

Diversity of Some Butterflies at Montaw Village, Amarapura Township

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Abstract

A total of 3026 butterflies, representing 50 species from 36 genera and five families were recorded from three study sites from Montaw Village in Amarapura Township. The species of butterflies identified were Nymphalidae (26) species, Pieridae (12) species, Lycaenidae (five) species, Papilionidae (four) species and Hesperidae (three) species. Among them the most abundant butterfly species was recorded from Nymphalidae and the least abundant species was observed in family Hesperidae. Margalef's index (d) of species richness was the highest in January, 2016 with (7.76) and the lowest in July, 2015 with (4.29). Various diversity indices such as Simpson's index (D) and Shannon-Wiener's index (H'), (N_1) and (N_2) were highest in January, 2016 and lowest in July, 2015. Evenness was highest in August, 2016 (0.79) and the lowest in February, 2016 (0.49). The calculated value of indices showed that these were seasonal variation from month to month. The species richness, Shannon-Wiener's index, Simpson's index, N_1 , N_2 and Evenness were highest in site (C) and the lowest in site (B). Therefore, it may be concluded that Montaw Village in Amarapura Township can be considered as environment of good health and rich butterfly diversity.

Keywords: Diversity, butterflies, Montaw Village, Amarapura Township

Introduction

Butterfly species are an important aspect of ecosystem for the reason that they interact with plants as pollinators and herbivorous (Tiple *et. al.*, 2006). Butterflies are also good indicators of environmental changes as they are sensitive to habitat degradation and climatic changes (Kunte, 2000). Butterfly species are susceptible to changes in their habitats because butterflies and their caterpillars are dependent on specific host plant for foliage, pollen and nectar as their food. Thus, butterfly diversity reflects overall plant diversity, especially, that of shrubs and herbs in the given area. Among the insects, butterflies occupy a vital position in ecosystem and their occurrence and diversity are studied as good indicators of the health of any given terrestrial biotope (Kunte, 2000; Asaithambi and Rao, 1995, Thomas, 2005).

Butterflies take place in a very wide range of situations but are particularly characteristic of known species occur. Two important measures of diversity are species richness (Landauejal 1997) and relative abundance of individuals (Hammond and Miller, 1992). Butterfly species richness is a crucial variable in conservation planning and natural resources management (Boonvanno, *et. al.*, 2000).

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Species diversity of butterflies in any particular geographical region is related mainly to vegetational diversity. This, in turn, is dependant mostly on climatic and generally, highest in an areas of high rainfall, high temperatures (low altitudes and latitudes), and variable landscapes. Butterfly diversity (and abundance) is therefore highest in wet, tropical, lowland forest and lowest in dry, cold and polar deserts (Pippen, 2004).

Krebs (1985) stated that changes in butterfly species diversity are in some ways affected to the habitat and environment. The more diverse the physical environment, the greater the rate of diversity in each ecosystem. Because of the physical differences of environment within an ecosystem there are also differences in the number of butterflies between their particular environments. Butterfly species richness or diversity has become important component of biodiversity assessment and one of the currently active research areas in ecological community.

In Myanmar, few studies have been undertaken on diversity of burrerfly species. Therefore, the present research was selected to do. The objectives were to record and identify the butterfly species, and to examine the diversity of butterfly species from three study sites at Montaw village in Amarapura Township.

Materials and Methods

Study Area

The specimens were collected from three study sites: Eggplant plantation (Site A), Lemon Plantation (Site B) and Papaya Plantation (Site C) at Montaw Village in Amarapura Township. This study area was located between latitudes 21°49' and 31.43" N and also between longitudes 96°12' 38.95" E (Figure 1).

Study Period

The study period lasted from July 2015 to February 2016.

Collection of Specimens

The collection was made during the day between 8:00 am and 16:00 pm. All specimens were randomly captured by using butterfly net in the selected study site.

Identification of the Specimens

Identification of the recorded of the specimens was followed after Bingham (1905, 1907), Talbot (1939) and Pinratana (1977, 1988) based on the natural colour and markings.

Data Analysis

The species richness, diversity and evenness of butterflies species were analyzed by four methods: Margalef (1958), Simpson (1949), Shannon -Wiener (1948) and Hill (1973) (Ludwing and Reynold, 1988).

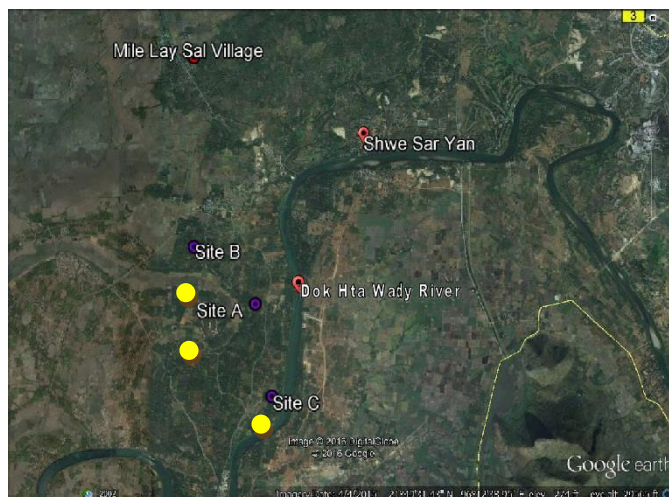


Figure 1. Map of Eggplant plantation in site (A), Lemon plantation in site (B) and Papaya plantation in site (C) at Montaw Village, Amarapura Township (Source from Google Earth)

Results

The study period lasted from July 2015 to February 2016. The total number of 50 butterflies' species (45 subspecies and 5 species) from 36 genera and five families and under 46 subspecies were recorded and identified.

Species Diversity

A total number of 50 species comprising 1186 individuals at site A, 766 individuals at site B and 1074 individuals at site C were recorded throughout the study period and their corresponding species richness (d) evenness (E) and diversity indices (H') are cited in (Table 1 to 2).

At the study site (A), the maximum value for D, H' , N_1 , N_2 and E (0.048, 3.28, 26.51, 20.93 and 0.78) were recorded in February, 2016 but the maximum value for d (7.38) was observed in January, 2016. The minimum value for d, D, H' , N_1 , N_2 (4.08, 0.112, 2.52, 12.48 and 8.93) were recorded in July, 2015 but the minimum value for E (0.66) was observed in November, 2015.

At the study site (B), the maximum value for d, D, H' , N_1 and N_2 (6.08, 0.061, 3.09, 22.01 and 16.29) were recorded in February, 2016 but the maximum value for E (0.81) was observed in August, 2015. The minimum value for d, H' and N_1 (4.19, 2.62 and 13.75) were recorded in August, 2015 but the minimum value for D, N_2 and E (0.108, 9.24 and 0.60) were observed in October, 2015.

At the study site (C), the maximum value for D, H' , N_1 and N_2 (0.050, 3.29, 26.76 and 20.19) were recorded in February, 2016 but the maximum value for d (7.57) was observed in January, 2016 and the maximum value for E (0.77) was recorded in September, 2015. The minimum value for d, D, H' , N_1 and N_2 (5.07, 0.078, 2.83, 16.92 and 12.89) were recorded in July, 2015 but the minimum value for E (0.71) was observed in January, 2016.

When the diversity indices between three study sites were compared, the maximum value for d , D , H' , N_1 , N_2 and E were (5.59, 0.057, 3.17, 23.84, 17.47 and 0.69) in site C. The minimum value for d , D , H' , N_1 , N_2 and E were (4.37, 0.085, 2.70, 18.14, 11.77 and 0.63) in site B. (Table 1)

Combination data of three study sites, the maximum value for d , D , N_1 and N_2 (7.76, 0.047, 28.84 and 21.10) were recorded in January, 2016 but the maximum value for H' (3.62) was observed in February, 2016 and the maximum value for E (0.76) was recorded in September, 2015. The minimum value for d , D , H' , N_1 and N_2 (4.29, 0.078, 2.81, 16.57 and 12.75) were recorded in July, 2015 but the minimum value for E (0.49) was observed in February, 2016. (Table 2)

Table 1. Comparison on diversity indices at study three study sites in Montaw Village, Amarapura Township (July, 2015 to February, 2016)

Month	Site A	Site B	Site C	Total
Total no. of individuals	1186	766	1074	3026
Total no. of species	38	30	40	50
d	5.23	4.37	5.59	6.11
D	0.071	0.085	0.057	0.055
H'	3.02	2.70	3.17	3.20
N_1	20.46	18.14	23.84	24.53
N_2	14.05	11.77	17.47	18.10
E	0.67	0.63	0.69	0.73

Table 2. Comparison on monthly diversity indices at three study sites in Montaw Village, Amarapura Township (July, 2015 to February, 2016)

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Total no. of individuals	270	360	406	440	470	390	330	360	3026
Total no. of species	25	28	34	34	45	43	46	45	50
D	4.29	4.59	5.49	6.09	7.15	7.04	7.76	7.48	6.11
D	0.078	0.065	0.062	0.061	0.053	0.053	0.047	0.054	0.055
H'	2.81	2.97	3.04	3.07	3.23	3.24	3.36	3.62	3.20
N_1	16.57	19.44	20.96	21.44	25.24	25.58	28.84	37.28	24.53
N_2	12.75	15.50	16.16	16.38	18.72	18.82	21.10	18.62	18.10
E	0.75	0.79	0.76	0.75	0.73	0.72	0.72	0.49	0.73

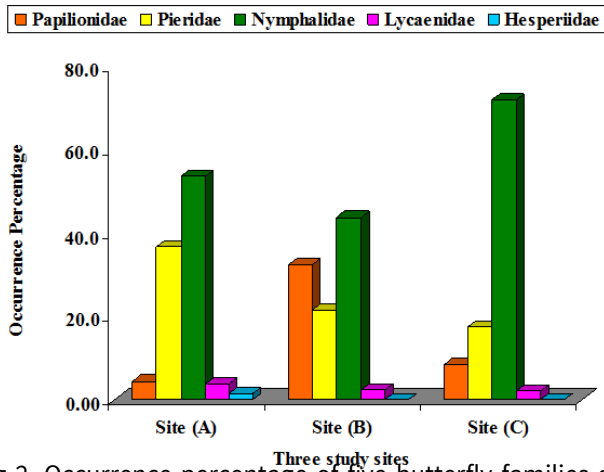


Fig 2. Occurrence percentage of five butterfly families at three study sites in Montaw village, Amarapura Township (July, 2015 to February, 2016)

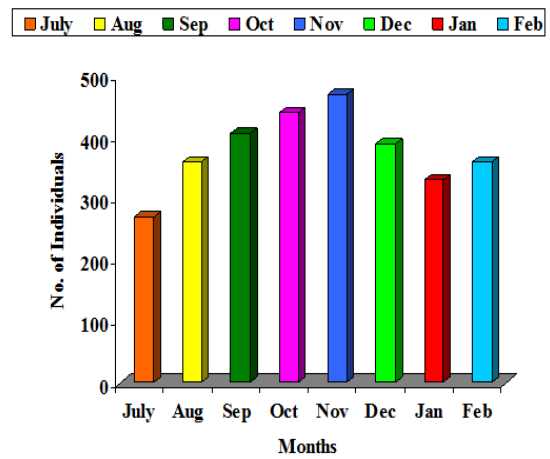


Fig 3. Monthly individuals occurrence of butterflies in three study sites at Montaw village, Amarapura

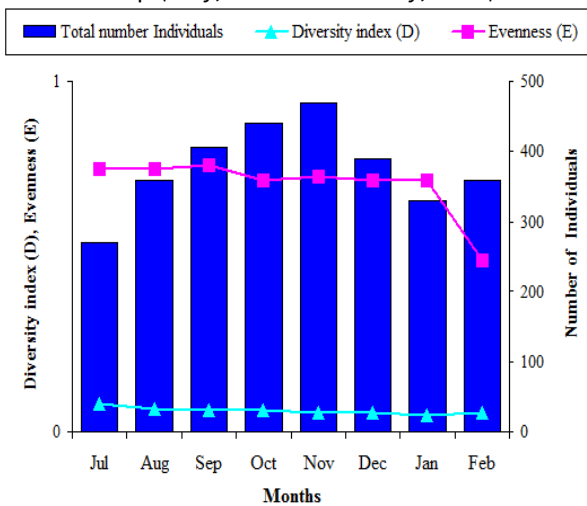


Fig 4. Comparison on number of individuals with Simpson diversity index (D) and evenness (E) from three study sites.(July, 2015 to February, 2016)

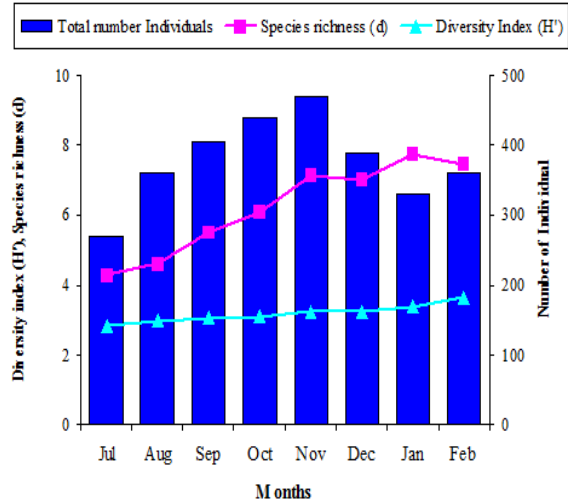


Fig 5. Comparison on number of individuals with species richness (d) and Shannon-Wiener diversity index (H') from three study sites

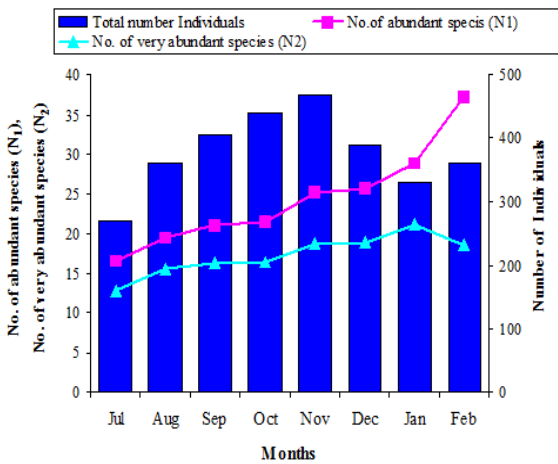


Fig 6. Comparison on number of species with number of abundant species (N₁) and number of very abundant species (N₂) from three study sites (July, 2015 to February, 2016)

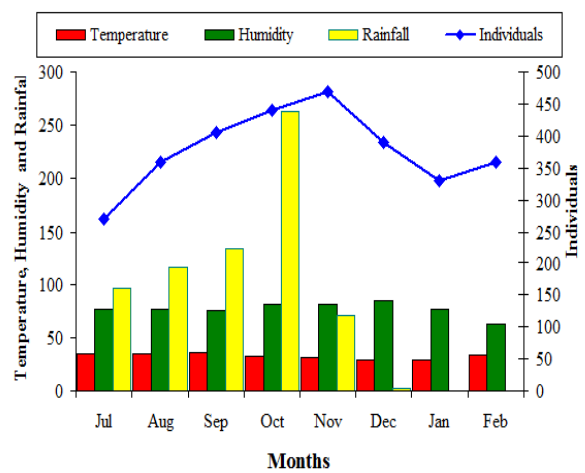


Fig 7. Comparison on number of individuals and weather conditions of temperature, humidity and rainfall for the three study sites (July, 2015 and February, 2016)



Papilio demoleus malayanus



Leptosia nina nina



Appias libythea alferna



Ixias pyrene verna



Catopsilia pyranthe pyranthe



Catopsilia pomona pomona



Eurema hecabe contubernalis



Danaus chrysippus chrysippus



Danaus genutia genutia



Melanitis leda leda



Mycalesis mineus mineus



Acraea violae



Junonia almana almana



Junonia lemonias lemonias



Ariadne ariadne pallidior

Discussion

During the study period, a total number of (3026) individuals were collected from July, 2015 to February, 2016. Among these, 50 species, 36 genera and five families were collected, identified and recorded.

Among these, five families of butterflies species from Family Nymphalidae (1746) individuals (57.70%) were most dominant followed by Pieridae (787) individuals (26.01%), Papilionidae (392) individual (12.95%), Lycaenidae (83) individual (2.75%) respectively and the lowest with (18) individual (0.59%) of Hesperiiidae were collected. Sreekumar and Balakrishnan (2001) reported that the maximum of species was observed in the family Nymphalidae through out the entire study area of Aralam Wildlife Sanctuary, Karala. Many local workers have carried out on diversity of butterflies in the different area. Among them in the works of Su Su Tun (2010), Nang Cherry Win (2011) and Thi Thi Han (2012), Family Nymphalidae was dominant over others. The present study agrees with the findings of above authors. Many members of this family were Polyphagous which would help them to live in all habitats and in different elevation gradients (Sreekumar and Balakrishnan 2001). Wynter Blyth (1957) described that Hesperiiidae are exclusively confined to the grassland. Large numbers of them are crepuscular in habit as they fly early in the morning, and to a lesser extent, in the evening. This presumed to be the reason that they were caught less than other butterfly species in this study.

The Community varies greatly according to their geographical location and their extremes of temperature and rainfall, all of which exert a powerful influence on the nature of vegetation on which the members of animal were completely dependent (Preston-Mafham & Preston-Mafham 1988). The monthly abundance of the number of species in butterflies was observed to be obviously different from month to month in the study period.

In three study sites the highest number occurred in November, 2015 with 470 individuals and 45 species. The lowest number of individuals occurred in July, 2015 with 270 individuals and 25 species. Murugesan and Muthusamy (2011) revealed that the butterfly population is greatly raised during the period of October-November in tropical habitats of the eastern part of Western Ghats. They also reported that the cool climate, increased moisture content, emergence of fresh larval host plants and flowering of adult host plants may be the factors for the emergence of the butterflies during the same seasons. The present observation agrees with the above-mentioned authors.

During the study period, Margalef's index (d) of species richness show that it was the highest in January, 2016 and the lowest in July, 2015. Margalef's index (d) of species richness showed a seasonal pattern of variation, increasing from July, 2015 to January, 2016.

Shannon-Wiener's diversity (H') index as well as Hill's evenness (E) index was used to explain the relation between butterfly species richness and abundance distribution among species in each season (Ludwing and Reynolds, 1988).

In the study period, Simpson's index (D) showed the highest (0.047) in January, 2016 and the lowest (0.078) in July, 2015. The maximum index of butterflies was recorded during January, 2016 when the rainfall was zero but the mean humidity was 76% and the mean temperature was 21.5°C.

The minimum index of butterflies was recorded during July, 2015. It was observed that, the rainfall was 96 mm, the mean humidity 76% and the mean temperature 29.95°C. The above-mentioned trend was also found in Shannon-Wiener's index of diversity.

Shannon diversity index (H') confirmed that the month of January, 2016 has more favorable conditions for butterflies because of different vegetation, mixed plantation, scrub vegetation and more favorable condition for butterfly species in the study area. In addition, the increasing species abundance from July, 2015 to January, 2016 was observed in the study area. Tiple and Khurad (2009) recorded the butterflies diversity, habitats and seasonal distribution in and around Nagpur City, Central India. They reported about the increasing species abundance from the beginning of the monsoons (June - July) till early winter (August - November) and decline in species abundance from late winter (January - February) to the end of summer. The result of the present study is similar to the above-mentioned authors.

When seasonal occurrence of butterflies was considered, it was found out that species richness, Shannon-Wiener's index, Simpson's index N_1 , N_2 and Evenness were highest in the site C and the lowest in site B. This may be because, at site (C) there were more flowering plants, trees, vegetables, various cross plantations, herbs and shrubs than the site A and site B. In addition, it is near the Dok Hta Wady River. It is also likely that at site (C), plantations and flowers are attractive to more species of butterflies.

Butterfly species are good biological indicators of habitat quality as well as general environmental health (Larsen, 1988; Kocher and Williams 2000; Sawchike *et. al.*, 2005). The abundance of butterfly species in an environment indicates the rich flora in this area (Gooden, 1975). The Montaw Village could be considered an environment of good health and rich butterfly diversity although eight months of this study is quite short. The long-term monitoring is needed for more accurate information. In addition, the study on the relationship of butterflies with their environment should also be conducted to further our understanding of biotic effects on butterfly members and diversity in Amarapura Township.

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References

- Asaithambi, P.N., Baskar and N. Jaganandha Rao. 1995. Butterflies of Aringnar Anna Zoological Park, Madras, Zoos' Print J., 10, 1.
- Bingham, C.T., 1905. *The fauna of British India Including Ceylon and Burma. Butterflies volume 1*. Taylor and Francis company, London.
- Bingham, C.T., 1907. *The Fauna of British India Including Ceylon and Burma. Butterflies Volume II*. Taylor and Francis company, London.
- Boonvanno, K., Watanasit, S., Permkam, S., 2000. Butterfly Diversity at Ton Nga-Chang Wildlife Sanctuary, Songkhla Province, Southern Thailand. *Science Asia*, 26: 105-110.
- Gooden, R., 1975. *Butterflies and moths*. Transworld Publishers Ltd., London. 47 pp.
- Hammond, P.C., and Miller, J.C., 1992. Composition of the Biodiversity of Lepidoptera within Three Forest Ecosystem. *Conservation Biology and Biodiversity* 91: 323-328.
- Kocher, S.D and Williams E.H. 2000. The diversity and abundance of North American butterflies vary with habitat disturbance and geography. *Journal of Biogeography* 27:785-794.
- Krebs C.J., 1985. *Ecology: The Experimental Analysis of Distribution and Abundance*, 2nd ed. Addison Wesley Longman, Inc, New York. 677pp.
- Kunte, K.J., 2000. The butterflies of the Nilgiri Mountains of Southern India (Lepidoptera; Rhopalocera). *Journal of the Bombay Natural History Society* 84 (3): 560-584.
- Kunte, K.J., 2000. *Butterflies of Peninsular India*, University Press (India) Limited. 262 pp. Larsen, T.B. 1988.
- Landauejal, D.D., 1997. Intensive versus Long-term Sampling to Access Lepidopteran Diversity in a Southern Mixed Mesophytic Forest. *Conservation Biology and Biodiversity*, 92: 435-441.
- Larsen, T.B. 1988. The butterflies of the Nilgirimountain of Southern India (Lepidoptera; Rhopalocera). *Journal of the Bombay Natural History Society* 84(3): 560-584.
- Ludwing, J.A and Reynolds, J.F., 1988. *Statistical Ecology*. A primer on method and computing John wiley and sons, New York. Pp 85-103.
- Murugesan S. and Muthusamy M., 2011. Patterns of butterfly biodiversity in three tropical habitats of the Eastern part of Western Ghats. *Journal of research in Biology*.
- Nang Cherry Win, 2011. Diversity and Seasonal occurrence of Butterflies species in Taungyi and Hopone, Southern Shan State. *Ph.D Dissertation*, University of Mandalay.
- Pinratana A., 1977-1988. *Butterflies in Thailand. (Vol-1)*. The Viranthan Press Bangkok. 86 pp.
- Pippen, J. S., 2004. *Duke Forest Butterflies*. Duke Forest Teaching and Research Laboratory. pp. 1-3.

- Preston-Mafham, R. and Preston-Mafham, K., 1988. *Butterfly of the World*. Facts on File, Inc. 460 Park Avenue South New York. 192 pp.
- Sawchike J., M. Dufrene and Ph. Lebrum, 2005. Distribution patterns and indicator species of butterfly's assemblages of wet meadows in *Southern Belgium*. *Journal of Zoology* 135 (1): 43-52.
- Sreekumar P.G and Balakrishman M., 2001. *Habitat and altitude preferences of butterflies in Aralam Wildlife Sanctuary, Kerala*. *Tropical Ecology* 42 (2): 227-281.
- Su Su Tun, 2010. The species diversity and seasonal abundance of some butterfly in Pyin Oo Lwin Township. *Ph D Dissertation*, University of Mandalay.
- Talbot. G., 1939. *The Fauna of British India Including Ceylon and Burma Butterflies*. Vol. I. Taylor and Francis Company, London.600 pp.
- Thi Thi Han, 2012. Species Diversity and Seasonal Occurrence of Butterflies in Kengtung Environs with Emphasis on Life cycle of Three *Ariadne* species. *Ph.D Thesis*. University of Mandalay.
- Thomas, J.A., 2005. Monitoring change in the abundace and distribution of insects using butterflies and other indicator groups. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 360: 339-357.
- Tiple, A.D., Deshmukh V.P., and Demis R.L.H., 2006. Factors influencing nectar plant resource visits by butterflies on a university campus: implication for conservation *Nota Lepidopteralogica*, 28: 213-224.
- Tiple, D. A. and Khurad, A.M., 2009. Butterfly Species Diversity, Habitats and Seasonal Distributionb in and Around Nagpur City, Central India. *World Journal of Zoology*, 4(3): 153-162.
- Wynter-Blyth, M.A., 1957. *Butterflies of the Indian Region*. The Bombay Natural History Society, Mumbai, India.