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ASSESSMENT OF BUTTERFLIES AT THE LA UNION BOTANICAL GARDEN (SAN FERNANDO, LA UNION, PHILIPPINES), THEIR DISEASES, NATURAL ENEMIES AND PREFERENCES FOR FOOD PLANTS

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ABSTRACT

There are no reports on the biodiversities of butterflies at the La Union Botanical Garden (LUGB). This study was undertaken to look into the species richness, diversity indices, natural enemies, diseases and food plant preference of butterflies at LUGB. Butterflies were collected by random sampling from 6 vegetative areas at LUGB. Standard methods of immobilizing, relaxing and mounting of specimens were done prior to specie identification. The natural enemies, diseases and food plant preferences were observed. The vegetation of LUGB is vast and varied, with both flowering, scented and dipterocarp plants. The families Nymphalidae, Pieridae, Papilionidae, Satyridae and Lycenidae are the dominant families represented by a total of 400 collections. The sunny areas of LUBG have higher butterfly diversity than the shaded areas. The bird *Orioles sterii* was found to be the common natural enemies. Butterfly diseases comprised mainly of bacterial, viral and fungal infections secondary to chemical poisoning. *Ixora* sp. and *Carphalea kirondon*, both from Rubiaceae, were the predominant food plants. This study indicates that more conservation measures must be observed for specie propagation and protection.

Keywords: Butterflies, La Union Botanical Garden, butterfly sanctuary, biodiversity, food plants

INTRODUCTION

The butterfly sanctuary of the La Union Botanical Garden (LUBG) exemplifies an ecosystem with great diversity allowing for opportunities to assess species richness of butteflies and the different factors affecting their existences, such as natural enemies, diseases and food (i.e., host plants). Diversity of butteflies at LUBG was studied for conservation and sustainability measures which may serve as a model for conservational studies in other related ecosystems.

MATERIALS AND METHODS

Collection and Sampling

The vegetation of LUBG was described according to the ethnobotanical model of de Guzman et al [1]. Butterflies at LUBG sampled by random by plotting jungle to entrance latitude and longitude against elevation (m.a.s.l.) in both sunny and shaded areas. The collections were identified by the checklist of Baltazar [1]. Observation period was done at least twice a month for 1 year in 6 observation areas. The observation areas are about 300 meters and are about 20 square meters away from each other.

Collection Treatment

Freshly collected butterflies were collected initially by the paper triangle method. Alternatively, butterflies were relaxed in wide-mouthed bottles

containing cottons saturated with carbolic acid. Some specimens were relaxed by injecting lukewarm water into the thorax. Collections were fixed in a spreading board for drying purposes. Collections were later sacrificed by storing in wide-mouthed air-tight closed jars containing adsorbent cottons saturated with chloroform or by pressing the thorax. An electric dryer was used to blow dry the specimens to remove debris from natural pests [2]. Specimens were identified using the checklist of Baltazar. The natural enemies, diseases and food plants of the adult butterflies were also identified.

Collections and Identification of Host Plants

Host plants were collected such that the cuttings included the branches, leaves, flowers and fruits. Plants were pressed in newspaper to allow for complete drying after 20 hours [3]. Plants were treated with denatured alcohol – phenol (4:1) before they are mounted and labeled. Specimens were identified at the Philippine National Herbarium, Manila.

RESULTS AND DISCUSSION

Vegetation

LUBG (16055'30"; 120033'20") is a 10 hectare garden where different varieties of plants, insects and wildlife co-exist. The most noticeable characteristics are: (1) a shaded garden containing tropical flowering plants; (2) a sunken garden corresponding to the natural terrain of the area: (3) a Chinese garden that leads the way to the white garden and view deck; (4) a fragrance garden filled with scented plants; (5) the butterfly garden; (6) a medicinal plant garden; and (7) a dipterocarp garden lined up with opposite rows of mabolo trees and *Diospyros philippinensis* Rolfe. A Japanese garden gives LUBG more accents, with more than 1,500 *Mangifera indica* L. trees. The arid area in the garden also grows several cacti, palms, *Heliconia* sp., *Bambusa* sp., *Morinda* sp. and *Anana scomosus*.

Species Richne

There are 158 species (N = 400 individuals) of butterflies collected consisting of 289 genera and 8 families. Table 1 shows the frequency of observation according to butterfly genus.

The abundance of bamboo trees in the densely forested areas and the presence of creeks in the surroundings may explain for the high frequency of species belonging to the Nymphalidae family since these environmental settings are the most favored by these butterflies [4]. The low medium frequencies of butterflies accounted for the families Lycenidae, Papilionidae, Pieridae, Danaidae and Satyridae must be attributed to the presence of grassy lands and cogon plants and the availability of the flowering plants that served as foods these butterflies particularly plants belonging to the coffee family Rubiaceae. These food plants serve as energy source for long-flying insects, the absence of which diminishes their lifespan [5]. The lesser availability of host plants for butterflies belonging to Libythidae and Riodinidae will explain for their low specie count to suggest that they are migratory butterflies.

Diversity

The different parameters of diversity of the butterflies' collections in both shaded and sunny areas at LUBG are presented in Table 2. The higher frequency of distribution of butterflies in the sunny area is due to the availability of rotten mango fruits, animal maneurs coming from the aviary, availability of water deposition at the fountain where the butterflies were found paddling. In the shaded area, the families Papillonidae, Satiridae and Nymphalidae are commonly found as their natural habitat.

Survey of Natural Enemies

The natural enemies of butterflies at LUBG which affects their life cycle are given in Table 3. The high frequency of prey-predator relationships between *O. sterii* and birds with Pieridae and Papilionidae butterflies can be explained by the abundance of this bird at the LUBG due to the presence of the fruit-bearing trees (i.e., mango, mabolo, soursop and citrus fruits). The wasps, on the other hand, preys on the pupa found on certain host plants and food plants. Spiders (i.e., arachnids) feed on adult butterflies perching on trees. The fire ants collectively feeds on the larva found in host plants.

Survey of Diseases

Table 4 lists the common infections encountered by butterflies at LUBG according to the pattern of Poinar and Thomas [6] and Cayabyab et al [7]. Habitat lost and the uses of pesticides are the common causes of death of butterflies at LUBG. The presence of pesticides in host and food plants causes chemical poisoning to larva. Vomiting and diarrhea are some signs and symptoms of chemical poisoning among butterflies especially when larva feeds on host plants sprayed with pesticides. At LUBG, caretakers move and transfer food plants in a pot from the range to the cage.

Symptoms from suspected chemical poisoning can be caused by bacterial infections. When larva cease from eating and becomes lethargic and turns from brown to black, these can be signs of viral infections. Therefore, transferring of larva and pupa from 1 place to another container require proper hygiene and sanitation. Hand sanitation must be observed during transfers; otherwise, butterflies can acquire contamination. The observed signs and symptoms was patterned on

Survey of Food Plants

Table 5 shows the diverse list of nectarine plants serving as food sources of the butterflies collected. The

high volume of nectar collected from *Ixora* sp. and *Carphalea kirondon* is due to the high volume of nectars that can be extracted from the corolla of these plants.

The conventionally optimized walking pattern of butterflies in the flowers of these plants may also explain for the large volume of nectars sucked. Butterflies visiting plants with little nectars extracted is due to the aggregation of flower into heads or inflorescences and, thus, secreting little quantity of nectars because of the energy expended in walking from one flower to another can be less than an equivalent period of flight [8].

Table 1. Butterfly Genera Ranked According to Frequency

Families	No. of Genus	Frequency
Nymphalidae	65	22.50%
Pieridae	60	20.80%
Papilionidae	54	18.70%
Danaidae	40	13.80%
Satyridae	37	12.80%
Lycenidae	30	10.40%
Riodinidae	2	0.70%
Libythidae	1	0.30%
Grand total:	289	100.00%

Table 2. Diversity Indices of Butterflies at La Union Botanical Garden

Parameter	Shaded Area	Sunny Area
Total No. of Species (St.)	76	82
Maragalef's Richness (M)	14.22	15.1
Shannon Diversity (H)	4.28	4.41
Pielou Evenness (J')	0.99	0.99
Simpson's Reciprocal Index 1/D)	68.51	75.82

Table 3. Natural Enemies of Butterflies Observed at La Union Botanical Garden

Natural Enemies	Adult Butterfly Pupa & Larva	Observed Frequency	Percentage
Nephelis sp. (Nephelidae); arachnids	*Hypolimnas bolina* (Nymphalidae); *Papilio demoleus* (Papilionidae); *Danaus chrysipus* (Danaidae)	3	10.34%
Solenepsis sp. (Formidae); fire ants	*Cotopsila pomona* (Pieridae); *Papilio demoleus* (Papilionidae)	2	6.90%
Polistes sp. (Vespidae); wasps	*Cotopsila pyranthe, C. Pomona* (Pieridae); *Danaus chrysipus* (Danaidae)	4	13.80%
Orioles sterii (Oriolidae); birds	*C. Pomona* (Pieridae); *P. demoleus* (Papilionidae)	20	68.96%
Total		29	100.00%

Table 4. Symptoms of Infected Larvae and Pupa Observed at La Union Botanical Garden

Microbial Groups	Signs and symptoms
Virus	Infected larva of *D. chrysippus* glided towards the top where larva stop feeding on leaves; inclusion bodies appeared under the microscope.
Bacteria	Larva of *Hypolimnas bolina* lost appetite, with profuse diarrhea and discoloration; presence of cocci and or bacilli under the microscope
Fungi	Mummified tissue larva of *P. rhadamantus* indicative of mycelium and spore under the microscope.

Table 5. Nectarine Plants Serving as Food Sources of Butterflies at La Union Botanical Garden

Nectarine Plants	Approximate Nectar Volume Collected in a Corolla	Approximate Nectar Volume Gathered by Butterflies in Cubic Mm.	Butterfly Family Found Sucking Nectarine Plant
Ixora sp (Rubiaceae)	3mm x 18	220.68	Danaidae, Papilionidae, Nymphalidae, Pieridae, Riodinidae. Lycenidae, Libythidae, Satyridae
Carphalea kirondon Bail (Rubiaceae)	6mm x 32	784.44	Danaidae, Papilionidae, Nymphalidae, Pieridae, Satyridae, Riodinidae, Libythidae, Lycenidae
Hibiscus rosasinensis L. (Malvaceae)	2 mm	8.7	Papilionidae, Danaidae, Nymphalidae, Pieridae, Satyridae
Plumeriar rubra (Apocynanceae)	1.2 mm	4.9	Papilionidae, Danaidae, Nymphalidae, Pieridae, Satyridae
Zinia elegans Jacq. (Asteracea)	0.1 mm x 11	1.1	Papilionidae, Danaidae, Nymphalidae, Lycenidae, Pieridae
Clitoria ternatea L. (Fabaceae)	1mm	4.09	Pieridae, Satyridae, Nymphalidae, Papilionidae
Lantana camara L. (Verbenaceae)	0.1 x 10 mm	4.09	Papilionidae, Danaidae, Nymphalidae, Papilionidae
Catharantus roseus L. (Apocynaceae)	1mm	4.09	Nymphalidae, Pieridae,, Danaidae, Papilionidae, Libythidae, Lycenidae
Nerium oleander (Apocynaceae)	1mm	4.09	Nymphalidae, Papilionidae, Danaidae, Satyridae, Papilionidae, Riodinidae, Libythidae
Asystasia gangetica L. Anders (Acanthaceae)	1mm	4.09	Papilionidae, Nymphalidae, Danaidae, Pieridae, Lycenidae
Cuphea hysofolia Hbk (Lythraceae)	0.1 mm	0.24	Papilionidae, Lycenidae, Nymphalidae, Satyridae
Cosmos sulphurreus L. (Asteraceae)	0.1 mm	0.24	Papilionidae, Nymphalidae, Satyridae, Danaidae, Libythidae, Pieridae, Riodinidae
Helinathus annus L. (Asteraceae)	0.1 mm x 35	14.3	Papilionidae, Nymphalidae, Satyridae, Danaidae, Libythidae, Pieridae, Riodinidae, Lycenidae
Chromoleana odorata (Asteraceae)	0.1	0.24	Papilionidae, Nymphalidae, Satyridae, Danaidae, Libythidae, Pieridae, Riodinidae, Lycenidae

CONCLUSION

This study was able to assess butterflies at LUBG in terms of species richness and biodiversity. It is the first study among surveys of butterfly sanctuaries in the Philippines to combine measurements of biodiversity indices and preferences of species according to food plants and surveys of the diseases and natural enemies that affects their existence.

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