# Diversity of Butterflies (Rhopalocera) inBulusukan (San Ildelfonso, Bulacan, Philippines)

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***Abstract—*** *There are 1,615 species and sub species of butterflies in the entire Philippines (**C.R Baltazar, 1991**), LUBG San Fernando La Union has 104 species recorded they belong to 6 families and 66 genera**(Nacua et al2015).**In Manila,**Nacua (2016)** 22 species of butterflies belong to 6 families 17 genera were also recorded. Thisstudyseeks to determine the species composition, conservation status, richness and abundance of butterflies in the town of Bulusukan, a community in San Ildefonso, Bulacan province (Luzon Island, Philippines). The opportunistic transect sampling method was used to collect butterflies. Collection was done at daytime on August 6, 2016 from 8 am up to 5 pm in areas with GPS of 15°04'26.0652"northand 121°02'39.9588"east near the vicinity of Bulusukan Cave**.**Species richness and butterfly diversity in all areas sampled was calculated. A dendogram showing 75% species abundance was accounted and comes mostly from the secondary dipterocarp forest. Graphium antiphates Cramer, Ypthima semperaand **Ptychandra lorquini-lorquini** were found to be endemic to Bulusukan. Butterflies were observed to be attracted to shady forest areas consisting of mosses clinging on metamorphic rocks along a river and includes species from the families Nymphalidae and Papilionidae. This study was able to identify 21 butterfly species with 19 genera 2 of them are rare and 2 endemic species of butterflies in Bulusukan. It is recommended to continue further study for wet and dry season.*

***Keywords— Bulusukan, Rhopalocera, butterflies, diversity.***

## I. INTRODUCTION

Bulusukan (Figures 1 and 2), a community of the municipality of San Idelfonso, Bulacan province,is nested at the foot of the Sierra Madre mountain ranges, is said to be historical because of the residence maintained by Gen. Emilio Aguinaldo before he migrated to different cave systems of Biak-na-bato in the nearby municipality of San Miguel during World War II. Common plant species found in this area include *Ceiba pentandra* (L.) Gaertn. (“white cotton trees”), *Samanea saman* Merr.(“rain tree”), *Mangifera indica*L. (“mango”), *Artocarpus altilis* Fosberg ( Breadfruit), *Nymphaea nouchali* Burm. F. (“lotus lily”) and*Imperatacylindrica* Raeusch (“spear grass”). A water lagoon is found in the middle of the secondary dipterocarp forest. At Bulusukan river, huge formation of metamorphic rocks of different size and shapes are found crossing the rapid water.Here, butterfly species like*Ptychandra lorquini*, *Graphium antiphates*, *Abisara echerius*, and *Graphium Bsarpedon*are found sipping moist on mosses found on the rocks along the river. Along the vicinity of Bulusukan cave, colorful butterflies such as *Idea leuconoe leuconoe*, *Melanitis leda leda* and*Vindula dejone*are found hovering along the river banks.As to date, no other scientific studies have been undertaken to assess the ecology of butterflies in Bulusukan. Therefore, this study seeks to determine the species composition, richness, abundance, and diversity and conservation status of butterflies in this area.


*Fig.1: Vicinity Map Showing Satellite Views of Bulusukan, San Ildefonso, Bulacan (Philippines)*

*Fig.2: Bulusukan Cave Showing (A) the Entrance, (B) the Exit, (C) metamorphic rock formation,(D) Rapid water*

## II. MATERIALS AND METHOD

Opportunistic transect sampling method was used to collect butterflies and was done once on August 6, 2016 from 8:00 AM to 5:00 PM, starting from an unnamed street with a GPS of 15°04'26.0652"N 121°02'39.9588"E which is approximately 7.3 km from the transect walk to Bulusukan cave . A barangay permit was obtained from the appropriate LGU. Three (3) local forest guides assisted the researchers provided by the barangay captain. During the sampling, the recorded temperature was 29˚ Celsius along the vicinity of the cave at an estimated precipitation of 100%. During the sampling, the weather was dry and sunny. However, the grounds were slippery and wet. The humidity was set at 88% with a wind velocity was 19kph. Butterflies were preserved by pressing the thorax, placed in a paper triangles and stored in jar filled with moth balls. A LUX meter was used to measure the luminosity of light inside the cave. BIO Pro Version 2 software was used to measure diversity and conduct cluster analysis of all sampled taxa of butterflies.

Butterflies are identified by the corresponding author, using as guide, of the atlas of Treadaway (1995) and the checklist of butterflies in the Philippine Islands (Lepidoptera: Rhopalocera) Treadaway, C. G., & Schroeder, H. G. (2012). The authenticity of species was verified with the Zoology Department of the National Museum (Manila, Philippines).Distribution and conservation status of identified species was verified with the IUCN Red List of Threatened Species (2014). Voucher specimens for each species collected that were difficult to identify were verified together with photographs. Specimens collected were deposited at the Science department of the graduate school, University of East (Manila, Philippines).

## III. RESULT AND DISCUSSION

Table 1 lists the 21 species of butterflies, their families and national and local conservation status. Table 2 shows the corresponding descriptive statistics of the 21 butterfly species collected. Figure 3 shows the abundance plot of the 21 butterfly species collected in the areas surveyed. Figure

4 shows the cluster analysis of the specimens showing similarity indices.

In terms of abundance and species richness, the 3 families of butterflies most represented by this survey includes Pteridae, Nymphalidae and Papillonidae. This finding is consistent with the abundance reported by Nacua et al. (2014) for butterflies collected at the La Union Botanical Garden. The congruence of host plants in both sampling sites may explain for this similarity. Similarities in climate and the presence of running water and shaded areas may also contribute to this similarities, leading to emphasize the importance of sunlight in the migration of butterflies. The presence of *Bambusa* sp. ("bamboo") and *Samanea saman* ("rain tree") in both surveyed areas may account for the congruence of similar butterfly species.

The abundance plot (Figure 3) shows a good correspondence between kilometer radius and preferential species abundance. The most predominant migration of butterflies was seen at a kilometer radius of 1 to 3 because of the presence of open areas and the greater luminosity of light in these areas at 29 LUX value. The proximity of these areas to a lagoon explains for these preferential migration due to the undisturbed nature of the habitats. Mating and hovering of butterflies along the river banks also accounts for the great abundance observed in these areas.

The cluster analysis in Figure 4 shows a similarity index range of 75 to 100% for butterflies migrating within the 6 to 7 kilometer radius. Inconsistent similarity indices were observed for butterflies residing within the 1 to 5 kilometer radius. The presence of running of water, mosses, metamorphic rock formations and minerals within the 6 to 7 kilometer radius influences the presence of butterflies in this area. The cool shady ecosystem provides a haven for butterfly species, particularly in the families Nymphalidae, Papilionidae, Satyridae and Hespiridae.

*Table.1: List of Butterfly Species Collected at Bulusukan and their Conservation Status*

| Butterfly Species and Families | No. of Individuals | Local Conservation Status | National Conservation Status |
|---|---|---|---|
| 1.*Abisara echerius laura* Fruhstorfer 1904 (Pieridae) | 8 | common | common |
| 2.*Appias phoebe phoebe* Felder & Felder 1775 (Pieridae) | 3 | common | common |
| 3.*Catopsilia pyranthe pyranthe* (L.) 1758 (Pieridae) | 10 | common | common |
| 4.*Eurema hecabe hecabe* (L.) 1758 (Pieridae) | 5 | common | common |
| 5.*Gandacaharina mindanensis* Fruhstorfer 1910 (Pieridae) | 5 | common | common |
| 6.*Graphium agamemnon agamemnon*(L.) 1758 (Papilioniade) | 4 | common | common |
| 7.*Graphium antiphates* Cramer (Papilionidae) | 1 | Rare | Rare |
| 8.*Graphium sarpedon sarpedon*(L.) 1758 (Papilionidae) | 7 | common | common |
| 9.*Hypolimnas bolina philippensis* Butler 1874 (Nymphalidae) | 8 | very common | common |
| 10.*Idea leuconoe leuconoe* Erichson 1834 (Danaidae) | 1 | very common | common |
| 11.*Jamidescelenolydanius* Cramer 1975 (Lyceanidae) | 1 | common | Rare |
| 12.*Liptosia nina georgi* Frushtorfer 1910 (Pieridae) | 8 | common | common |
| 13.*Melanitisledaleda*(L.) 1758 (Nymphalidae) | 5 | common | common |
| 14.*Papilio demoleus libanius* Fruhstorfer 1908 (Papilionidae) | 6 | common | common |
| 15.*Ptychandra lorquini lorquini* Felder1861 (Satyridae) | 2 | common | endemic |
| 16.*Rhinopalpapolynicetratonice* Felder 1867 (Nymphalidae) | 3 | common | common |
| 17.*Telicota* sp (Hespiridae) | 6 | common | common |
| 18.*Troides rhadamantus* Lucas 1835 (Papilionidae) | 2 | common | common |
| 19.*Vinduladejonedejone Erichson* 1834 (Nymphalidae) | 7 | common | common |

| | | | |
|---|---|---|---|
| 20.*Ypthima sempera* Felder & Felder 1863 (Nymphalidae) | 4 | common | endemic |
| 21.*Zizinia Otis oriens* Butler 1883 (Lyceanidae) | 6 | very common | common |
| Total | 102 | | |

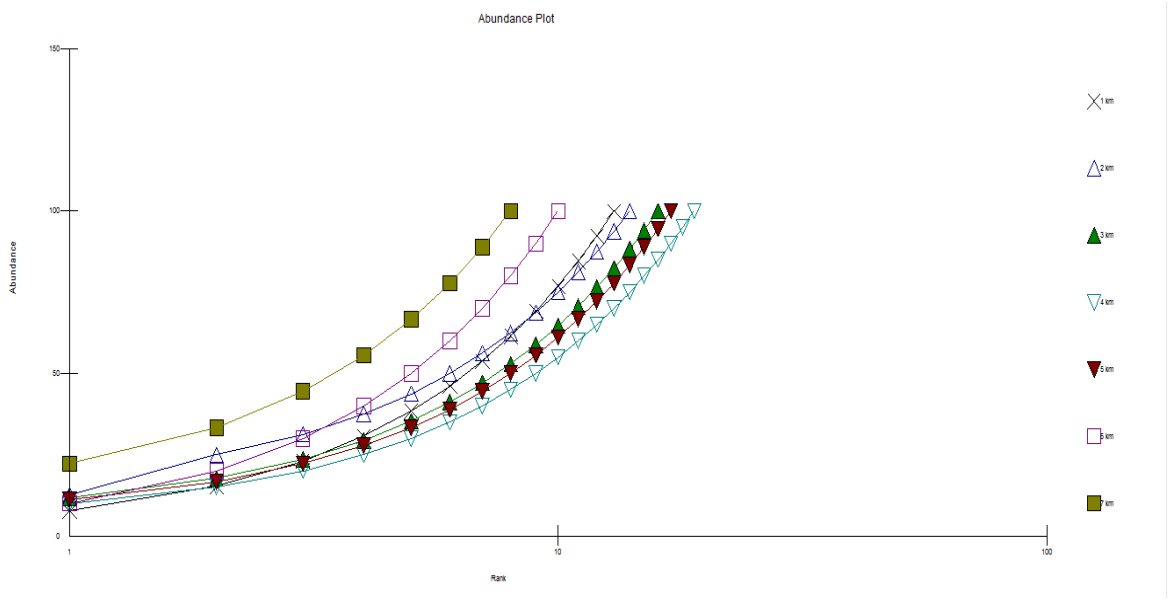



*Fig.3: Bundance Plot of the 21 Butterfly Species Collected Showing the Kilometer Radius*

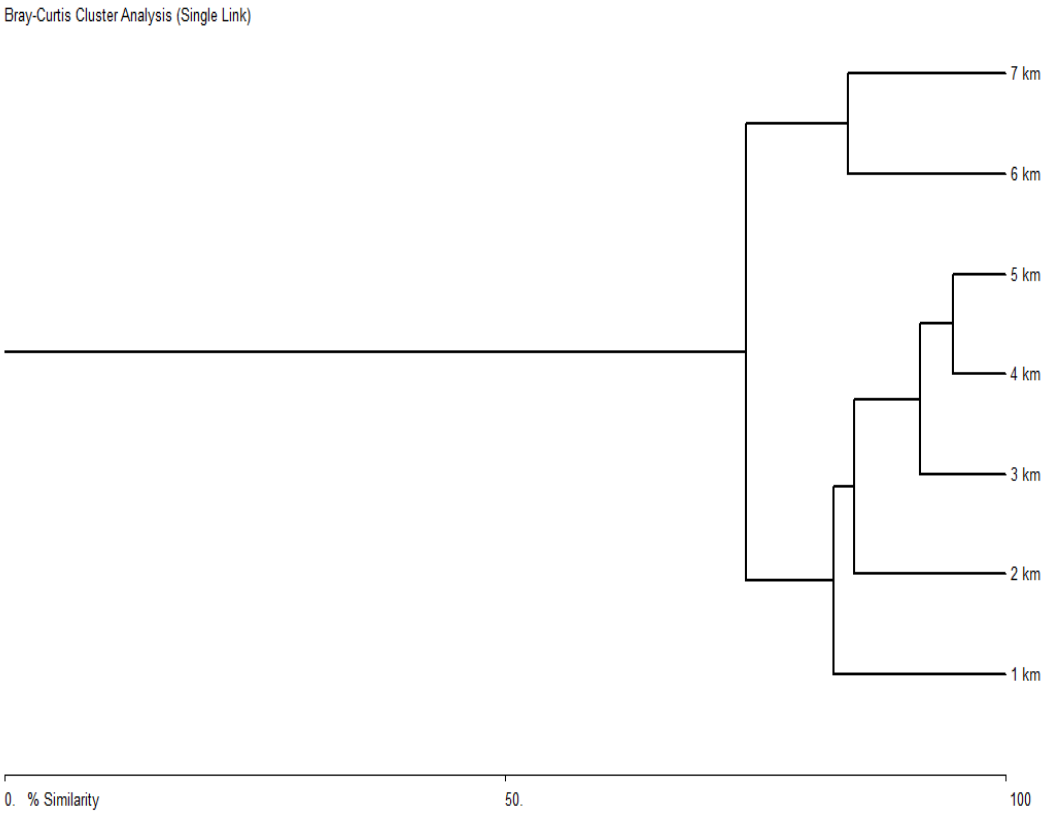
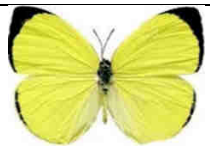



*Fig.4: Bray Curtis Cluster Analysis of the 21 Species of Butterflies Collected at Bulusukan Showing Similarity Indices*

*Table.2: Descriptive Statistics of the 21 Species of Butterflies Collected at Bulusukan as Derived from the Biodiversity Pro Version 2 Software*

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Sample | Mean Individuals | Variance | Standard Deviation | Standard Error | Total Individuals | Total Species | Minimum | Maximum | Mean Confidence Interval |
| 2 | 1st km | 0.619 | 0.248 | 0.498 | 0.109 | 13 | 13 | 0 | 1 | 0.106 |
| 3 | 2nd km | 0.762 | 0.39 | 0.625 | 0.136 | 16 | 14 | 0 | 2 | 0.167 |
| 4 | 3rd km | 0.81 | 0.262 | 0.512 | 0.112 | 17 | 16 | 0 | 2 | 0.112 |
| 5 | 4th km | 0.952 | 0.148 | 0.384 | 0.084 | 20 | 19 | 0 | 2 | 0.063 |
| 6 | 5th km | 0.857 | 0.229 | 0.478 | 0.104 | 18 | 17 | 0 | 2 | 0.098 |
| 7 | 6th km | 0.476 | 0.262 | 0.512 | 0.112 | 10 | 10 | 0 | 1 | 0.112 |
| 8 | 7th km | 0.429 | 0.357 | 0.598 | 0.13 | 9 | 8 | 0 | 2 | 0.153 |

The highest diversity of butterfly species, accounting to standard deviations of not less than 0.5, occurs in the 2nd, 3rd, 6th and 7th kilometer radius. Greater butterfly diversities in these area are influenced by the similarity indices within the 6 to 7 kilometer radius as depicted in the cluster analysis in Figure 4 and the preferential migration of butterflies within the 1 to 3 kilometer radius as observed in the abundance plot in Figure 3.

| | | |
|---|---|---|
|  B1. *Abisara echerius laura* Fruhstorfer 1904 |  2. *Appias phoebe phoebe* Felder & Felder 1775 |  3.*Catopsilia pyranthe pyranthe* (L.) 1758 |
|  4.*Eurema hecabe hecabe* (L.) 1758 |  5.*Gandaca harina mindanensis* Fruhstorfer 1910 |  6.*Graphium agamemnon agamemnon*(L.) 1758 |
|  7.*Graphium antiphates* Cramer |  8.*Graphium sarpedon sarpedon*(L.) 1758 |  9. *Hypolimnas bolina philippensis* Butler 1874 |
|  10. *Idea leuconoe leuconoe* Erichson 1834 |  11.*Jamides celenolydanius* Cramer 1975 |  12. *Liptosia nina georgi* Frushtorfer 1910 |

| | | |
|---|---|---|
|  13. *Melanitisledaleda* (L.) 1758 |  14. *Papilio demoleus libanius* Fruhstorfer 1908 |  15. *Ptychandra lorquini lorquini* Felder1861 |
|  16. *Rhinopalpapolynice stratonice* Felder 1867 |  17. *Telicota* sp. |  18.*Troides rhadamantus*Lucas 1835 |
|  19. *Vinduladejonedejone* Erichson 1834 |  20.*Ypthima sempera*Felder & Felder 1863 |  21. *Zizinia Otis oriens* (Butler) 1883 |

*Fig.6: Photographs of the 21 Butterfly Species Collected at Bulusukan Identified Based on the Atlas of Treadaway, C. G. (1995), C.G. & Schroeder(2012) and Nacua, A.E. (2016)*

## IV. CONCLUSION

This study was able to characterize the abundance, cluster similarity and differences and preferential migration of the 21 species of butterflies collected. Species richness in terms of frequencies from the most represented families as well as the endemicities of 3 species and species rareness were also reported. It is recommended that the same sampling methods be carried out to include collection in both wet and dry season encompassing 12 months of collection. This should include the crepuscular species that may only preset during lateafternoon forecological conservationpurposes within the vicinity the entire municipality of San Idelfonso. Appropriate funding for Conservation measures in the nearby Bulusukan River from contamination and pollution must be observed to protect butterfly species and the habitat.

## V. ACKNOWLEDGEMENT

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