonal occurrence of butterfly fauna revealed the highest species richness with 8.8171 at Site A in cold season. The value of Shannon’s-Wieners index, Simpson's index, N1, N2 and evenness (3.8735, 0.0241, 48.1114, 41.4552 and 0.8587) respectively were found to be highest in species richness and abundance in cold season 2014, compared to those of the rainy and hot season since the indices for d, H', D, N1 and N2 (6.3234, 3.2824, 0.0466, 26.6388 and 21.4524) respectively

were lowest in rainy season 2015 and evenness value with 0.7881 was low in hot season 2015 (Table 1).

Similarly seasonal indices of butterfly species d, H', D, N1, N2 and E with 8.5902, 3.7632, 0.0269, 43.0874, 36.1998 and 0.8601 respectively were found to be highest in species richness and abundance in the cold season 2014 at Site B. The lowest diversity indices d, H', D, N1 and N2 (6.1843, 3.277, 0.0455, 26.4956 and 21.9698) respectively appeared in rainy season and so also the evenness value with 0.7947 was lowest in hot season (Table 2).

Table 1. Comparison of diversity indices in the seasonal occurrence at Hta-ein-gon village (Site-A) in Nyaung Shwe (June 2014-May 2015)

Site-A	Rainy Season	Cold Season	Dry Season
Total no. of individuals	477	1268	549
Total no. of species	40	64	56
d	6.3234	8.8171	8.7189
H'	3.2824	3.8735	3.5592
D	0.0466	0.0241	0.0358
N1	26.6388	48.1114	34.1372
N2	21.4524	41.4552	27.9032
E	0.7977	0.8587	0.7881

Table 2. Comparison of diversity indices in the seasonal occurrence at Kan-daw village (Site-B) in Nyaung Shwe (June 2014-May 2015)

Site -B	Raining Season	Cold Season	Dry Season
Total no. of individuals	548	1080	436
Total no. of species	40	61	42
d	6.1843	8.5902	6.746
H'	3.277	3.7632	3.3562
D	0.0455	0.0269	0.0435
N1	26.4956	43.0874	28.6978
N2	21.9698	36.1998	23.0114
E	0.8225	0.8601	0.7947

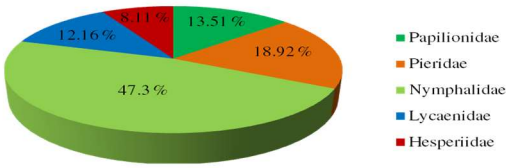


Fig. 2 Composition of butterfly species in different families at two study sites (June 2014-May 2015)

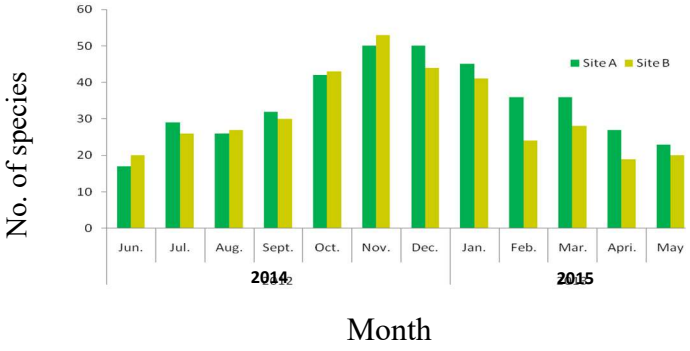


Fig. 3 Monthly occurrence of butterfly species at two study sites (June 2014-May 2015)

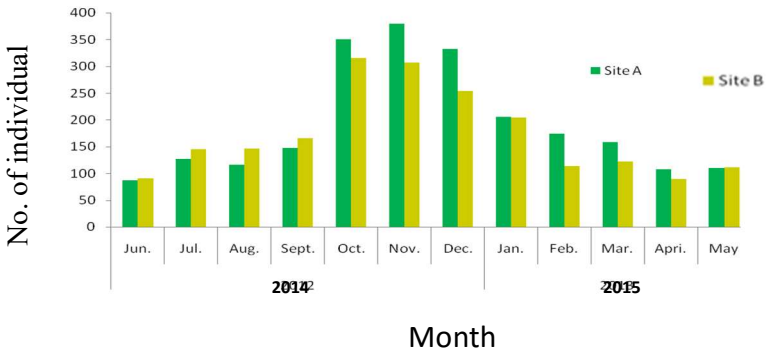


Fig. 4 Monthly occurrence of butterfly individual at two study sites (June 2014-May 2015)

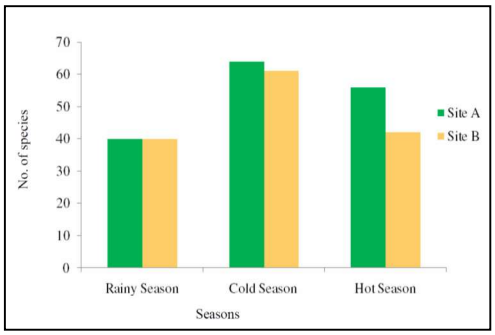


Fig. 5 Seasonal occurrence of butterfly species at two study sites of Nyaung Shwe environs (June 2014-May 2015)

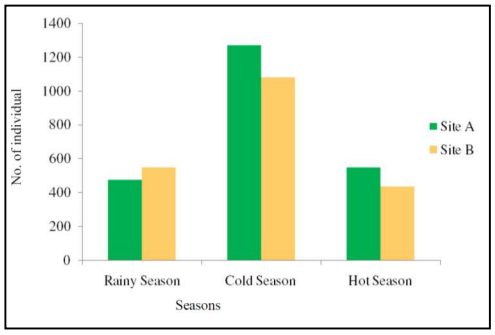


Fig. 6 Seasonal occurrence of butterfly individual at two study sites of Nyaung Shwe environs (June 2014-May 2015)

A. *Troides Helena*

B. *Pachliopta aristolochiae*

C. *Chilasa clytia*

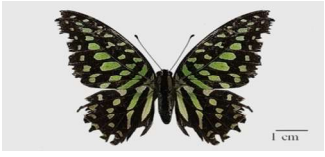
D. *Papilio demoleus*

E. *Papilio helenus*

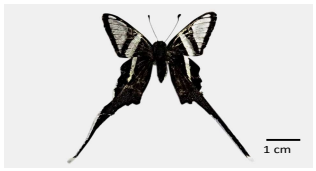
F. *Papilio*

G. *Papilio paris*

H. *Papilio machaon*



I. *Graphium agamemnon*



J. *Lamproptera curius*

K. *Delias pasithoe*

L. *Delias acalis*

M. *Delias decombesi*

N. *Pieris canidia*

O. *Pieris*

P. *Pontia daplidice*

Q. *Cepora nerissa*

R.*Hebomoia glaucippe*

Plate 1 Butterfly species in Nyaung Shwe environs

S. *Pareronia anais*

T. *Catopsilia pyranthe*

U. *Catopsilia pomona*

V. *Catopsilia scylla* W. *Eurema hecabe* X. *Eurema ada*

Y. *Danaus genutia* Z. *Tirumala limniace* AA. *Parantica*

AB. *Euploea core* AC. *Euploea klugii* AD. *Melanitis*

AE. *Elymnias casiphone* AF. *Elymnias malelas* AG. *Lethe*

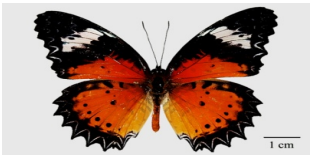
AH. *Acraea terpsicore* AI. *Acraea issoria* AJ. *Ariadne ariadne*

Plate 1 Continued

AK. *Phalanta palantha*

AL. *Vagrans egista*

AM. *Vindula erota*



AN. *Cethosia cyane*

AO. *Junonia iphita*

AP. *Junonia atlites*

AQ. *Junonia lemonias*

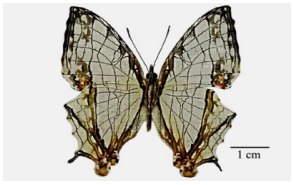
AR. *Junonia almona*

AS. *Junonia orithya*

AT. *Junonia hierta*

AU. *Hypolymnas bolina*

AV. *Kallima*



AW. *Cyrestis thyodamas*

AX. *Neptis sappho*

AY. *Neptis columella*

AW. *Cyrestis thyodamas* AX. *Neptis sappho* AY. *Neptis*

Plate 1 Continued

BC. *Tanaecia julii* BD. *Polyura athamas* BE. *Polyura*

BF. *Charaxes solon* BG. *Charaxes bernardus* BH. *Abisara*

BI. *Curetis bulis* BJ. *Castalius rosimon* BK. *Caleta elna*

BL. *Chilades pandava* BM. *Jamides elpis* BN. *Loxura atymnus*

BO. *Cheritra freju*

BP. *Talicada nyseus*

BQ. *Celaenorrhinus*

BR. *Celaenorrhinus aurivittatus*

BS. *Odontoptilum angulatum*

BT. *Onryza meiktia*

BU. *Erionota torus*

BV. *Telicota linna*

Plate 1 Continued

Discussions

Butterflies are more distributed in different localities where well favorable conditions for their larval and adult food resources in habitats. Kinyon (2004) also mentioned that total numbers of butterflies 1146 species were collected and identified in Myanmar. Nowadays, the species of butterflies have still being distributed all over Myanmar.

In the present study, a total of 4358 buterflies accounted from 74 butterfly species confined to 52 genera were recorded from Nyaung Shwe environs, Southern Shan State. Among five families recorded, Nymphalidae was the dominant family represented by (35 species, 47.3 %), followed by Pieridae (14 species, 18.92 %), Papilionidae (10 species, 13.51 %) and Lycaenidae (9 species, 12.16 %) and the last dominant family was Hesperiidae (6 species, 8.11 %) during the period from June 2014 to May 2015. Thus Nymphalids appeared as predominant butterflies in the study area

Under the genus *Papilio*, three species namely, *Papilio demoleus*, *Papilio polytes* and *Papilio paris* were recorded in large number. The abundance for these species is alluded to the abundance of host plants, including flowering plants and flowering herbaceous trees such as sein-na-ban (*Lantana aculeate*) are present among human dwellings from which nectar was collected by the butterflies. Moreover *Pieris brassicae* were also encountered abundantly as their major host plant, *Brassica* spp. appeared as major cultivated plants in the study area. *Telicada nyseus* was also recorded in large number in both the study sites but more common in Hta-ein-gon village (Site A) where their host bryophyllum plants occurred abundantly. In contrast, some species such as *Papilio machaon* appeared as rare, since only four specimens were collected from Site A during the wholes study period. Similarly, a single specimen each of *Acraea issoia* from Site B and *Modusa procris* and *Celaenorrhinus aurivittatus* from Site A respectively were recorded. The rareness of these species in the study area may rest upon the specificity in their choice for food and host plant.

During the study, highest number of species and individuals were revealed in November with 50 species and 379 individuals at Site A and 53 species and 307 individuals in Site B alluded to the presence of abundant food sources and place of shelter, following the rainy season whence vegetation thickened as new sprouting appeared followed by flowering and fruiting.

Magurran (2004) stated that biological diversity can be divided into two components: species richness and species evenness. Species richness measure that focus on the components of diversity.

Margalef's index revealed that the highest species richness was observed in cold season at Site A with 8.8171 (64 species) and at Site B with 8.5902 (61 species). Thus it appeared that the butterflies were similarly abundant at both the study sites, during the cold season.

Evenness index describes the variability in species abundance (Magurran, 2004). The result of the evenness index at Site A and Site B was approximately the same, at Site A (0.8587) and at Site B (0.8601) during the cold season. Thus it revealed abundance of species during the cold season; the environment was similarly eco-friendly to the butterflies at both the study sites.

When seasonal occurrence and diversity of butterfly species and individuals was considered the highest diversity indices value occurred in cold season because of the presence of more food sources during and after the rainy season, new sprouting appeared, the vegetation became lush green followed by flowering and fruiting providing of food sources for the butterflies to enjoy. Moreover impact of seasonal cultivation may not be ruled out, creating more chances for sustainability.

The result of present study indicated that the butterfly species appeared to thrive well in both the study areas. Thus, there is a need to maintain the environment friendlier for the butterflies to thrive even better.

Conclusions

Nyaung Shwe environ is one of the well known places in Southern Shan State, Myanmar. The result of present study indicated that Nyaung Shwe environ still harbor a variety of butterfly communities. Thus, there is a need to safeguard the sustainability of the diversity of butterflies' species by conserving their habitats in Nyaung Shwe environs.

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