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The species composition of butterflies (Lepidoptera: Rhopalocera) in Lipa city, Batangas, Philippines

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Abstract
The aim of this paper was to identify the species composition, abundance, and the status of butterflies in Lipa City, Batangas, Philippines. Opportunistic sampling within transect method was used. This study recorded a total of 25 species of butterflies, belonging to 7 families and 23 genera, for both wet and dry weather condition. It was found out that the dominant family is Pieridae (34.78%), followed by Lyceanidae (18.84%), Danaidae (11.59%), Nymphalidae (8.70%), Hespiridae (4.35%) and Papilionidae (4.35%). The abundance of butterflies in dry weather condition is greater compared to the wet weather condition. The species accumulation was 60.87% in dry weather condition and 39.19% in wet weather condition. In terms of the ecological status of butterflies, there were 57.97% common, 1.45% very common, 4.35% common endemic, 7.25% endemic, 26.09% rare, 2.90% very rare. Torn wings by wind and sharply colored wing markings were observed mostly in the wet weather condition. This is the first butterfly study done in Lipa City, Batangas.

Keywords: Wet and dry weather condition, species composition, abundance, sharp colored wings

1. Introduction
Butterflies are cold blooded insects attracted to warm heat of the sun in preparation for flight. Sunlight warm their flight muscles in order for them to actively search for specific host plants and appropriate nectarine plants for survival. During heavy rainfall, butterflies were rarely seen flying. Exposure to sunlight provide opportunity for butterflies to fly and dry their wings. They are commonly found patrolling for mates in search for host plants and to oviposit eggs. Male butterflies often hover in different nectarine plants to gain energy. Some species of Papilionidae sips minerals on wet soil, a few bird wings (Papilionidae) puddle on the lake side. Lepidopterons species richness correlates positively with amount of ripe fruits and foliage [1].
It is well known that most Lepidoptera wings are hydrophobic which prevents liquid water from penetrating into the photonic nanostructure because water droplets roll off the surface [2]. Butterflies with moist thorax and wings are less active flyers. They were mostly threatened with heavy rainfalls and strong wind, as they hide under the leaves, shaded tall trees to dry themselves. Seasonal parameters also play vital roles as the distribution factors for local butterflies [3]. Different butterfly species have different requirements for different habitat types for performing their basic life processes like mating, breeding and foraging. Butterflies in wild that were freshly caught exhibit sharply colored wings due to phototonic structures. The photonic crystal structures in lepidopteran wings are mainly constructed from chitin and air. Chitin has a moderate refractive index (n =1.56) [4].
Understanding the significance of butterflies in an ecosystem as an environmental health indicator and pollination of flowering plants is crucial to achieve sustainability and conservation of floral diversity [3]. Healthy biological communities depend on three main seasons: June/July wet Monson and its insects as pollinators, seed dispersers, herbivores, aftermath from June till October, the cool dry winter from predators and prey. Butterflies are one of the most important assemblages of insects that act as biodiversity indicators as well as nature's gardeners [5]. Butterflies are important as biological indicator for ecological and sustainable diversity of host plants and nectarine plants [6]. The aim of this paper is to, identify the effects of monsoons (rainfalls) on species composition, abundance of butterflies and the status of butterflies.

Fig 1: Satellite google map: The unnamed road of the sampling site at Halang Lipa City, Batangas. Image above shows the map of the study site. The coordinates: 13°56′28″N 121°09′44″E, having a temperature of 23-26 ^{0}C with a 400 mm precipitation between 0900 to 1700 Philippines standard time (PST).

2. Materials and Methods

2.1 Study Site, Study Stations, Ecological Parameters and Entry Protocol

The study area in Halang, Lipa City, Batangas is 95 masl and is a mixed dipterocarp forest. GPS were used to record the coordinates. The lux meter were used to note the intensity of light. The weather condition was partly cloudy skies with light to moderate rains experienced. Partly cloudy to cloudy skies with isolated light rains. The sampling site were overlooking the Taal lake of Batangas. Special permission at the Barangay official of Halang was considered prior to sampling.

2.2 Sampling Techniques

2.2.1 Transect walk and Opportunistic Rapid Sampling

A field transect method of 2000 m at 100 m interval were established once on December 2016. Sampling were done at 0900 to 1700. All butterflies seen along the transect line were collected, counted and listed. To ensure and increase species records, opportunistic sampling were considered along the areas outside the transect lines [7]. All butterflies outside the transect line with in the 2000 m x 100 m distance were collected. Photograph were also taken for documentation, however those butterflies that are unfamiliar were collected. An average of 1-2 individual butterflies were kept in each paper triangle. The first sampling were done with moderate rain fall (400 mm precipitation) and the other sampling was done with no rain fall (dry).

2.2.3 Assessment of Butterfly Status

The national status of butterflies were determined based on the checklist of Treadaway (1995) and Treadaway & Schroeder (2012) [7, 8].

3. Results and Discussion

Results revealed 69 individuals of butterflies belonging to 25 species of butterflies found in both wet and dry habitats (Table 1). They belong to 7 families and 23 genera. It was found out that the dominant family is Pieridae (34.78%), followed by Lyceanidae (18.84%), Danaidae (11.59%), Nymphalidae (8.70%), Hespiridae (4.35%) and Papilionidae (4.35%) (Figure 2). The species accumulation are 60.87% in dry weather condition and only 39.19% during wet weather condition due to north east monsoons (Figure 3).

Most butterflies were found less active and hidden under the shaded trees, hanging on expanded leaves and branches of tall trees. Most butterfly families are represented in this study. This may be possibly attributed to the amount ripe fruits and foliage [9]. For the local status of butterflies in Halang Lipa Batangas, 63.32% are common in Batangas, 11.59% are very common, 26.09% are said to be rare (Figure 4). The ecological national status of butterflies in Halang Lipa Batangas showed that 57.97% were common and 1.45% are very common and 2.9% are very rare, 7.25% are endemic in Halang, 4.35% are common and endemic, and 26.09% are rare (Figure 5). Dendrogram of Bray-Curtis cluster analysis shows that there were 60% similarity between the butterflies in wet and dry weather condition (Figure 6). The presence of host plants and nectarine plants made a favorable habitat for them to survive despite the rainfall. One of the primary factors influencing the survival of butterflies are the relative territorial abundance of nectarine flowering plants [10]. It can also be said that at some point species accumulation were almost the same in wet and dry weather condition (Figure 7).

Table 1: Species composition, abundance and status of butterflies with a 400 mm precipitation in Halang, Lipa, Batangas

Butterfly Family/Species	Habitat		Status
	Wet	Dry	National Assessment (Treadaway (1995) and Treadaway & Schroeder (2012))
I. Hespiridae			
1. *Bibasis harica cosonbrina*	0	3	Common
II. Lyceanidae			
2. *Jamides cyta amphisissimus*	1	1	Very Rare
3. *Jamides elps psueudolpis*	1	1	Rare
4. *Chilades lajus tavoyanus* Evans,1925	1	1	Rare
5. *Jamides celeno asianus*	1	0	Rare

6. *Nakaduba kurava fujiokai* Hayasi 1786	1	1	Common
7. *Sinthusia nasaka amba*	1	1	Rare
8. *Zizinia otis oriens* (Butler) 1883	2	0	Common
III. Nymphalidae			
9. *Athyma sp.*	1	1	Rare
10. *Neptis mahendra* Moore, 1872	1	1	Common
11. *Panopria dama*	1	1	Common
IV. Danaidae			
12. *Ideopsis juventa* Cramer 1777	1	3	Common
13. *Parantica vitrina* (C. & R. Felder), 1861	1	3	Endemic
V. Papilionidae			
14. *Achilledes palinurus daedalus* Felder & Felder 1864	0	1	Endemic
15. *Menelaides ledebouria polytes* Felder & Felder, 1864	0	1	Very common
16. *Troides magellanus* Felder & Felder, 1862	0	1	Common
VI. Pieridae			
17. *Cepora aspasia olga* (Stall) Eschscholtz 1821	1	3	Common
18. *Delias henningia* henningia Eschscholtz 1821	1	2	Common
19. *Eurema hecabe hecabe* (Linnaeus) 1758	3	3	Common
20. *Gandaca harina mindanensis* Fruhstorfer 1910	1	2	Common
21. *Leptosia nina georgi* Frushtorfer 1910	5	3	Common
VII. Satyridae			
22. *Mycalesis visala* phamis	0	3	Rare
23. *Mycalesis mineus meneus malayana*	0	3	Rare
24. *Mycalesis fusca fusca* (C. & R. Felder), 1860	0	3	Rare
25. *Ytima baldus necoboldi*	3	0	Common, Endemic

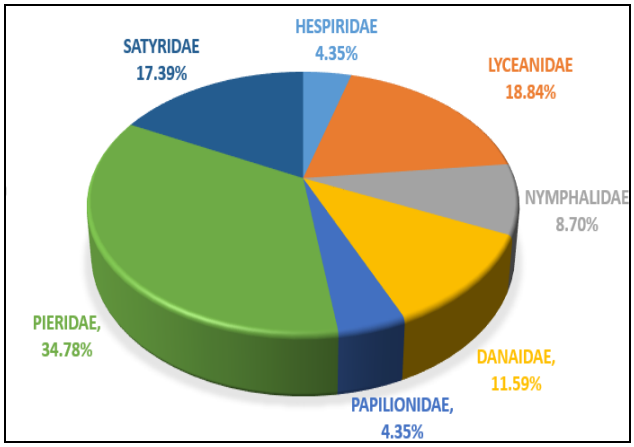


Fig 2: Percentage Species Composition of Butterflies in Halang, Lipa City Batangas

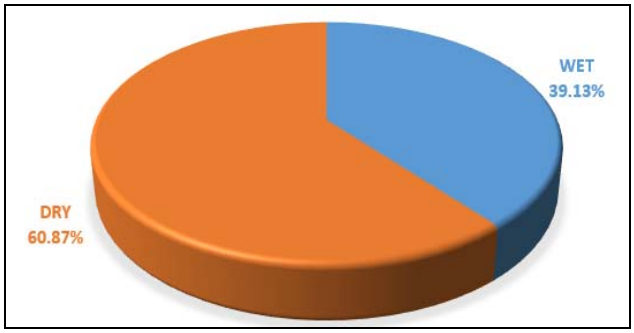


Fig 3: Species accumulation of butterflies in wet and dry weather condition

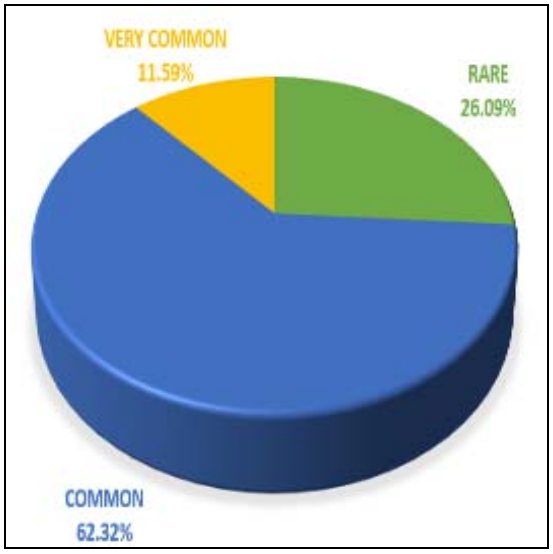


Fig 4: Local Status of butterflies at Halang Lipa Batangas

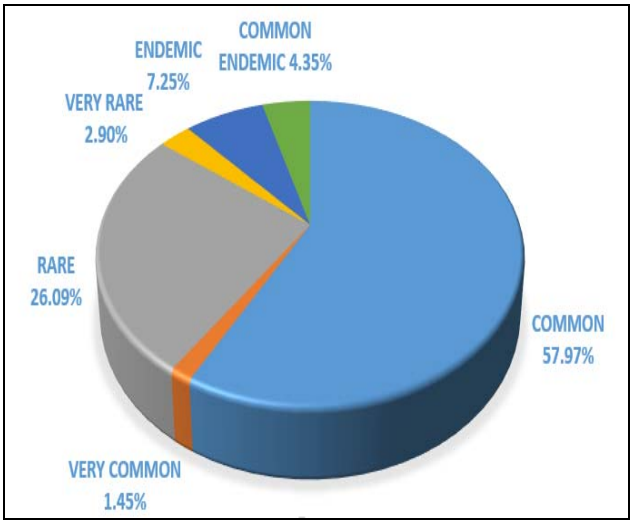


Fig 5: National Status of butterflies at Halang Lipa, Batangas

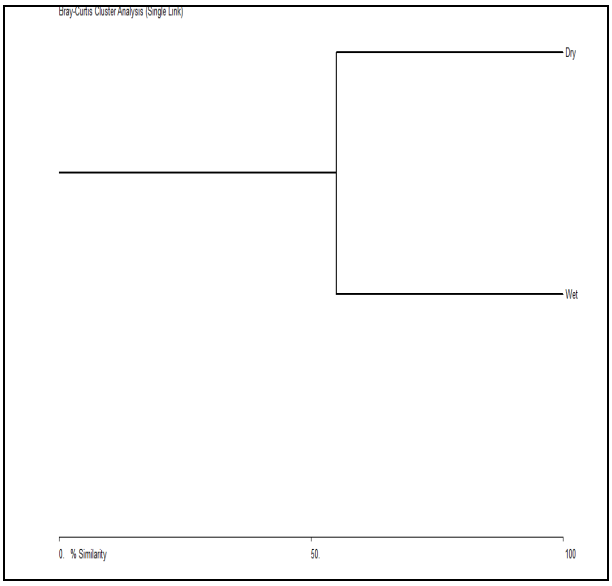


Fig 6: Dendrogram of butterfly species' composition in Halang, Lipa Batangas, City

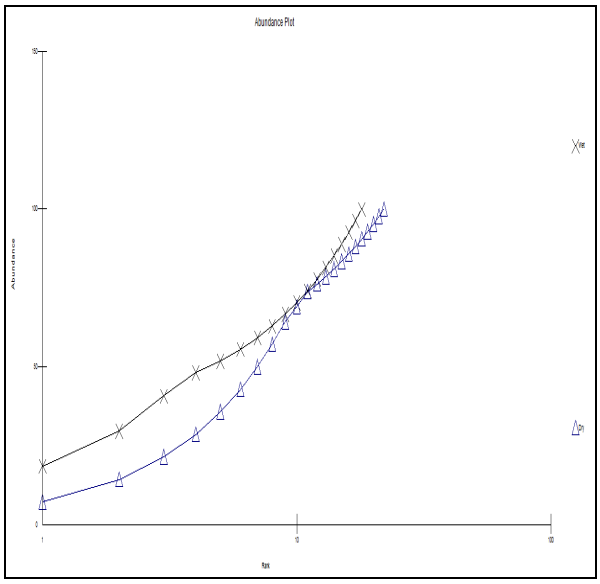
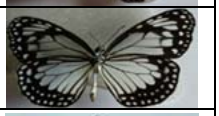
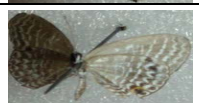


Fig 7: Species accumulation curve of butterflies in wet and dry weather condition

Table 4: Original photographs of the butterfly samples collected from Halang, Lipa City, Batangas, Philippines

Butterfly Family/Species	Dorsal	Ventral		Dorsal	Ventral
I. Hespiridae 1. *Bibasis harica* cosonbrina			11. *Panopria dama*		
II. Lyceanidae 2.*Jamides cyta* amphisissimus			IV. Danaidae 12.*Ideopsis juventa* Cramer 1777		
3.*Jamides elps* psueudolpis			13.*Parantica vitrina* (C. & R. Felder), 1861		
4.*Chilades lajus* tavoyanus Evans,1925			V.Papilonidae 14.*Achilledes palinurus* Daedalus Felder & Felder 1864		
5.*Jamides celeno* asianus			15.*Menelaides ledebouria* polytes Felder & Felder, 1864		
6.*Nakaduba kurava* fujinkai hayasi 1786			16.*Troides magellanus* Felder & Felder, 1862		
7. *Sinthusia nasaka* amba			VI. Pieridae 17.*Cepora aspasia* olga (Stall) Eschscholtz 1821		
8.*Zizinia Otis* oriens (Butler) 1883			18.*Delias henningia* henningia Eschscholtz 1821		
III. Nymphalidae 9. *Athyma sp*			19.*Eurema hecabe* hecabe (Linnaeus) 1758		
10. *Neptis mahendra* Moore, 1872			20. *Gandaca harina* mindanensis Fruhstorfer 1910		

21. *Leptosia nina* georgi Frushtorfer 1910			22. Mycalesis visala phamis		
VII Satyridae 23. *Mycalesis mineus* meneus malayana			24. *Mycalesis fusca* fusca (C. & R. Felder), 1860		
25. *ytima baldus* necoboldi					

4. Conclusion and recommendation

The study concludes that the species composition of butterflies in Halang Lipa Batangas consist of 25 species both in wet and dry habitat. The abundance of butterflies in dry weather condition was much greater compared in wet weather condition. They belong to 7 families and 23 genera. Percent distribution per family are Hespiridae 4.35%, Lyceanidae 18.84%, Nymphalidae 8.70%, Danaidae 11.59%, Papilionidae 4.35% and Pieridae 34.78% (Figure 2). The species accumulation are 60.87% in dry weather condition and only 39.19% during wet weather condition due to north east monsoons. Wind caused ripped butterfly wings and rainfall makes the wings sharply colored when water evaporate. On the other hand, The dark colored markings in the WSF (Wet season form) of both butterfly species might be the high melanin deposition in the wing scale and it could be increased in wet season when temperature was high and photoperiod was longer than 12 hours. It is indicating that the change in seasonal markings of both species were correlate with temperature and photoperiod, in these instance it is believed that one color form can provide more rapid or effective solar heating through a larger proportion of darker pattern. In other cases, the seasonal forms are believed to be connected to a more effective cryptic ability according to the nature of available background surfaces [11]. Presence of host plants and nectarine plants will keep make them remained in the habitat [10]. Plant family such as Capparaceae, Fabaceae, Rutaceae and Poaceae were most preferred host plants of butterfly species like the Pieridae, Papilionidae and Lyceanidae. There is a need to maintain these plants throughout the year to conserve the butterfly species that have an identified occurrence in this particular urban garden [12]. Host plant should be conserve and be protected by the local government. This is to continue the study by the succeeding researcher. This paper will served as a reference of information for those would study butterflies of Halang Lipa Batangas and the effects of rainfall to butterflies. Extensive study of butterfly wings in reference to a change of color due to water vapor can be done. However it's not part of this study.

5. Acknowledgement

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6. Conflict of interest

We declare that there was no conflict of interest.

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