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Urban diversity of rhopalocera (Butterflies) at cultural centre of the Philippines, Pasay city, metro manila, Philippines

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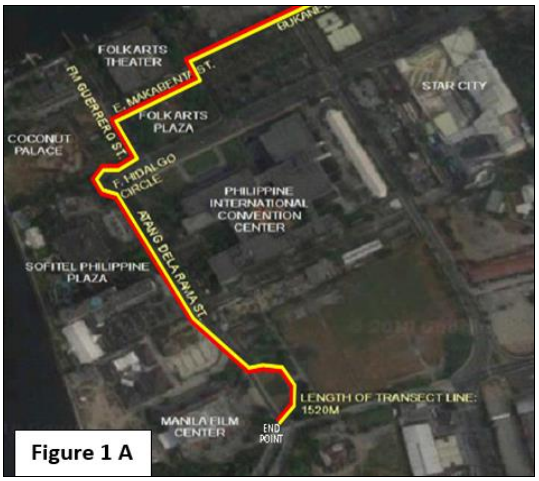
Abstract
There is a scarcity of data and information regarding the study of butterflies in the Philippines, especially in the urban diversity. The aim of this study was to determine the species composition and abundance of butterflies and their host plants at CCP, Pasay City. Opportunistic sampling method was used to collect butterflies from the line transect of 1520 meters by 100 meters' perpendicular to the line transect. The butterfly collection was done during sunny (dry) and rainy weather (wet). There were 11 species and subspecies of butterflies identified. The abundance of butterflies during dry season were much greater than during the wet season in Cultural Center of the Philippines, Pasay City, Metro Manila.

Keywords: Host plants, nectarine plants, urban biodiversity, butterfly diversity

Introduction
There were 1,615 species and subspecies of butterflies in the Philippines, Forty-four percent (44%) of these species are endemic to the Philippines [1]. An additional 59 species of Hespiriidae that makes a total of 1,674 species and subspecies all in all [2]. A documented of a total of 104 species of butterflies that were collected in Maitum Village, Tandag, Surigao Del Sur [3]. A record of 1,027 butterfly species was recorded in the entire Philippines [4].
In the national capital region of Luzon, A published report of 158 species and subspecies in 8 families of butterflies and their preferred Nectarine Food Plants at La Union Botanical garden (LUBG). In a dipterocarp forest of Cadaclan San Fernando La Union [5].
Another dipterocarp forest in San I ldelfonso Bulacan, there were 21 species of butterflies was recorded [6]. Also in another dipterocarp forest in Halang Lipa Batangas there were 25 species of butterflies was also recorded [7]. In the city of Manila, a record of 22 species of butterflies occurred in the mini urban garden [8].
Urban diversity of butterflies is less studied in the Philippines. People should be educated in the importance of butterflies in the ecosystem. They play an important role in the food chain of an ecosystem. Also, butterflies are pollinators and they help the plants in reproduction. Angiosperms around the urban areas Like in Pasay city create conducive atmosphere. Flowers and butterflies contributes in a colorful aesthetic effect thus create a very relaxing view in the urban areas of CCP.
During sampling period, when there is strong rainfall coming, bigger butterflies migrate in a cool dry places, however small medium size butterflies hide in tall grasses for protection.
CCP was considered as a reclaimed area shared between Pasay and Manila known as the Bay City in the Philippines. The presence of shrubs and a manicured land along the roadside were found favorable for the small and medium butterflies.
Many butterflies were sipping nectars on peanuts grass (*Arachis glabrata* Benth), creeping daisy (*Sphagneticola trilobata*), and devil weed (*Chromolaena odorata*). Butterfly species belonging to the family of Hespiriidae, Lyceanidae and Pieridae were resilient to heavy drops of rain. Tall trees like Narra (*Pterocarpus indicus*), fire tree (*Delonix regia*), and coconut trees (*Cocos nucifera*) provide shades for butterflies during sunny weather condition.
Interestingly, butterflies thrive in the urban city of Pasay Metro Manila despite of heavy traffic along the area. A prime land for cultural complex and commercial business development and 2 kilometers away from the water front of Manila bay. It is very common to see butterflies flying in the dipterocarp forest of the Philippines, and some sipping moisture along the coastline of

the bay. Butterflies is a good biological indicator for a change in weather condition, because they are sensitive to heat and humidity. Although some species are resilient to heat and can survive the direct pouring of rainfall. The aim of this study was to determine the species composition and abundance of butterflies and their host plants.



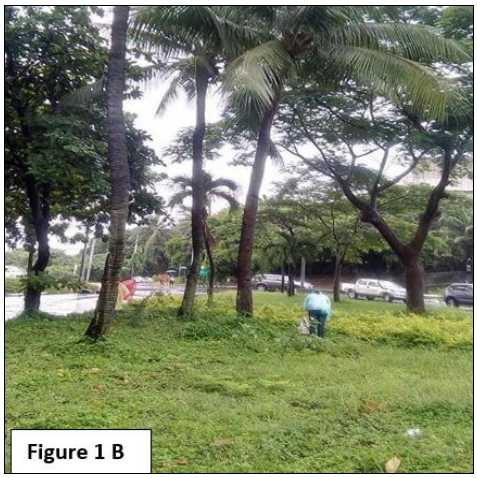


Fig 1: (A) it shows the Google Satellite map of Cultural Center of the Philippines shown the transect line which represent the wet and dry sampling of butterfly. The coordinate's 14.554257°N 120.982618°E
The data sampling started at Bukaneg street corner Roxas Blvd which was adjacent to Cultural Center of the Philippines (CCP) up to open space of Atang dela Rama Street at the front of Manila Film Center. All butterflies found along the transect line of 1,520 meter by 100 meters were collected. While on **Fig 1: (B)** it shows the sampling area of the study area.

Rapid Sampling Technique

a. **Transect walk Sampling:** About 1,520 from the Cultural Center of the Philippine (CCP) up to the Experimental Cinema. The initial field collection was done in month of April 2018 and the second collection was August 2018.
b. **Opportunistic sampling**: Collection started from 0900 hours to 1600 hours. Field observation of butterfly behavior and collection were done during sunny (dry) and rainy (wet) season. All butterflies within 100 meter away from the transect line were also collected. Insect net was used to collect butterflies. Only 2-3 individual per species were sampled for proper identification.
c. **Classification and Identification:** Butterflies of South East Asian Island [9], Field Guide to Butterflies of the Philippines [10], Butterflies of Thailand [11], Revised Checklist of the Butterflies of the Philippines [12].
d. **Data Processing**: Bio Pro software version 2.0 were used to determine species composition and abundance of butterflies, and to solve for descriptive statistic, correlation of wet and dry sampling, and to describe the similarity between wet and dry sampling using Bray-Curtis Analysis.

Results and Findings

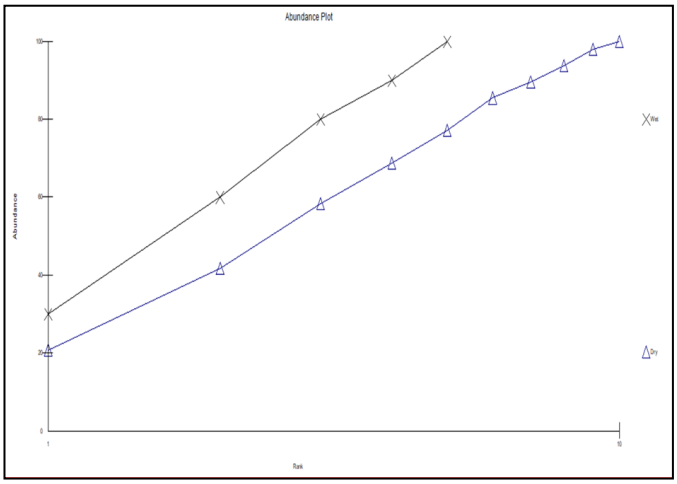


Fig 2: Abundance plot

On Figure 2, A total of 48 individuals of butterflies collected both in wet and dry season. Abundance plot shows greater collection on dry season

Table 1: Descriptive statistic

Sample	Mean	Variance	Standard Deviation	Standard Error	Total Individuals	Total Species	Minimum	Maximum	Mean Confidence Interval
Wet	2	6.222	2.494	0.789	20	**5**	**0**	**6**	**3.856**
Dry	4.8	11.511	3.393	1.073	48	**10**	**1**	**10**	**7.135**

Table 1. Shows the descriptive statistic results and findings, validates Abundance plot of figure 2. Butterfly occurrence during wet of mean value 2 and Dry mean value of 4.8.

Table 2: Correlation of Wet and Dry Sampling

	Wet	Dry
Wet	1.	*
Dry	0.2363	1.

Table 2 shows the correlation of wet and dry sampling has a very slight significant difference between the wet and dry

season. This validates the descriptive analysis from Table 1. CCP is a reclaimed land and not a forested area. However, with the presence of specific host plant, Butterflies continually thrive in the urban habitat on a wet and dry season. There are few butterfly species identified but what is important crepuscular species present in the city.

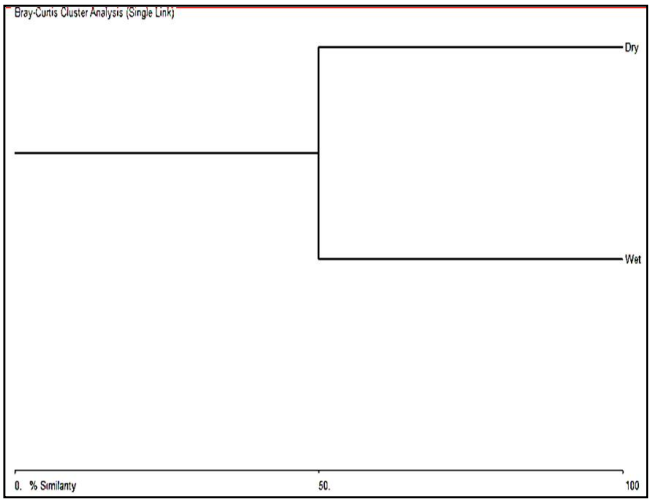


Fig 3: Dendrogram (Bray-Curtis)

Figure 3 shows that there were 50% similarity between wet and dry sampling using Bray –Curtis. It validated the results and findings of Figure2, Correlation of Wet and Dry Sampling.


Potanthus Omaha (Hespiriidae) Dorsal ***Ventral***


***Pelopidas Mathias Ventral* (Hespiriidae), Dorsal**


Bothridia chenille celastroides (Lycaenidae) Dorsal Ventral


Graphium Agamemnon (Papilionidae) Dorsal Ventral


Papilio demoleus libanius (Papilionidae) Dorsal Ventral


Hypolimnas bolina philippensis (Nymphalidae) Dorsal *Ventral*


***Ideopsis juventa marillan* (Nymphalidae) Dorsal** **Ventral**


Leptosia Nina georgi (Pieridae) Dorsal


Appias olferna peducae ♀ (*Pieridae*) Dorsal Ventral


Appias olferna peducae ♂ (Pieridae) Dorsal Ventral


Eurema hecabe (Pieridae) Ventral

Plate 1: Species composition of butterflies at CCP, Pasay City, Nacua *et al.* 2020

Table 4: List of butterflies and host plants observed in CCP, Pasay City Nacua *et al 2020*

	Butterfly	Host plants
1	*Potanthus omaha omaha*	*Imperata cylindrica* (Poaceae)
2	*Pelopidas mathias mathias*	*Imperata cylindrica* (Poaceae)
3	*Bothridia chenille celastroides*	*Ruellia celiosa* (*Acanthoideae*)
4	*Graphium agamemnon*	*Polyathia longifolia* var. pendula (Annonaceae)
5	*Papilio demoleus libanius*	*Citrus mitis* (Rutaceae)
6	*Hypolimnas bolina philippensis*	*Ipomoea batatas (*Convolvulaceae*)*
7	*Ideopsis juventa marillan*	*Tylophora flexuosa* R. Br Asclepiadaceae)
8	*Leptosia nina georgi*	*Cleome rutidosperma* DC, (Capparidaceae) *Capparis zeylanica* (PROSEA) (Capparidaceae)
9	*Appias olferna peducae*	*Capparis zeylanica* (PROSEA) (Capparidaceae) *Cassia alata* (Fabaceae), *Cleome rutidosperma DC*, (Capparidaceae)
10	Eurema hecabe	Pithecellobium dulce (Roxb.) Benth.

Discussion

Plate 1. Listed the 11 species and sub species of butterflies, observed to be actively soaring in the sky on a luminous light of a 28,000 to 34000 LUX. At the temperature of 36 degrees' Celsius heat index during dry weather sampling period. In preparation for mating period, female butterflies hovering around the nectarine plants sipping nectar and moist on the ground. While male found search for minerals on wet rocks and soil before and after mating to sustain its plight pattern. CCP were near the Manila bay area, rocks and soil are presumed to be rich salt minerals.

In many Lepidoptera species, only males puddle for sodium. Two explanations have been offered for this: [1] neuromuscular activity: males need increased sodium for flight because they are more active flyers than females; and [2] direct benefits: sodium is a type of direct benefit provided by males to females via ejaculate during mating [13]. It was recorded that the Luminosity of light was 31000 LUX with a temperature of 30 degrees' Celsius, with a monsoon moderate rain precipitation were observed during wet the sampling period. It was also noted that *Eurema hecabe, Appias olferna, Leptosia nina* are resilient to a heavy pouring of rain. It was found out that these butterfly's species soaked in the rain some were hidden either under the leaves or clinging in the branches of moderately tall trees.

The 50% similarity between wet and dry sampling period using Bray-Curtis found on Figure 3. can be explained with the light penetration in the ground during wet and dry season and the availability of the host plant in the area. The variation in light penetration that will consequently affect temperature [15]. The butterfly occurrence during wet and dry sampling such as Nymphalid butterflies are attracted to numerous nectarine plants like in family of Verbenaceae, Acanthaceae, Fabaceae, Caesalpinacea and rotten fruits.

Female *Appias* species are found ovipositing eggs on larval host plants listed on table 4, leaves has traces of eggs either under the leaves or on top of the leaves, some are on the branches of the plants. Butterflies are commonly found sipping nectar along the flowering plants of Verbenaceae. *Appias olferna* has been observed ovipositing eggs on *Ruellia repens (Acanthaceae), Barleria prionitilis L. (Acanthaceae)*, sad to say no signs of hatched larva. It was noted that open green ground space was covered with *Arachis glabrata (*Fabaceae), *Eleusine indica* (Linn.) Gaertn (Poaceae) which was a common habitat for species of *Appias olferna, Potanthus Omaha, Pelopidas Mathias.* Plants species like Poacea, Fabaceae were very common in the area serves as protective habitat of the Pieridae, Lyceanidae and Hespiriidae, they found hidden under the leaves, in between stem strands of Poacea. It serves as shields on a heavy downpour of rains and strong luminosity of sunlight. Papilionidae, found basking and resting on tall trees of Rutaceae, Nymphalidae rest on trees like in *Bambusa sp. Capparidaceae, Cocus nucifera, Pterocarpus indicus, Plumeria rubra.* Species of Papilionidae and Nymphalidae on plate 1, were sensitive to heat. They hide under the leaves on extreme heat condition with 34000 LUX luminosity of light of a temperature of 36 degrees' Celsius heat index. They were seen resting in the shady area to cool down themselves. In the current studies made, results suggest that darker and larger butterfly individuals tend to prefer cooler conditions both within and across habitats in tropical Australia. It was observed consistent patterns of lightness and size across each level of exposure in space and time, spanning microhabitat (shade to sun), time of day (crepuscular to midday), and habitat (rainforest to open woodland) [4].

Conclusion

CCP is a home for 11 species and subspecies of butterflies, the abundance of butterflies during dry season is greater than during the wet season and the listed host plant were found on table 4.

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