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Diversity and Status of Butterflies in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Island, Philippines

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Abstract - Diversity assessment of butterflies was conducted to provide information on species composition, diversity trends cross vegetation type's status, and distribution of butterflies in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Island. This study was carried out using catching net to collect butterfly species in the two mountains of Camiguin namely Mt. Hibok-hibok and Mt. Timpoong from December 2009 to May 2010. The study revealed 81 species of butterflies in both mountains. 73 species were collected in Mt. Timpoong and 41 species in Mt. Hibok-hibok. Species richness of butterflies showed that there is a decreasing trend across vegetation types in both mountains. Highest diversity level was observed in the agro-ecosystem of Mt. Timpoong (H'= 1.70) and Mt. Hibok-hibok (H'=1.48) respectively. Status assessment showed 18 or 22 % endemic species out of which, 14 are present in Mt. Timpoong and only 8 are present in Mt. Hibok-hibok.

Keywords - butterflies, Mt. Hibok-hibok, Mt. Timpoong

INTRODUCTION

Butterflies are very important to the environment. They are excellent group for communication information in science and conservation issues (Koplins and Opler, 1997). They are pollinators of crops, wild plants and an excellent indicator of the ecological condition of the most terrestrial habitats (Barua, 2009). Philippines have the highest concentration of butterflies and the biodiversity is outstanding when compared globally (Aguilar, 2007). The country's endemic species by group such as butterflies is always richer than the much larger mega-diverse countries. Treadaway (1995) listed 1,030 of butterflies in the Philippines. However, there is inconsistency in the number of endemic species of butterflies in the Philippines. The inconsistencies on the number of butterfly species diversity in the Philippines reported by the different authors accentuates the need to survey the species of butterflies.

Mt. Timpoong and Mt. Hibok-hibok are the protected areas under NIPAS. These are also Key Biodiversity Areas in the Philippines. Birds and mammals have been studied in the area (Balete et al., 2006; Heaney, 2006) but no studies were done on butterflies. Intense commercial logging has already denuded many slopes in forested areas which results in severe erosion. If this problem continues, species of butterflies may be lost in the area.

OBJECTIVES OF THE STUDY

This study was conceptualized provide information of species composition, diversity and status of butterflies in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Islandas basis for conservation.

MATERIALS AND METHODS

Entry Protocol

Prior to the issuance of Gratuitous permit (GP); a Prior Inform Consent (PIC) was secured from Camiguin DENR during PAMB meeting. The PIC was released last July 2010 after the board resolution. GP application was done by sending a proposal of the study and a

request letter to the DENR and PAWD in December 2009. The Wildlife GP application was approved last July in which it has a permit no. 2010-01.

Place and Duration of the Study

The study was done in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Island from the month of December 2009 to May 2010.

Establishment of Sampling Stations and Sampling Techniques

Two transect belts were established within Mt. Timpoong and Mt. Hibok-hibok. Three vegetation types were identified per transect belt. Mt. Timpoong includes agroecosystem, dipterocarp forest and montane forest. Mt. Hibok-hibok includes agroecosystem, montane forest and mossy forest. In each station, two 20x20 m. plots/ quadrats were established. Transect walks were done between 8:00 and 11:00 in the morning and between 2:00 and 5:00 in the afternoon under sunny weather conditions each for a duration of three hours. Opportunistic sampling was used to sample butterflies outside the quadrats and transects.

Sampling Schedule and Collection Techniques

Collection of butterflies which fed on flower nectar and other sugars was done from 6:00 am to 12:00 noon. The butterflies, which fed in vertebrate feces and dead animals, were done 1:00 p.m to 5:00 p.m using catching net. The catching net was made of silk cloth with a measurement of 25 cm x 60 cm. and traps with fruit as bait to attract butterflies into the bait. The baits were fermented banana or pineapple for the frugivorous butterflies. The bait traps were installed 1.0 m above the ground. Two traps were situated in every study stations. Colored clothes like red, yellow were also recommended colors to attract butterflies (Mohagan and Treadaway, 2010).

Diversity and Distribution Assessment of Butterflies

Density, abundance, species richness, species distribution and Shannon- Weiner diversity index were determined using BIOPRO software ver. 2.0. (McAleece, 1993). The reported distribution of butterflies was based on Treadaway (1995) and Mohagan (2007). Local distribution was based on the butterflies observed and collected in the study station. Spatial distribution of butterflies was described as randomly distributed or aggregate assemblages (McAleece, 1993).

Preservation and Specimen Storage

Butterflies collected were slightly killed with acetone in the killing jar. These were placed in a wax envelope to prevent wing damage. Specimens were placed in the box with moth balls. Specimens were mounted on a grooved board with a long insect pin inserted through the thorax. The specimens were labeled with the location and date of capture and name of collector. The specimens were deposited at the Zoology Section of the Central Mindanao University Museum.

Classification, Identification and Examination of Wing and Antenna Morphology

Classification and initial identification of butterflies were done using journals and photographs of identified specimens and a checklist of Treadaway (1995). Confirmation of species was done by Dr. Alma B. Mohagan and Mr. Dave P. Mohagan.

Conservation and Ecological Assessment

Specimens collected were also assessed using Treadaways' checklist (1995) and IUCN (2009). Conservation status was assessed using Treadaway's list. Ecological status of butterflies was based on the rarity or commonness of the species. Local populations were considered to evaluate the local status of butterflies. It was based on the number of individuals per study site in which it follows the legend in which 1-3 occurrence (very rare); 4-10 occurrence (rare); 11-

20 occurrence (common) and 21- above occurrence (very common) (adapted from Mohagan, 2007).

RESULTS AND DISCUSSION

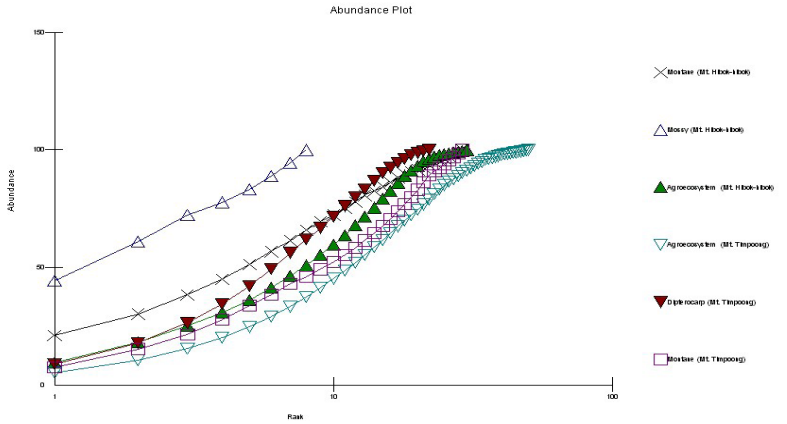
Species Composition of Butterflies

There were eighty one species of butterflies identified in Camiguin Island. Of these, forty one species were in Mt. Hibok-hibok and seventy three species in Mt. Timpoong. Mt. Hibok-hibok butterflies were represented by two genera and four species of Hesperids; three genera and four species of Lycaenids; twelve genera and fifteen species of Nymphalids; five genera and eight species of Papilionids; five genera and ten species of Pierids. In Mt. Timpoong, there are eight genera and twelve species of Hesperids; sixteen genera and seventeen species of Lycaenids; twelve genera and twenty one species of Nymphalids; seven genera and ten species of Papilionids; and five genera and thirteen species of Pierids.

The agroecosystem in Mt. Hibok-hibok has plenty of fruiting trees. Its montane forest has few flowering plants and trees, the most common tree species is Mahogany. Its mossy forest is very abundant in moss species and only epiphytic trees are flowering. On the other hand, Mt. Timpoong dipterocarp forest has plenty of *Medenilla* sps and fruit trees that may serve as food plant of some butterfly species. Its montane forest also has plenty of fruit trees and a quality type forest. According to Weilbull and Ostman (2003) landscape features largely affect species composition especially for the most mobile group of butterflies. The percentage of land temporarily with perennial grass and clover is the most important landscape feature for butterfly and plant species composition. This is proven in the result of this study in which agroecosystem in both mountains the highest species composition has. In addition, according to Bergman et.al. (2004) species which have high occupancy probabilities in landscape with low amount of surrounding deciduous forests/ semi-natural grasslands are significantly more mobile than the others. There is also a significant relationship between butterfly species richness and habitat quality in the form of vegetation height and abundance of flowers (Ockinger

and Smith, 2000). Typically, short and temporarily variable growing seasons at high elevation result to a dramatic population fluctuation (Boggs and Murphy, 1997).

Species Richness and Diversity of Butterflies



Hibok-hibok and Mt. Timpoong, Camiguin Island

Adequacy of sampling was reached for all stations except for the mossy forest of Mt. Hibok-hibok where additional sampling is needed (Fig. 1). Additional species of butterflymaybe listed if sampling will be extended. A total of 50 species of utterflies observed in the agroecosystem of Mt. Timpoong. Species abundance showed highest in agroecosystem in Mt. Timpoong (495). This may be due to the decreasing temperature at the higher elevation. This is true to Mohagan (2007) Species richness is decreasing in the mossy forest. This is due to the change of species composition of trees from the lower elevation to the higher elevation as well as temperature and humidity (Gomez, 2007). This result suggests that regional distributions of butterflies are likely to be limited by climatic tolerances of species, while local abundance may be influenced by local resource level. In addition, Kocher and Williams (2008) different factors that control the abundance and species richness of butterflies. Along with geographical location, habitat disturbance

and topographical variability affect species richness.

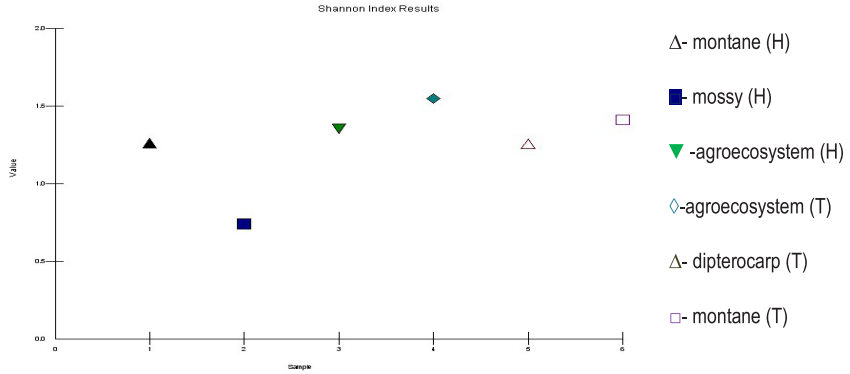


Figure 2. Shannon Diversity index results in the species of butterflies in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Island

Shannon Weiner index result shows that species diversity is fair for all stations except the mossy forest of Mt. Hibok-hibok (H'=0.91) (Fig. 2). Higher diversity level was observed in agroecosystem of Mt. Timpoong (H'=1.70), and agroecosystem of Mt. Hibok-hibok (H'= 1.48 (Table 2). Vegetation types might be the most important factor that affects the diversity of the species. This result is consistent to Mohagan (2007). Haribon (2000), reported that species diversity, endemism and distribution of species is influenced by the two factors: the temporal (date and time) and spatial (faunal region, ecosystem and habitat). Ghazoul (2004) demonstrated the abundance and diversity of the butterfly community decreases with the increase in logging disturbance. During the conduct of the study trunks of trees traversed across the transects. It seemed that trees were artificially logged.

Endemicity and Local Status of Butterflies

Out of eighty one (81) species of butterflies only eighteen or 22% are endemic. This indicates that endemicity is low for both mountains. There are thirteen Philippine endemic and one Mindanao endemic in Mt. Timpoong while Mt. Hibok-hibok has seven Philippine endemic and one Mindanao endemic species. These analyses suggest a more

endemic butterfly species at the undisturbed site. According to Ghazoul (2004) butterflies abound most frequently in the undisturbed site. Posa and Sodhi (2005) reported endemicity and larval host plant specificity are significant for butterflies. Butterflies were negatively affected by anthropogenic disturbance but may respond to different components in the habitat (i.e., structure and resources).

For the local status of butterflies there are many locally very rare species in Mt. Hibok-hibok and many common species in Mt. Timpoong. This indicates that the number of individuals in every butterfly species is higher in Mt. Timpoong than of the same species in Mt. Hibok-hibok. This may be due to weather conditions, flowering seasons of food plants and availability of food plants, geographic locations and disturbance of the site which happened in Mt. Hibok-hibok like volcanic eruption. It also indicates that only few individuals were observed in Mt. Hibok-hibok.

CONCLUSIONS

Mt. Timpoong and Mt. Hibok-hibok are the home of eighty one species of butterflies and eighteen endemic species. Of these, forty one species are in Mt. Hibok-hibok and seventy three species in Mt. Timpoong. Butterfly abundance is high in the agroecosystem and montane forest in Mt. Timpoong. Diversity level using Shannon-Weiner index showed fair except for the mossy forest of Mt. Hibok-hibok (H'=0.91). Diversity of endemic butterfly is low (22%) for Mt. Timpoong and Mt. Hibok-hibok.

RECOMMENDATION

The study recommends further sampling of butterflies for the two mountains in order to enhance turn over of more species which were not yet listed in this study. . Explore new and other collection techniques for the fast and high flyers to enhance species diversity and richness of butterflies. Protection and conservation to the endemic and threatened species of butterflies should also be done. Factors that may affect the distribution of species should also be studied and other vegetation types of the mountains should also be considered.

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Table 1. List and count of butterfly species sampled in Mt. Hibok-hibok and Mt. Timpoong, Camiguin Island.

FAMILY/SPECIES		MT. HIBOK-HIBOK			MT. TIMPOONG	
	Montane	mossy	agroecosystem	agroecosystem	dipterocarp	montane
I-HESPERIIDAE						
						2
1.Aeromachus musca mabile						
2.Ancestroides negrita				2		
3.Caltoris cormasa						2
4.Caltoris philippina philippina	1					
5.Hasora mixta mixta						1
6. Notocryta paralysos volux						1
7. Oriens californica				1		
8. Pothanthus omaha bione						1
9. Potanthus mingo mingo	3		10	10		

10. Tagiades gana elegans						1
11.Tagiades trebellus manticus				1		
12. Tagiades japetus titus				1		
II-LYCAENIDAE						
13.Acytolepsis puspa bazilana						2
14.Allotinus fallax aphaeus				1		
15.Amblopodia narada plateni						2
16.Caleta roxus angustior						2
17.Caleta panorus exiguus						2
18.Catochrysops strabo luzonensis				21	21	
19.Catochrysops cnejus cnejus				2		
20.Deodonix epijarbas epijarbas						2
21.Euchrysop cnejus cnejus				23	14	
22.Hypolycaena sipylus tharrytas						3
23.Jamides bochus pulchrion				19	17	
24.Jamides celeno lydanuis	3		10	26	18	5
25.Lampides boeticus	6		11	17	16	4
26. *Nacaduba berenice*				11	8	3
27.Rapala caerulescens						1
28. Rapala danoma						2
29.Rapala scintilla nemana						1
30.Rapala varuna nada	3	1	5			
III-NYMPHALIDAE						
31.Amathusia phidippus			2			
32. Anosia melanippus edmondii			9	6		
33. Cyrestes maenalis rizali				4		

34. Euploea mulciber mindaensis	1		1	2	1	
35. Hypolimnas anomala anomala	1		2	12		2
36. Hypolimnas bolina philippensis	1		1	19		
37. Ideopsis juventa manillana			23	1		
38. Junonia almana almana				4		
39. *Junonia atlithes atlithes*				6		
40. Junonia hedonia ida	23		25	25		
41. Junonia orithya leucasia			19			
42. Lassipa ebussa laettia						3
43. Melanitis boisduvalia.				2		
44. Melanitis leda leda	5	3	13	14	8	
45. Mycalesis frederici frederici	2		9	8	5	
46. Mycalesis handana micromede	7	1	14	21	19	
7. Mycalesis mineus philippina	10		12	15	9	
48. Neptis pampanga boholica			1	9		
49. Parthenos sylvia				1		
50. Symbrennia litea semperie				1		
51. Taratia cosama cosama				1		
52. *Ypthima sempera chaboras*	9		15	22	11	
53. Ypthima sensilis	2		11	16	8	
54. Ypthima stellera stellera	3		6	6	5	2
55.*Vagrans sinha sinha*	1					
IV-PAPILIONIDAE						
56.Achillides palinurus daedalus						2
57.Atrophaneura semperi apthonia						1
58.Atrophaneura semperi semperi	1					

59.Graphium agamemnon agamemnon	2		5	4	2	
60.Graphium sarpedon sarpedon	1		6			2
61.Menelaides deiphobus rumanzovia	1	2		11	4	
62.Menelaides helenus hystaspes	1	8		5		2
63.Menelaides polytes ledebouria	1			11	5	2
64.Pachliopta aristochiae philippus	2	1		1		
65.Pacliopta kotzebuena philippus				15		2
66.Papilio demolinus libanus				2	4	
67.Triodes rhadamanthus	1			7	2	
V-PIERIDAE						
68.Appias nero zamboanga	2					
69.Catopsilia scylla asema		10	2			
70.Catopsilia pomona pomona		1	5			
71.Catopsilia pyranthe pyranthe		8	6			
72.Cepora aspasia orantia			1			
73.Eurema alitha alitha	3	1	12	26	20	4
74.Eurema blanda vallivolans	4		11	22	21	2
75.Eurema brigitta roberto	2	1	9	16	11	4
76.Eurema hecabe tamiathis	7		14	17	11	
77.Eurema sarilata sarilata						5
78.Eurema simulatrix mycalleneus				11	8	
79.Eurema simulatrix simulatrix				11	5	
80.Leptosia nina terantia	5			12		
81.Pareronia boebera trinobantes			1	6		

Table 2. Descriptive statistics on the species richness of butterfly in Mt. Hibok-hibok and Mt. Timpoong, Camiguin Island.

Sample	MI	Vari-ance	SD	SE	T I	TS	Shan-non H′	MCI
Montane (H)	1.38	10.6	3.26	0.37	109	29	1.46	2.34
Mossy (H)	0.23	1	14	0.11	18	8	0.90	0.22
Agroecosystem (H)	3.35	34.6	5.9	0.66	265	30	1.48	7.63
Agroecosystem (T)	6.27	64	8	0.9	495	50	1.70	14.11
Dipterocarp (T)	2.98	35.1	5.92	0.67	235	22	1.34	7.74
Montane (T)	0.82	1.67	1.29	0.15	65	29	1.46	0.37

Table 3. Descriptive statistics on the status of butterfly in Mt. Hibok-hibok and Mt. Timpoong, Camiguin Island.

Sample	MI	Vari-ance	SD	SE	TI	TS	Shannon H′	MCI
Montane (H)	1.11	4.93	2.22	0.52	20	7	0.85	2.28
Mossy (H)	0.56	3.56	1.89	0.45	10	3	0.48	1.64
Agroecosystem (H)	2.56	25.44	5.04	1.19	46	4	0.60	11.75
Agroecosystem (T)	6.17	79.56	8.92	2.10	111	0	1.0	36.75
Dipterocarp (T)	3.61	50.13	7.08	1.67	65	5	0.70	23.16
Montane (T)	1.39	2.61	1.61	0.38	25	0	1.0	1.20