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Species Composition and Status of Butterflies across Vegetation Types in Mt. Pinamantawan Sto. Domingo, Quezon, Bukidnon, Philippines

ALMA B. MOHAGAN
ORCID NO. 0000-0002-8303-5131
almohagan@gmail.com
Department of Biological Sciences,
Central Mindanao University, Musuan,
Maramag, Bukidnon, Philippines

SHARON GLADYS B. REMULTA
ORCID NO. 0000-0001-7960-7654
sgremulta@yahoo.com
Central Mindanao University, Musuan,
Maramag, Bukidnon, Philippines

DALE JOY B. MOHAGAN
ORCID NO. 0000-0002-8787-3618
djmohagan@yahoo.com
Central Mindanao University, Musuan,
Maramag, Bukidnon, Philippines

DAVE P. MOHAGAN
ORCID NO. 0000-0001-7138-4505
dpmohagan@yahoo.com
Central Mindanao University, Musuan,
Maramag, Bukidnon, Philippines

VICTOR B. AMOROSO
ORCID NO. 0000-0001-8865-5551
victorbamoroso@gmail.com
Center for Biodiversity Research and Extension in Mindanao,
Central Mindanao University, Musuan, Maramag,
Bukidnon, Philippine

HEIDI C. PORQUIS
ORCID NO. 0000-0001-7138-4505
hporquis@yahoo.com
Central Mindanao University, Musuan,
Maramag, Bukidnon, Philippines

JOSE A. ESCARLOS JR.
ORCID NO. 0000-0001-5418-3007
jaescarlos@yahoo.com
Central Mindanao University, Musuan,
Maramag, Bukidnon, Philippines

ABSTRACT

Diversity assessment across vegetation types in Mt. Pinamantawan was carried out to provide information on the species composition and status of butterflies using plot and transect walk sampling. A total of 118 species from 64 genera, and 5 families were recorded. High species composition was observed in the agroecosystem with 98 species, next was dipterocarp forest with 33 species, mossy forest with 14 species and 11 species in the montane forest. Status recorded 24 endemic species. Eight (8) were common endemic, 8 rare endemic, 2 common Mindanao endemic, 1 rare Mindanao endemic,1 common Philippine endemic, 1 rare Philippine endemic and 1 new record in Mindanao.

Keywords: Butterflies, vegetation types composition, status, Philippines

INTRODUCTION

Butterflies belong to order Lepidoptera. They are appreciated for their aesthetic, ecological and economic value. They are beneficial as pollinators and are indicators of environmental quality (Boonvanno et al., 2000). They are good indicators of habitat quality and anthropogenic disturbance (Kocher & Williams ,2000) since they quickly react to minor changes in environment. They provide early warning system of wild life loss which makes themas one of the most monitored group of insects in the world (Dobson, 2012).

Among the insect group, they are the most tantalizing and beautiful creatures and are regarded as flagship species (Raghavendra Gowda et al., 2011). Butterflies are admired for their splendid beauty and unique life cycle. Their wings are

covered by millions of scales that adequately reflect daylight which create different pure colours assembled into mosaic figures. Patterns of these different colours are called as small masterpiece of digital arts because they are easily noticeable for their gaudiness and broadness of wings.

Butterflies are mainly day-flying which comprise moths and butterflies species worldwide. (Mallet, 2007). Out of 174,250 known species of Lepidoptera, 28,000 species are butterflies known in the world (Frias et al., 2010). Records about butterflies in the Philippines have been studied and knowledge about their diversity, species richness and distribution are desirable in order to know their ecological status because many natural habitats have been lost due to human activities like building homes, roads, and farms.

Distribution of species in mountain ecosystems is determined by the suitability of habitat and climate (Storch et al., 2003). The main factors that influence the distribution of species and diversity include geographic isolation, altitude, climate and features of landscape and habitat such as structure, heterogeneity and quality (Fleishman et al., 1998, 2003; Pyrcz & Wojtusiak, 2002). Diversity and area/size of habitats at different altitudes affect the spatial distribution, species richness, morphology, physiology, life cycle and behavioural patterns of butterflies (Haslett, 1997).

Life of butterflies is prominent and perhaps important in the line of natural history. The details of declining habitat occupancy for butterflies and their increasing threat of survival have boosted the necessity to protect these magnificent creatures (Hanski & Kussaari, 1995). Conservation of species would be a major challenge since only few taxonomic and ecological studies have been made here in the Southern Philippines.

To amplify the knowledge of diversity of butterflies here in Mindanao, Mt. Pinamantawan was preferred as the site of the study because it has high richness of flora and fauna at a glance in the site but is not documented yet and are needing protection. This mountain was part of the Tangkulang Range with 21,924 hectares and was one of the proposed areas for protection in Bukidnon due to slash farming and other anthropogenic activities conducted in the area (DENR, 2013; Appendix I).

OBJECTIVES OF THE STUDY

This paper assessed the diversity of butterflies across vegetation types in Mt. Pinamantawan. Specifically, it aimed to determine species composition and to assess the ecological and conservation status of butterfly species

METHODOLOGY

Establishment of the Sampling Stations

There were four sampling stations identified based on vegetation types viz: station 1 - Agroecosystem (fig.1), station 2 - Dipterocarp forest (fig.2), station 3 - montane forest (fig.3), station 4 - mossy forest (fig.4) in Mt. Pinamantawan, Sto. Domingo, Lumintao, Quezon, Bukidnon. In each station, three 20m x 20m quadrats/plots were established along the transect belt from the base to the peak. Each quadrat/plot had two bait traps. The sites chosen were near the flowerings plants.

Sampling Schedules and Sampling Techniques

The sampling of butterflies was done within 8 days every month from the month August 2013 to February 2014. Two days were spent per vegetation types for a total of eight days every month during the sampling period. Collections of butterflies started from 7:00 A.M. to 5:00 P.M. using bait traps with baits like fermented bananas or pineapple with liquor to enhance the aroma of the fruit and using insect catching nets that measures 25x60 cm made of silk cloth. Coloured clothes like red and yellow were also used to attract butterflies. Two bait traps were installed 1.0 m above the ground within each plot as adapted from Mohagan and Treadaway (2010). One bait trap was installed along the transect belt per vegetation types of Mt. Pinamantawan, Sto. Domingo, Lumintao, Quezon, Bukidnon.

Sampling of the butterflies across vegetation types of Mt. Pinamantawan was carried out using combined methods. For butterfly species determination, the following techniques were employed.

a. Transect walk – In 2 km transect, butterflies were observed, counted and collected. The altitude, weather, vegetation and other information about butterflies and the area were recorded.

b. Quadrat Method – There were three 20m x 20m plots/quadrat established in each vegetation types. All butterflies collected in the quadrats/plot were counted and recorded with relevant data. This was done using rope labeled with water proof pen at one meter interval.

c. Oppotunistic Sampling – There was sampling outside the quadrats/plots and transects during leisure time or at rest. At times when there were visiting butterflies and they were collected and labeled with their corresponding data about habitat, altitude, and vegetation types.

d. Bait Traps – These traps were established along the belt transect and inside the quadrats/plots in each vegetation types of Mt. Pinamantawan. Fermented and rotten bananas and pineapples were placed inside the traps. Meats of fish or animal manure were also used as baits in sampling frugivorous and pheromone analogue attracted butterflies.

The habitat was described using the habitat description form adapted from Haribon foundation (2000) (Appendix I).

Collection and Preservation

Individual specimens were collected using the insect catching nets and bait traps after data processing. These were preserved to avoid damage of wings. All collected butterflies were slightly pressed at the thorax and were placed in a triangular wax paper. There were boxes prepared for all collections with moth balls for the preservation of the butterflies (Mohagan & Treadaway, 2010).

Each species in the triangular paper was labeled with the following data: collection number, initial identification, sampling method, vegetation-altitude, date, and important notes such as the colour, habitat, and source of information. After the specimens were preserved, butterflies were mounted on a grooved board with a long insect pin that was inserted on the thorax. The specimens were labeled with their names, location and date, the name of collector and other information about the species.

Status Assessment

A. Assessment of Ecological Status

The ecological status assessment was done by producing lists of butterflies sampled in Mt. Pinamantawan. The species lists produced were matched to

Treadaway's list for the determination of endemism or whether it is Philippine endemic, Mindanao endemic, Site endemic and widespread. The butterflies were also be locally assessed from Mohagan and Treadaway (2010) for the evaluation of the local status of butterflies in Mt. Pinamantawan using the scale below:

Very rare – 1-3 occurences
Rare - 4-10 occurences
Common – 11-20 occurences
Very common – 21 and above occurrence

B. Assessment of Conservation Status

In the assessment of the national conservation status, Danielsen and Treadaway (2004) lists were used in the determination of the status of butterflies as to threatened or not. Current IUCN Red list of butterflies was also used for the enhancement of information on the status of butterflies. Under the category of threatened were: (VU) – Vulnerable, (EN) – Endangered and (CR) – critically endangered.

Identification of Butterflies in Mt. Pinamantawan

Identification was done using the morphological features of the wings of butterflies and was confirmed by the last author in Central Mindanao University. The data recorded on antennae shape and structural modifications were based from Mohagan (2007). Nomenclature of venation and species were adapted from Fleming (1975).

RESULTS AND DISCUSSION

Species Composition of Butterflies in Mt. Pinamantawan

The seven months of sampling period in Mt. Pinamantawan produced one hundred eighteen (118) species of butterflies that belonged to five (5) families. There were eleven (11) genera and seventeen (17) species of Hesperiidae, seventeen (17) genera and twenty nine (29) species of Lycaenidae, twenty seven (27) genera and and forty nine (49) species of Nymphalidae, three (3) genera of and five (5) species of Papilionidae and six (6) genera and eighteen (18) species of Pieridae (Table 1).

The highest species composition was found in the agroecosystem with ninety eight (98) species followed by the Dipterocarp forest with thirty-three (33) species then mossy forest with fourteen (14) species and the montane forest with eleven

(11) species Table 1b). More species were observed in the agroecosystem due to many flowering plants and fruiting trees. Aside from that, there were many root crops and vegetables which have flowers in them. The two selected plots in the agroecosystem were placed near the streams. Butterflies were seen drawing near the stream to sip water. The other plot was placed in an area where abundant flowering plants were located. Agroecosystem had larger open area than the other type of vegetation. As observed, they prefer flying in an open area to find flowers, rotten fruits and animal manure to eat. The Dipterocarp forest had more tall trees covering the area and only few open areas. Montane Forest had steep areas, only few flowering plants were seen and butterflies tend to fly and secure food in the open area of Mossy Forest or in some open areas of Dipterocarp Forest. Mossy Forest had few open spaces near the peak where butterflies can have sunlight and butterflies were seen flying there but most of them prefer moist and wet areas. Klass and Dirig (1992) said that butterflies will not have the same resident of that in the forest vegetation for they prefer wetlands like riversides, swamps, and marshes.

Table 1. Composition and Status of butterflies in Mt. Pinamantawan

FAMILY/SPECIES	Local status	Ecological	National
HESPERIIDAE			
1.Ancestroides nigrita fumatus	very rare		common
2.Borbo cinnara	very rare		common
3.Caltoris bromus bromus	very rare		rare
4.Hasora chromus chromus	very rare		uncommon
5.Hasora taminatus padma	very rare		common
6.Hasora vitta proximata	very rare		
7.Notocrypta feisthomelii alinkara	very rare		common
8.Notocrypta paralysos volux	Rare		common
9.Oriens californica	very rare	Endemic	common
10.Pelopidas conjuncta conjuncta	very rare		common
11.Pelopidas mathias mathias	very rare		common
12.Pothanthus hetaenus hetaenus	very rare		uncommon
13.Pothanthus mingo mingo	very rare		uncommon
14.Tagiades gana elegans	very rare		common
15.Tagiades japetus titus	very rare		common
16.Taractrocera luzonensis luzonensis	common		common
17.Telicota colon vaja	very rare		uncommon

LYCAENIDAE			
18.Allotinus fallax aphacus	very rare		common
19.Allotinus punctatus	very rare	endemic	common
20.Allotinus nivalis felderi	very rare		uncommon
21.Allotinus sp. 1	very rare		undetermined
22.Allotinus sp. 2	very rare		undetermined
23.Arophala sp	very rare		undetermined
24.Catochrysops strabo luzonensis	very rare		common
25.Celarchus archagathos archagathos	rare		
26.Celastrina sp.	very rare		undetermined
27.Deramas nelvis manobo	rare		common
28.Flos fulgida zilana	very rare		
29.Hypolycaena schinozui	very rare	endemic	rare
30.Hypolycaena sipylus tharrytas	very rare		common
31.Jamides alecto manilana	common	endemic	uncommon
32.Jamides bochus pulchrior	very rare		common
33.Jamides celeno lydanus	very rare		rare
34.Jamides cleodus cleodus	common		common
35.Jamides philatus osias	common		uncommon
36.Lampides boeticus	very common		common
37.Monodontides apona	common	endemic	common
38.Nacaduba berenice lesi	very rare		common
39.Pithecops corvus corax	common		common
40.Udara dilecta dilecta	very rare		rare
41.Udara sp.1	very rare		undetermined
42.Udara sp.2	very rare		undetermined
43.Udara sp.3	very rare		undetermined
44.Zeltus amasa masaya	very rare		
45.Zizina otis oriens	very rare		uncommon
46.Zizula hylax pygmaea	very rare		uncommon
NYMPHALIDAE			
47.Acrophtalmia albofasciata	very rare	endemic	rare
48.Acrophtalmia leto ochine	very rare		common
49.Anosia chrysippus	rare		common
50.Anosia melanippus edmondii	very rare		common
51.Athyma maenas semperi	very rare		uncommon
52.Cethosia luzonica magindanica	very rare		common
53.Cyrestis kudrati	very rare	endemic	uncommon
54.Cyrestis maenalis rizali	common		common
55.Discophora philippina	very rare	endemic	uncommon

56.Elymnias esaca georgi	very rare		
57.Euploea mulciber mindanensis	rare		common
58.Euploea tobleri snellerii	very rare		uncommon
59.Euploea blossomae hilogensis	rare		rare
60.Faunis phaon leucis	common		common
61.Hestinalis waterstradti borealis	very rare		rare
62.Hypolimnas bolina philippenensis	rare		common
63.Idea electra electra	very rare	endemic	uncommon
64.Ideopsis gaura glaphyra	very rare	Mindanao endemic	rare
65.Junonia hedonia ida	rare		common
66.Junonia orithya leucasia	very rare		common
67.Lassipa ebusa laetitia	very rare		common
68.Lassipa pata semperi	very rare		rare
69.Lethe chandica byzaccus	very rare		common
70.Lexias panopus miscus	rare		common
71.Melanitis atrax lucillus	rare		common
72.Melanitis leda leda	common		common
73.Mycalesis zitenius xantopthalmus	very rare		
74.Mycalesis felderi felderi	common	endemic	uncommon
75.Mycalesis frederici	common	endemic	uncommon
76.Mycalesis ita imaldas	very rare		
77.Mycalesis janardana micromede	very rare		common
78.Mycalesis micromede micromede	very common		common
79.Mycalesis mineus philippina	very rare		uncommon
80.Mycalesis sp. 1	very rare		undetermined
81.Mycalesis tagala semiraza	rare		uncommon
82.Mycalesis treadawayi treadawayi	rare	endemic	uncommon
83.Neptis cymela nitetis	rare	endemic	common
84.Neptis pampanga boholica	common		uncommon
85.Orsotriaena medus medus	rare		common
86.Parantica dannatti divataensis	rare		uncommon
87.Parantica luzonensis luzonensis	rare		
88.Parantica vitrina oenone	very rare		common
89.Rhinopalpa validice polynice	very rare		common
90.Symbrenthia hippoclus anna	rare		common
91.Tanaecia leucotaenia aquamarina	very rare		common
92.Tirumala septentrionis valencia	very rare		common
93.Ypthima sempera chaboras	common	Phil. Endemic	uncommon
94.Ypthima sensilis	rare	endemic	rare
95.Ypthima stellera stellera	very common	Phil. endemic	common

PAPILIONIDAE			
96.Graphium sarpedon sarpedon	very rare		common
97.Menelaides ledefouria polytes	rare		common
98.Menelaides deiphobus rumanzovia	very rare	endemic	common
99.Troides magellanus apoensis	very rare		uncommon
100.Troides rhadamanthus	very rare	endemic	common
PIERIDAE			
101.Appias albina pancheia	very rare		
102.Appias olferna peducaea	very rare		
103.Appias paulina agave	rare		common
104.Appias remedios	rare	endemic	rare
105.Catopsilia scylla asema	very rare		common
106.Cepora aspasia orantia	very rare		common
107.Delias apoensis maizurui	very rare	endemic	uncommon
108.Delias diaphana diaphana	rare	endemic	common
109.Delias henningia saturnia	very rare		common
110.Delias hyparete mindanensis	rare	Mindanao endemic	common
111.Delias levicki justini	very rare		rare
112.Delias schoenigi hermeli	rare		uncommon
113.Eurema alitha alitha	common	Mindanao endemic	common
114.Eurema blanda vallivolans	rare		common
115.Eurema hecabe tamiathis	very common		common
116.Eurema hiurai hiurai	very rare		common
117.Eurema symulatrix symulatrix	very rare		common
118.Leptosia nina terantia	very rare		common

Table 2. Ecological Status of Butterfly Species in Mt. Pinamantawan

	National Status	Endemic	Mindanao Endemic	Philippine Endemic	New Record
Common	62	8	2	1	
Uncommon	14	8	0	1	
Rare	26	0	1		1
Undetermined	14	0	0		

Agroecosystem was represented by sixty four (64) very rare species, seventeen (17) rare species, twelve (12) common species and four (4) very common species; Dipterocarp forest had eleven (11) very rare species, eight (8) rare species, nine (9) common species and two (2) very common species; Montane had three (3) very rare species, seven (7) rare species, one (1) common species, and one (1) very common species; and the mossy forest had seven (7) very rare species, five (5) rare species, one (1) common species and no very common species (Table 1b). Agroecosystem had the highest species composition but most of them were very rare. These might be because most butterflies in the agroecosystem were captured early in the morning and many of the species of their kind were flying high when the sun was high and it was hard for them to capture anymore. Most butterflies at the ground level were also active during the sunrise to sip nectars on flowers and most of them were common species.

Dipterocarp forest had higher very rare species but the record of common species was not behind with the very rare butterflies which may imply that there were mixed species composition and number of individual species flying at the time of sampling that could be easily accessed by the catching nets and bait traps. Montane had higher rare species than the very rare species. This might be due to more individuals species of butterflies passing across the steep area near the ground level where they can be easily captured when they travel going to the open area. Mossy forest had few very rare, rare and common species of butterflies. Most of these butterflies were captured at the peak where they pass the clearances as they were seen flying in that direction. Some of the species were captured in quadrat/plot 2 which had small open area where there were presences of flowers and they were seen sipping nectars in the morning. In quadrat/plot 1 and 2 of the mossy forest were mostly moist and shady with moss and ferns on the ground. Although there were Medinilla plants around, they tend to go higher to the peak to capture warmth from the sun.

Trees that have flowers were their common stay especially that the flowers

of some trees were seen just beside the higher ground of the peak. Identifying factors like climate or weather conditions, temperature and habitats may be the reason to work out the existence of butterflies in the area. Haefeli (2012) said that the availability of butterfly species with its host plants have helped to respond to factors. According to Swengel (1997) most climates include times of the year unsuitable for butterfly activity, usually because of cold or drought. Some species do not migrate but wait for periods by going to dormancy - diapause. To maintain most kinds of species possible at a site, attention should focus on catering the needs of resident species which include their habitat needs.

Ecological Status of Butterflies

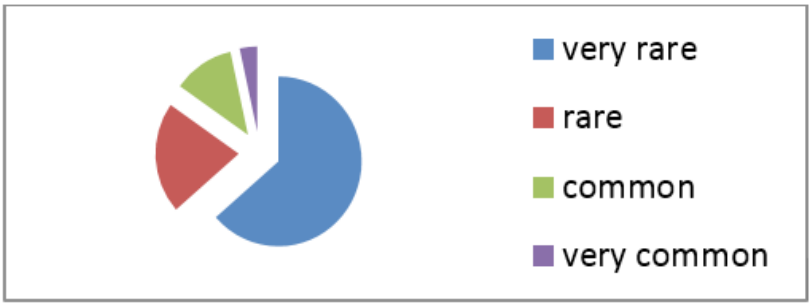


Figure 6. Chart for the local status of butterflies in Mt. Pinamantawan

Regarding the local status of butterflies, there were fourteen (14) common species (12%), four (4) very common species (3%), twenty five (25) rare species (21%), and seventy five (75) very rare species (64%) as shown in figure 1 and Table 2. There were many very rare species of butterflies during my study since most sampling period fall on cloudy, rainy and windy times. The butterflies may not like windy season and rainy seasons that tend them to have wet wings in their flight. Toledo and Mohagan (2011) said that butterflies may hide in these kinds of seasons for they were preventing disturbances in their flights and other reasons were due to flowering seasons and availability of their food source.

A total of twenty-four (24) endemic species were recorded out of one hundred eighteen (118) species of butterflies. Agroecosystem have one hundred ten (110) individuals from eighteen (18) species, dipterocarp forest have twenty-three (23) individuals from eleven (11) species, montane have five (5) individuals from four (4) species and mossy forest have twenty two (22) individuals from two (2)

families (Table 2b). Agroecosystem had the highest abundance of species than all forest vegetations, and this may be due to many open areas where sunlight was abundant. For the number of individuals, agroecosystem has the highest and montane forest have the lowest number, but for number of species, agroecosystem have the highest and mossy forest have the lowest. Mt. Pinamantawan had a hump-shaped pattern in the forest area that may result to lower endemic species. The general distribution of endemic butterflies in Mt. Pinamantawan across vegetation types was generally lower than of Mohagan and Treadaway (2010) with forty-four (44) endemic species in their study and they said that the abundance of butterflies was generally low in forest where the canopy is too closed for sunlight to penetrate.

Conservation Status of Butterfly Species

Based on Treadaway's checklist (1995) there were sixty-two (62) common species, twenty-six (26) species were uncommon, fourteen (14) rare species and fourteen (14) undetermined species of butterflies. Most of the common species were recorded from the agroecosystem which means that these butterflies were not widely distributed of which some belong to the twenty-four (24) endemic species.

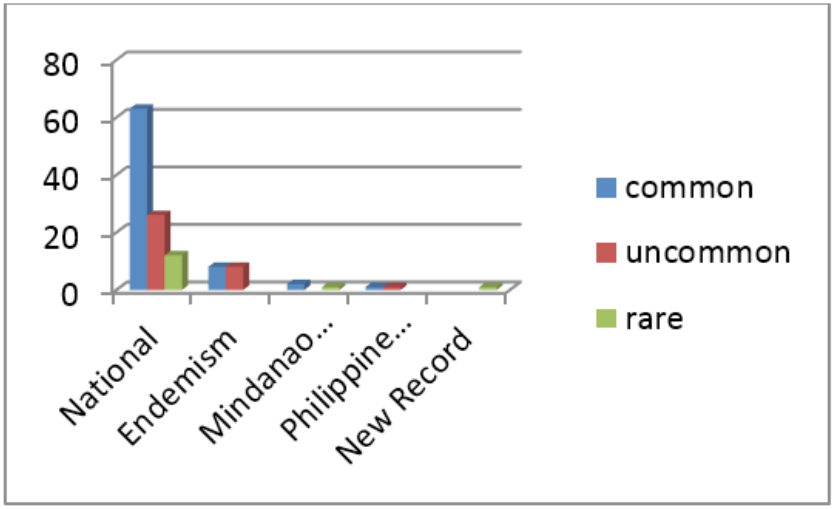


Figure 2. Chart for the national status of butterfly in Mt. Pinamantawan

Figure 2 shows the chart national status and endemism of butterflies. There were eight (8) common endemic, eight (8) uncommon endemic, two (2) common Mindanao endemic, one (1) rare Mindanao endemic, one (1) common Philippine endemic, one (1) rare Philippine endemic and one (1) rare new record in Mindanao - the Appias remedios. There were three threatened species according to IUCN Red list of butterflies (2013) and these were Euploea tobleri – nearly threatened, Idea electra – vulnerable and Parantica dannatti – vulnerable. The species with new record in Mindanao - Appias remedios was found in the Montane and Mossy Forest of Mt. Pinamantawan. There may be unique plant host for this butterfly species to surveyed. Swengel (1997) said that the existence of resident species largely depend on the resources available to support.

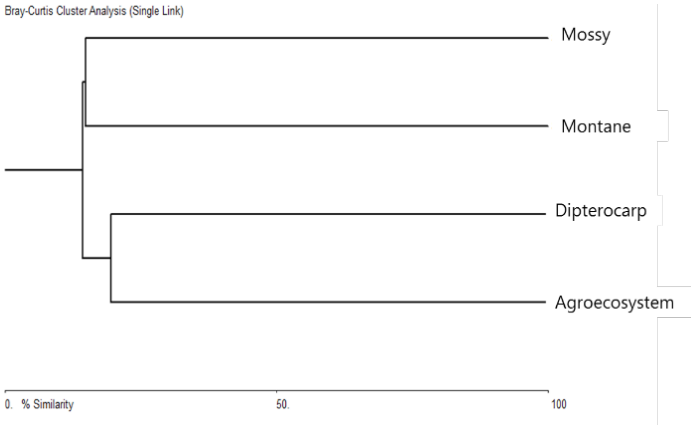


Figure 3. Dendogram species similarity in endemic butterflies in Mt. Pinamantawan

Dendogram of similarity of endemic butterfly species showed two major clusters of habitats (Fugure 3). The first cluster was the mossy forest and montane forest with similarity less than 1 % which suggest that each were unique habitats for butterflies of which there were species of butterflies in the area that are disconcordant endemic. The second cluster was the dipterocarp forest and the agroecosystem which showed that the two were related habitats with low similarity of endemic species composition, similarity equal 13 % which suggests that each one were also unique habitats. This may be due to the presence of food plants for butterflies that might have resulted to the increase in species endemism. Agroecosystem had high species richness due to varied plants found

important to butterflies in their existence. Posa and Sodhi (2005) stated that agroecosystem have high species richness due to many food plants and host plants were important to butterflies and endemicity depends on the abundance of it.

CONCLUSION

Mt. Pinamantawan is the home of one hundred eighteen (118) species of butterflies with sixty-four (64) genera and five (5) families. Agroecosystem had higher species richness of butterflies across vegetation types and lower in the montane forest across vegetation types. It serves as habitat for twenty-four (24) endemic species. Endemic species of butterflies belong to Nymphalidae and Pieridae family and are mostly found in the Agroecosystem. Mt. Pinamantawan is the home of 3 threatened species of butterflies namely: Idea electra, Eploea tobleri and Parantica dannatti, and there were two (2) new records in Mindanao. Agroecosystem is the preferred vegetation type for butterflies in Mt. Pinamantawan.

LITERATURE CITED

Boonvanno, K., Watanasit., S. & Permkam, S. (2000). Butterfly Diversity at Ton Nga-Chang Wildlife Sanctuary, Songkhla Province, Southern Thailand. *Science Asia, 26*,105-110.

Danielsen, F. & Treadaway, C.G. (2004). Priority Conservation Areas for Butterflies (Lepidoptera: Rhopalocera) in the Philippine Islands. The Zoological Society of London, printed in the United Kingdom. *Animal Conservation, 7*, 79-92.

Department of Environment and Natural Resources. (1998.) The First Philippine National Report of the Convention on Biological Diversity. Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources, Republic of the Philippines.

Department of Environment and Natural Resources. (2013). Technical Services. Protected Areas, Wildlife and Coastal Zone Management Service. Region 10 – Cagayan De Oro City. [Accessed on June 14, 2013 from: www. Protected Areas, Wildlife and Coastal Zone Mgmt. Service.htm].

Dobson, F. (2012). Butterflies Act as Wildlife Indicators, Warning Us of Ecosystem Changes. *The Entomologist*. Retrieved from www.enn.com/climate/article/45000.

Fleming, W.A. (1975). Butterflies of West Malaysia and Singapore. Longman Malaysia SDN Berhad. Wisma Damansara, Jalan Semantan, Kuala Lumpur.

Frias, A.P.E., Del Rio, M.S.S & Roque, J.S.. (2010). A Study on the Diversity of Butterflies at De La Salle University (DLSU) Dasmarinas. Retrieved from http://www.A Study on the Diversity of Butterflies.htm.

Haefeli, S. (2012). Rare Butterfly Expanding its Ranges. Posted May 27, 2012 in Climate, Nature, News and Science. Retrieved from http://scienceillustrated.com.au/blog/nature/rare-butterfly-expanding- its-anges/.

Hanski, I.A. & Kussaari, M. (1995). Butterfly Meta population Dynamic. *In Population Dynamic: New Approaches and Determinants of Community Diversity*. Ed. R. Ricklefs and Schluter. Chicago: University of Chicago Press, (pp.108-116).

Haribon. (2000). Teaching Module for Tertiary Teachers Training for biodiversity Conservation.

International Union for Conservation of Nature. (2013). Redlist of Butterflies. Retrieved from http://www.iucnredlist.org/details/ 10781/0.

Mallet, J. (2007). "Taxonomy ofLepidoptera: the scale of the problem". The Lepidoptera Taxome Project. University College, London. Retrieved from http://scholar.google.com/ scholar?q=MALLET%2C+J.+2007.

Mohagan, A.B. (2007). Diversity and Status of Butterflies across Vegetation Types of Mt. Hamiguitan, Davao Oriental, Philippines. Dissertation. Central Mindanao University, Musuan, Bukidnon, Philippines.

Mohagan, A.B. & Treadaway, C.G. (2010). Diversity and Status of Butterflies across Vegetation Types of Mt. Hamiguitan, Davao Oriental, Philippines. *Asian Journal of Biodiversity,1*(1), 1-24.

Mohagan, A. B., Mohagan., D.P. & Tambuli, A.E.(2011). Diversity of Butterflies in the Selected Key Biodiversity Areas of Mindanao Philippines. *Asian Journal of Biodiversity, 2*(1).

Nacua, A.E., Mohagan., A.B. & Alejandro, G.J.D. (2015). Diversity and Distribution of Butterflies in the Open and Close Canopy Forest of Cadaclan, San Fernando, La Union Botanical Garden of North Luzon, the Philippines. *Journal of Biodiversity and Environmental Sciences, 6*(1),169-177. Retrieved from http://www. innspub.net/wpcontent/uploads/2015/01/JBES-Vol6No1-p169-177.pdf

Ramirez, R.K.C., & Mohagan, A.B. (2012) . Diversity and Status of Butterflies in Maitum Village, Tandag, Surigao Del Sur, Philippines. *Asian Journal of Biodiversity, 3*(84),74-112.

Swengel, A. (1997). Straight Talk About Butterfly Population Biology. North American Butterfly Association. 4 Delaware Road, Morristown, NJ 07960. Retrieved from http://www.naba.org/ftp/bhpop.pdf

Toledo, J.M.S & Mohagan, A.B. (2011). Diversity and Status of Butterflies in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Island, Philippines. *JPAIR Multidisciplinary Journal, 6*.

Treadaway, C.G. (1995). Checklist of the butterflies of the Philippine Islands (Lepidoptera: Rhopalocera) Nachr.entomol. Apollo Suppl.14,7-118.

Treadaway, C.G. & Schroder, H.G.(2012). Revised checklist of the butterflies of the Philippine Islands (Lepidoptera: Rhopalocera). Nachr.entomol. er.Apollo, Suppl.20,1-64.

APPENDICES

Fig. 4. Agroecosystem at the foot of Mt. Pinamantawan

Figure 5.Dipterocarp Forest of Mt. Pinamantawan

Figure 6. Montane Forest of Mt. Pinamantawan

Figure 7. Mossy Forest of Mt. Pinamantawan

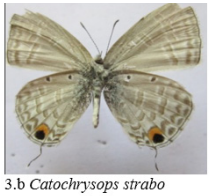
Plate 8. Some Butterflies on Mt. Pinamantawan, Bukidnon

1.a *Pothanthus hetaenus hetaenus*

1.b *Pothanthus hetaenus hetanus*

2.a *Pothanthus mingo mingo*

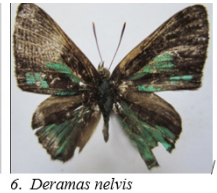
2.b *Pothanthus mingo mingo*



3.b *Catochrysops strabo luzonensis*

4 *Celarchus carchagathos archagathos*

5. *Celastrina sp.*



6. *Deramas nelvis manobo*

7a . *Athyma maenas semperi*

7b. *Athyma maenas semperi*

8.a. *Cethosia luzonia magindanica*

8.b. *Cethosia luzonia magindanica*

9b. *Menelaides deiphobus rumanzovia*

9. a. *Troides magellanus apoensis*

10b. *Troides magellanus apoensis*

11.a. *Troides rhadmanthus*

11.b. *Delias diaphana diaphana*

12. . *Delias henningia saturnia*

13.a. *Delias hyparete mindanensis*

13.b. *Delias hyparete mindanensis*

14.a. *Eurema alitha alitha*

14.b. *Eurema alitha alitha*

15.a. *Eurema blanda vallivolans*

15.b. *Eurema blanda vallivolans*