

SPECIES

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Diversity and status of true butterflies (Lepidoptera: Papilionoidea) in two ecological parks of Butuan City, Agusan del Norte, Philippines with new locality record

Jeco Jed J Ruales^{1*}, Meljan T Demetillo¹, Archie A Along¹, Alma B Mohagan², Jess H Jumawan¹

ABSTRACT

Studies on butterflies in the Philippines are scanty and some areas still need to be explored, especially in Butuan City, Agusan del Norte. The current study provided information on the species composition and status of true butterflies in Lauan Eco Park and Bood Promontory Eco Park, Butuan City. The studies employed transect walks and opportunistic sampling using insect net-sweeping techniques. A total of 218 individuals of true butterflies belonging to 37 species, 24 genera and four families were documented. 34 species belonging to 22 genera were observed in Lauan Eco Park, while 12 species belonging to 10 genera were recorded in Bood Promontory Eco Park. Of these, the family Nymphalidae was the most represented group having 20 species (54.05%) in two sites, followed by the family Pieridae with 11 species (29.72%); the family Lycaenidae with four species (10.81%); and the family Papilionidae as the least represented group with only two species (5.40%). Regarding national status and endemism, 25 (71%) out of 35 species were common, 1 (2.70%) rare species, 1 (2.85%) rare Mindanao endemic and 8 (22.85%) were Philippine endemic species; five (5) species were rare Philippine endemics and four (4) species were common Philippine endemics. As for the local status, 25 species were assessed as very rare, seven (7) were rare, three (3) were common and two (2) were very common. New locality record of *Ptychandra lorquini plateni* and *Mycalesis igoleta* were reported in Agusan del Norte. Lauan Eco Park showed a higher number of individuals (156) than Bood Promontory Eco Park (65). Diversity assessment using the Shannon-Weiner index showed a high index with $H = 2.92$ in Lauan Eco Park compared to Bood Promontory Eco Park with $H = 1.933$. The species richness, abundance and diversity of butterfly species, plus the presence of rare endemic species in Eco Parks, are essential for conservation and protection as a habitat for butterfly species.

Keywords: Endemism, Mindanao, national status, local status, net-sweeping, Eco Park

1. INTRODUCTION

The order Lepidoptera, a monophyletic group that includes moths, skippers and butterflies, is considered one of the largest orders of insects which consist of approximately 160,000 recorded species in the world (Kawahara et al., 2019; Mitter et al., 2017). This order of important nocturnal and diurnal organisms is categorized into four superfamilies: Bombycoidea, Noctuoidea, Zygaenoidea and Papilionoidea (Mullen and Durden, 2002). An interestingly taxa to study with over 18, 786 species (Mitter et al., 2017) is the superfamily Papilionoidea or what we called as the "true butterfly". It comprises five families, including Papilionidae (the swallowtails and birdwings), Nymphalidae (the brush-footed butterflies), Pieridae (the whites and sulfurs), Riodinidae (the metalmarks) and Lycaenidae (the blues and coppers) (Frentiu, 2010).

Ecologically, these butterfly species are plant-feeders during their larval stage and nectar-feeder during their adult stage, making as essential pollinators, seed dispersers and herbivores in the various ecosystem types (Goldstein, 2017; Regier et al., 2009). They are also considered bio-indicators as they respond quickly to environmental changes, including weather conditions, atmospheric shifts, climate, temperature and other ecological alterations (Goldstein, 2017; Mohagan et al., 2011; Mohagan and Treadaway, 2010). An area's abundance of butterfly fauna indicates a healthy ecosystem and is regarded as the flagship species in identifying and preserving vulnerable habitats (Mohagan and Treadaway, 2010; Domine and Dela-Cruz, 2020; Perveen and Khan, 2017). The Philippines, a mega diverse country, currently has approximately 927 species with 939 subspecies of butterflies documented, of which 377 (44%) of these species are endemic (Baltazar, 1991) and the number is still growing due to discoveries.

Ecological Parks are a crucial component in enhancing flora-fauna conservation, beneficial for wildlife refuge, environmental protection, sustainable city and the concept of human-nature interaction (Refaat, 2014; Ariyani et al., 2018). These butterfly species help monitor vulnerable areas, such as Ecological Parks, considering that ecotourism-related activities could still negatively affect the surrounding environment. The Philippine biodiversity is also threatened by loss due to anthropogenic activities, shifting cultivation and over-exploitation of resources (Coritico et al., 2020). In addition, the country's remaining butterfly fauna needs to be better documented. Some areas still need to be explored, especially in Butuan City, Agusan del Norte, the north-eastern section of Mindanao.

Currently, no studies are available online regarding the species composition of butterflies in Agusan del Norte, particularly in Butuan City. Thus, conducting and documenting butterflies in Lauan Eco Park and Bood Promontory Eco Park, Butuan City, Agusan del Norte, is essential. The existence of butterflies in Eco Park will not just add aesthetic value, but it will also add ecological support as a bio-indicator in the area. A clear understanding of these species will be the basis for proper management and conservation in the area.

2. MATERIALS & METHODS

Study sites

The study was conducted and the butterfly samples were collected in two ecological parks in Butuan City: Lauan Eco Park and Bood Promontory Eco Park (Figure 1). Lauan Eco Park (Figure 2) is situated approximately at latitude 8.77360°N and longitude 125.56922°E with 110.51m elevation in Barangay Tungao, which lays in the north of Barangay San Mateo, on the east of Barangay Florida, on the south of Barangay Dankias and the west of the Municipality of Buenavista, Agusan del Norte.

The land area consists of 25 hectares, where 5 hectares are developed as an Arboretum near the Subait and Agusan Rivers (1 km). It is dominated by endemic and exotic species of plants, including *Shorea contorta*, *Lansium domesticum*, *Swietenia macrophylla*, *Tectona grandis*, *Artocarpus elasticus*, *Spathodea campanulate* and *Acacia mangium*. On the other hand, Bood Promontory Eco Park (Figure 3) is located approximately 800 m away at the bend of Masao River at 8.95246852°N and 125.49242867°E in Barangay Pinamanculan and Libertad with an elevation of 63.732m. Masao River is connected to Butuan Bay, making the area abundant to *Nypa fruticans*.

The eco-park has an approximate area of 72 hectares, where farming and fishing are the main livelihoods of the nearby communities. The area is dominated by native and threatened tree species in the Philippines: *Tectona grandis*, *Shorea astylosa*, *Artocarpus blancoi*, *Pterocarpus indicus*, *Vitex parviflora* and *Eucalyptus deglupta*. Other plant species include *Bambusa* sp., *Calamus* sp., *Cocos nucifera* and *Leucaena leucocephala*.

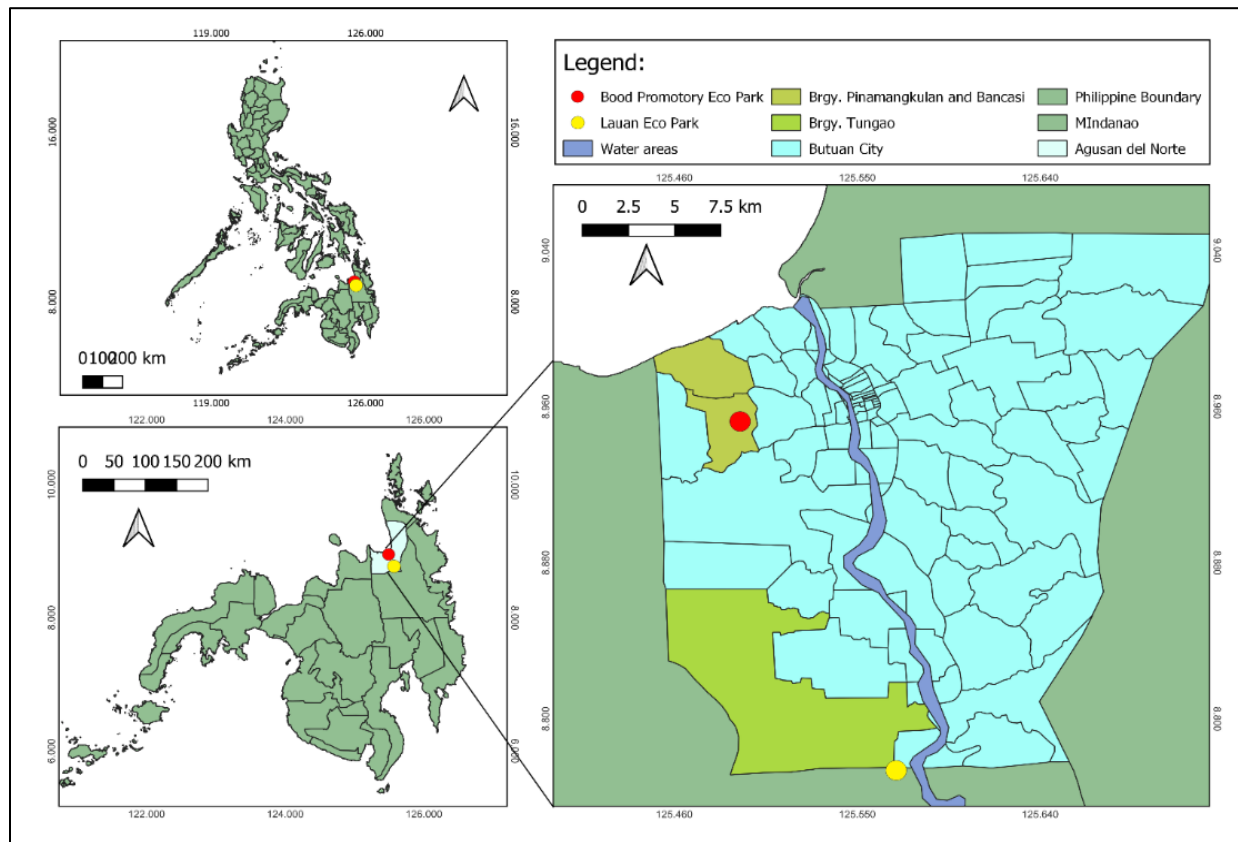


Figure 1 Study map showing the two ecological parks in Butuan City: Lauan Eco Park (yellow point) and Bood Promontory Eco Park (red point)



Figure 2 Lauan Eco Park, Tungao, Butuan City: (A & B) Along the road of the eco-park, (C) agro forest area and (D) pond inside the Eco-Park



Figure 3 Bood Promontory Eco Park, Butuan City: (A) Lower portion of the eco-park and (B) Upper portion of the eco-park

Entry protocol

Before the conduct of the study, necessary collection permits were secured from 2 sampling sites. A Prior Informed Consent (PIC) form was obtained in Brgy. Tungao, Butuan City, by presenting the background and objectives of the study. A gratuitous wildlife permit (No. R13-2021-21) was secured from the Department of Environment and Natural Resources (DENR) office in region 13 in compliance with Republic Act 9147, known as Wildlife Resources Conservation and Protection Act of 2001. An approved letter to conduct in Bood Promontory Eco Park was also secured from DENR – Ecosystems Research and Development Bureau (ERDB) – Forest and Wetland Research and Extension Center.

Collection and sampling techniques

Transect walks and opportunistic sampling was employed to collect and observe butterflies in Lauan Eco Park and Bood Promontory Eco Park, Butuan City. It was done using catching nets or insect net-sweeping techniques. This method involved moderate sweeping while walking slowly and consistently in the transect line (Mohagan and Treadaway, 2010). A total of six days of exploration in two sampling sites were devoted last July 23-25, November 13, 26 and 27, 2022, at three days per site. Captured and seen butterflies within and outside the transect line were recorded and stored in a paper triangle.

The triangular papers containing the butterfly specimens were enclosed in a clean plastic container with mothballs to preserve and prevent contamination from other insects. The collected specimens were mounted on a grooved Styrofoam board using insect pins inserted in the thorax and the wings were spread over using wax paper and insect pins. It was then photo-documented using a camera for identification.

Species identification and assessment of conservation status

Published journals, online websites, books, photograph classification through differentiating characters and morphological structures were used in the pre-identification of butterfly species. The pre-identified butterfly species was forwarded to the fourth author for identification and verification of the butterfly species.

Conservation status, endemism and the Philippine distribution were based on the Illustrated Lists of Philippine Butterflies of Badon et al., (2013) and Hardy and Lawrence, (2017). Site distribution was based on the occurrences of species in two sampling sites. The national status of butterflies was assessed using Treadaway, (1995) and Hardy and Lawrence, (2017). In addition, the scale of occurrences of Mohagan and Treadaway, (2010) was used to assess the local status of butterflies in the area. The following ranges

were: Very rare for 1-3 individuals, rare for 4-10 individuals, common for 11-20 individuals and very common for 21 individuals and above.

Diversity statistical analysis

Diversity indices were computed using the Paleontological Statistics (PAST) software that includes the following indices: Species richness, abundance, evenness, dominance and Shannon-Weiner diversity index. In addition, JASP was also used in determining the statistical difference.

3. RESULTS & DISCUSSION

Butterfly Species Composition, Status and Endemism

The faunistic inventory of butterflies recorded 218 individuals comprising 35 species and two unidentified species in 24 genera, under four families, from the sites in Lauan Eco Park and Bood Promontory Eco Park (Table 1). Thirty-Four (34) species belonging to 22 genera were observed in Lauan Eco Park, while twelve (12) species belonging to 10 genera were recorded in Bood Promontory Eco Park. Of these, the family Nymphalidae (the brush-footed butterflies) was the most represented group having 20 species (54.05%) in two sites, followed by the family Pieridae (the whites and sulfurs) with 11 species (29.72%), the family Lycaenidae (the blues and coppers) with four species (10.81%) and the family Papilionidae (the swallowtails and birdwings) as the least represented group with only two species (5.40%). Similar results were observed by Domine and Dela-Cruz, (2020), Novelyn and Solania-Naling, (2021), Guadalquiver et al., (2020), Mape and Conception, (2020) and Ramirez and Mohagan, (2012) as the family Nymphalidae obtained the highest number of species. It is because Nymphalidae is the most prominent family of butterflies in the world and is dominant in tropical areas due to their polyphagous nature, which enables them to survive and adapt in various habitats (Anbalagan et al., 2015; Bora et al., 2014).

The result of the study revealed a higher species composition of true butterflies compared to the study of Domine and Dela-Cruz, (2020) in Andanan Watershed Agusan del Sur with 26 species; Nuñez et al., (2016) in Bega Watershed Agusan del Sur with 13 species; Gracia et al., (2021) in Surigao del Sur with 29 species; Sebua and Nuñez, (2020) in Experimental Forest Area, Zamboanga City with 23 species. However, the number of species in Lauan and Bood Promontory Eco Park is relatively lower than in reported studies of Toledo and Mohagan, (2011) from Mt. Timpoong and Mt. Hibok-Hibok, Camiguin; Ramirez and Mohagan, (2012) in Tandag, Surigao del Sur; Mohagan et al., (2013) in Dinagat Island; Guadalquiver et al., (2020) in Misamis Oriental; Novelyn and Solania-Naling, (2021) in Mt. Magdiwata, Agusan del Sur; Mohagan et al., (2011) in Mt. Kitanglad, Mt. Apo, Mt. Timpoong and Mt. Musuan. It could be due to the different habitat types and conditions (biotic and abiotic factors) where most reported studies with high butterfly species richness were conducted in mountain areas. According to the observed study by Igano et al., (2021), butterfly species richness is likely to be richer in forest habitats than in agro ecosystems and disturbed areas. Aside from this, the two mentioned ecological parks have lesser vegetation layers and smaller sampling areas. The sampling duration was smaller with only one (1) sampling technique employed, which could also be a factor for a lesser species count compared to other areas in Mindanao.

An endemic species, *Ypthima stelleri stelleri*, had the highest number of individuals, with 32 in Lauan Eco Park and 21 in Bood Promontory Eco Park. It was followed by *Ypthima sempera chaboras* with 46 individuals, *Leptosia nina terentia* with 16, *Zizina otis oriens* and *Junonia hedonia ida* with 12, *Hypolimnas bolina philippensis* with 10 and *Menelaides polytes ledebouria* with 10. Most of these species were documented in an open area where the availability of their host plants was observed. These species are also tolerant of a wide range of habitats. The abundance of these species concluded that the Eco Parks in Butuan City have ecological support for their survival, especially the two species of *Ypthima* that are endemic in the Philippines.

As of national status and endemism, 25 (71%) out of 35 species were common, 1 (2.70%) rare species, 1 (2.85%) rare Mindanao endemic and 8 (22.85%) were Philippine endemic species; five (5) species were rare Philippine endemics and four (4) species were common Philippine endemics. The rare Philippine endemics were: *Athyma maenas semperi*, *Moduza thespias*, *Mycalesis frederici*, *Mycalesis igoleta*, *Neptis pampanga boholica* and *Ypthima sempera chaboras*. The common Mindanao endemic was: *Ptychandra lorquinii plateni*. The common Philippine endemic includes: *Mycalesis igoleta*, *Ypthima stelleri stelleri* and *Pareronia boebera trinobantes*. The endemism percentage of the current study had a similar endemism value to Ramirez and Mohagan, (2012), with 21.1% in Tandag, Surigao del Sur. The current study showed lower endemism compared to the reported studies of Abao et al., (2022), with 31% in Mt. Hilong-Hilong. As for the local status, 25 species (consisting of 67.56%) were assessed as very rare; seven were rare (consisting of 18.91%), three were common (consisting of 8.1%) and two were very common (consisting of 5.40%). It implies that despite the small area, the eco-parks in Butuan are preferable homes for common and rare endemic butterfly species

Table 1 Species composition, abundance, status and endemism of true butterfly in Lauan Eco Park and Bood Promontory Eco Park, Butuan City

Family/Species Name	Local	National	Endemism	LEP	BPEP
Family LYCAENIDAE					
<i>Catochrysops strabo luzonensis</i> Tite, 1959	Very Rare	Common		1	0
<i>Lampides boeticus</i> Linnaeus, 1767	Very Rare	Common		1	0
<i>Everes lacturnus lacturnus</i> Godart, 1824	Very Rare	Common		1	0
<i>Zizina otis oriens</i> Butler, 1883	Common	Common		10	2
Family NYMPHALIDAE					
<i>Amathusia phidippus pollicaris</i> Butler, 1870	Very Rare	Common		2	0
<i>Athyma maenas semperi</i> Moore, 1896	Very Rare	Rare	PE	1	0
<i>Hypolimnas bolina philippensis</i> Butler, 1874	Rare	Common		10	0
<i>Ideopsis juvena manillana</i> Moore, 1883	Very Rare	Common		1	0
<i>Junonia almana almana</i> Linnaeus, 1758	Very Rare	Common		1	0
<i>Junonia atlites atlites</i> Linnaeus, 1758	Very Rare	Common		2	0
<i>Junonia hedonia ida</i> Cramer, 1755	Common	Common		7	5
<i>Melanitis leda leda</i> Linnaeus, 1758	Rare	Common		0	5
<i>Moduza thespias</i> Semper, 1889	Very Rare	Rare	PE	1	0
<i>Mycalesis frederici</i> Aoki & Uemura, 1982	Very Rare	Rare	PE	3	0
<i>Mycalesis igoleta</i> Felder & Felder, 1863	Very Rare	Common	PE	1	1
<i>Mycalesis janardana micromede</i> Fruhstorfer, 1900	Very Rare	Rare		2	0
<i>Mycalesis mineus philippina</i> Moore, 1892	Very Rare	Common		1	0
<i>Mycalesis perseus caesonina</i> Wallengren, 1860	Very Rare	Common		1	0
<i>Neptis pampang boholica</i> Moore, 1899	Very Rare	Rare	PE	1	0
<i>Orsotriaena medus medus</i> Fabricius, 1775	Very Rare	Common		1	0
<i>Polyura athamas acuta</i> Rothschild, 1899	Very Rare	Common		0	1
<i>Ptychandra lorquini plateni</i> Semper, 1892	Very Rare	Rare	ME	1	0
<i>Ypthima sempera chaboras</i> Fruhstorfer, 1911	Very Com.	Rare	PE	27	19
<i>Ypthima steller steller</i> Eschscholtz, 1821	Very Com.	Common	PE	32	21
Family PAPILIONIDAE					
<i>Menelaides polytes ledebouria</i> Eschscholtz, 1821	Rare	Common		8	2
<i>Menelaides deiphobus rumanzovia</i> Eschscholtz, 1821	Very Rare	Common		0	1
Family PIERIDAE					
<i>Appias olferna peducaea</i> Fruhstorfer, 1910	Very Rare	Common		2	2
<i>Catopsilia pomona pomona</i> Fabricius, 1775	Very Rare	Common		2	0
<i>Catopsilia pyranthe pyranthe</i> Linnaeus, 1758	Rare	Common		5	0
<i>Delias hyparete mindanaensis</i> Mitis, 1893	Very Rare	Common		1	0
<i>Eurema alitha alitha</i> Felder & Felder, 1862	Very Rare	Common		2	0
<i>Eurema</i> sp. 2	Rare	-		4	2
<i>Eurema blanda villivolans</i> Butler, 1883	Very Rare	Common		3	0
<i>Eurema</i> sp. 1	Rare	-		2	0
<i>Eurema hecabe tamianthis</i> Fruhstorfer, 1910	Rare	Common		4	0
<i>Leptosia nina terentia</i> Fruhstorfer, 1910	Common	Common		14	2
<i>Paretonia boebera trinobantes</i> Fruhstorfer, 1911	Very Rare	Common	PE	1	0

Notes: PE = Philippine Endemic, ME = Mindanao Endemic, NE = Non-Endemic, LEP = Lauan Eco Park, BPEP = Bood Promontory Eco Park.

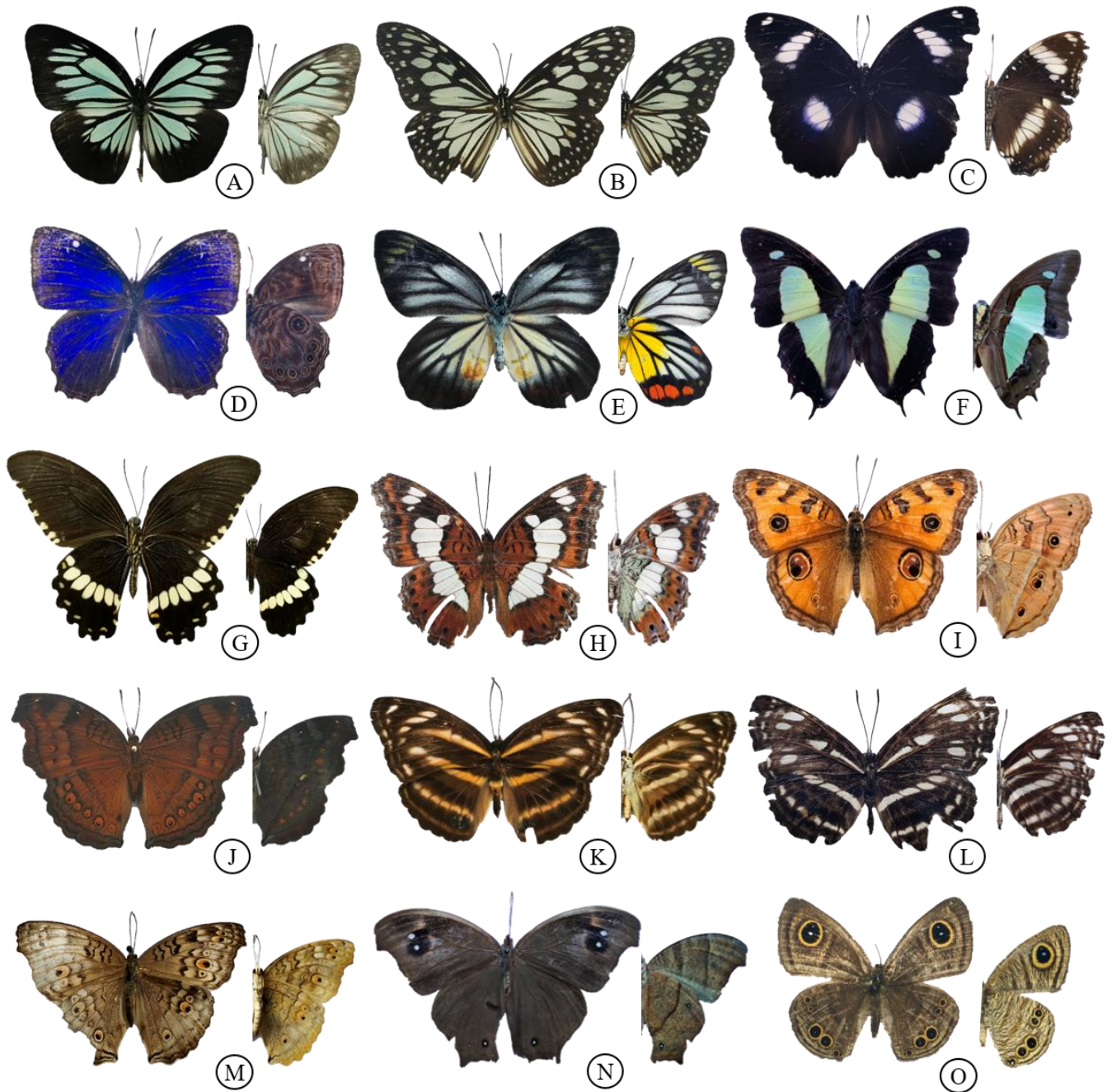


Figure 4 Some of the true butterflies (dorsal and ventral) collected in Lauan Eco Park and Bood Promontory Eco Park, Butuan City: A. *Pareronia boebersi trinobantes* Fruhstorfer, 1911; B. *Ideopsis juvena manillana* Moore, 1883; C. *Hypolimnas bolina philippensis* Butler, 1874; D. *Ptychandra lorquini plateni* Semper, 1892; E. *Delias hyparete mindanaensis* Mitis, 1893; F. *Polyura athamas acuta* Rothschild, 1899; G. *Menelaides polytes ledebouria* Eschscholtz, 1821; H. *Moduza thespias* Semper, 1889; I. *Junonia almana almana* Linnaeus, 1758; J. *Junonia hedonia ida* Cramer, 1755; K. *Athyma maenas semperi* Moore, 1896; L. *Neptis pampang boholica* Moore, 1899; M. *Junonia atlites atlites* Linnaeus, 1758; N. *Melanitis leda leda* Linnaeus, 1758; Ñ. *Ypthima stelleri stelleri* Eschscholtz, 1821

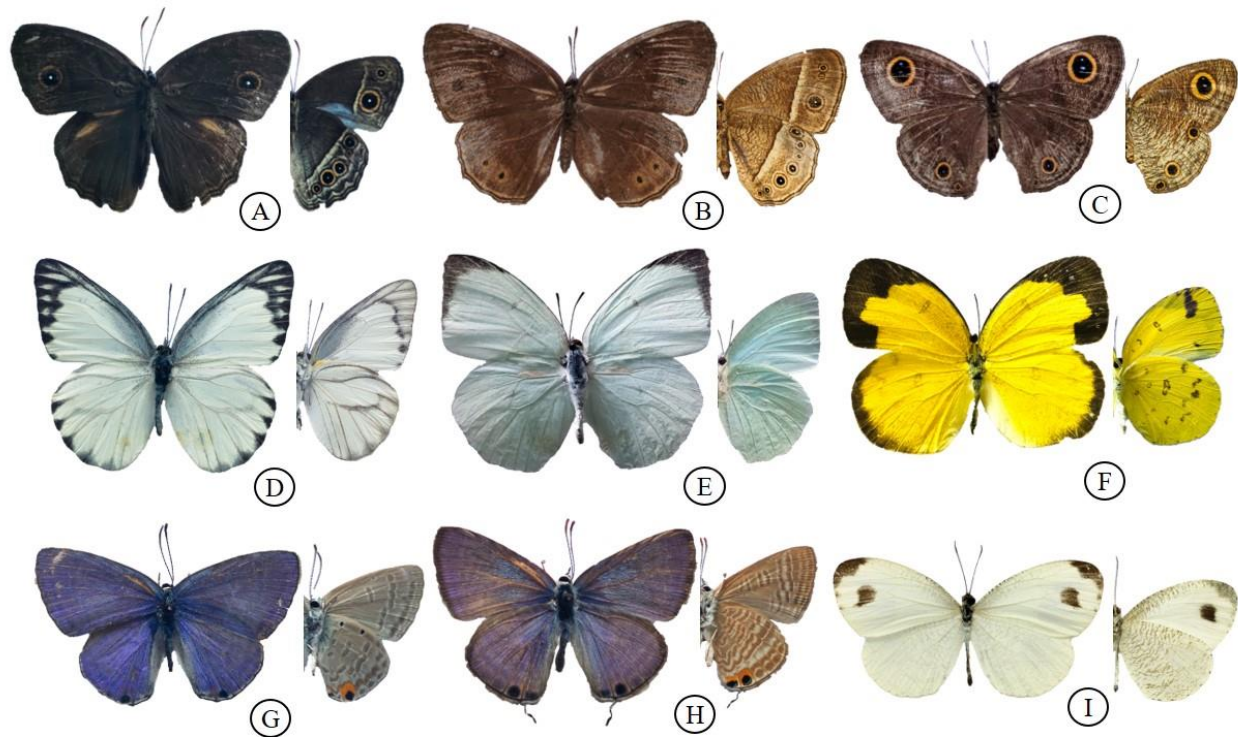


Figure 5 Some of the true butterflies (dorsal and ventral) collected in Lauan Eco Park and Bood Promontory Eco Park, Butuan City: A. *Mycalesis igoleta* Felder & Felder, 1863; B. *Mycalesis janardana micromede* Fruhstorfer, 1900; C. *Ypthima sempera chaboras* Fruhstorfer, 1911; D. *Appias olferna peducaea* Fruhstorfer, 1910; E. *Catopsilia pyranthe pyranthe* Linnaeus, 1758; F. *Eurema blanda villivolans* Butler, 1883; G. *Catochrysops strabo luzonensis* Tite, 1959; H. *Lampides boeticus* Linnaeus, 1767; I. *Leptosia nina terentia* Fruhstorfer, 1910

New Locality Record

Noteworthy to mention that the current study revealed two (2) new locality records of *Ptychandra lorquinii plateni* Semper, 1892 and *Mycalesis igoleta* Felder & Felder, 1863 in Agusan del Norte, Mindanao (Figure 6). The *P. lorquinii plateni* is a rare Mindanao endemic species previously recorded only in Siargao, Davao Oriental, Sarangani and other areas in Mindanao. It was observed on July 25, 2022, along the trail in the riparian area, perching on *Donax canniiformis* (Banban) during the butterfly assessment in Brgy. Tungao, Butuan City. The dorsal forewings and hind wings have an iridescent blue color. The forewing measures 26 mm in length and 22 mm in width. The hind wing measures 21 mm in length and 19 mm in width. The thorax size is 7 mm, the abdomen is 9 mm and the body length is 21 mm. The antennae measure 14 mm. On the other hand, *M. igoleta* is a common Philippine endemic species previously reported only in Alabat, Babuyan, Leyte, Luzon, Marinduque and Samar. The first occurrence of *M. igoleta* in Mindanao was reported by Senarillos et al., (2018) in Davao City. It is the second documented occurrence of *M. igoleta* in Mindanao and the first in the Caraga Region. The wings are dark brown with a series of circular rings in the hind wing. The forewing length measures 22mm and the width measures 14mm. The hind wing length measures 18mm and the width measures 16mm. The thorax size is 6mm, the abdomen is 10mm and the body length measures 18mm. The antennae measure 10mm. This species was observed in Lauan Eco Park, Brgy Tungao, Bood Promontory Eco Park, Brgy Pinamanculan, Butuan City.

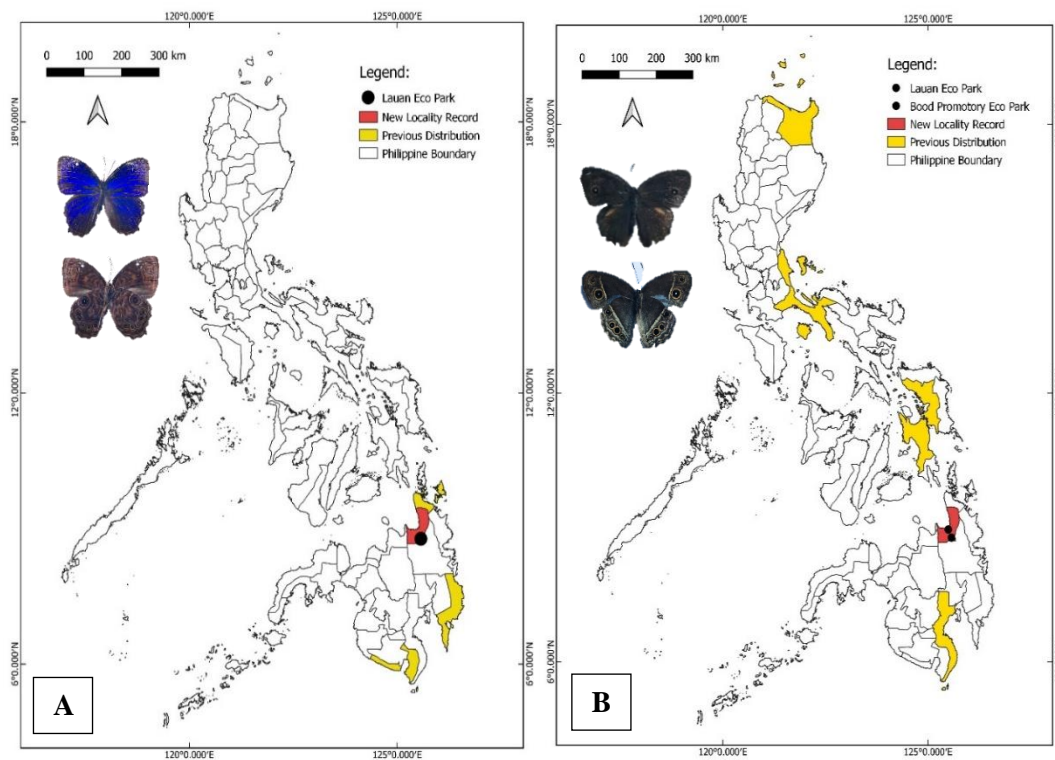


Figure 6 Distribution map of butterfly species showing the new locality records in Butuan City, Agusan del Norte, Mindanao, Philippines: A). *Ptychandra lorquinii plateni* Semper, 1892 observed in Brgy. Tungao and B). *Mycalesis igoleta* Felder & Felder, 1863 observed in both Lauan Eco Park, Brgy. Tungao and Bood Promontory Eco Park, Brgy. Pinamanculan

Diversity

The current study showed a high butterfly species richness and abundance in Lauan Eco Park (34 species and 156 individuals) than in Bood Promontory Eco Park (12 species and 62 individuals) (Table 2), which the two eco parks are significantly different as $t = 4.507$, $p < .001$ (Table 3). Diversity assessment revealed that Lauan Eco Park also had a higher Shannon diversity index with $H = 2.921$ than Bood Promontory Eco Park with $H = 1.933$. The high diversity in Lauan Eco Park can be attributed to several factors observed. According to Mohagan and Treadaway, (2010), the abundance of butterfly species increases as the elevation increases. The elevation in Lauan Eco Park is higher (124-151.53m) than in Bood Promontory Eco Park (47.48-63.73m), which might be a significant factor in the high diversity of butterflies in Lauan Eco Park. The presence of diverse trees and plants that provide shelter that offers other resources and more likely, the presence of their host plants could also be a factor since Lepidoptera depends on plants. The different vegetation types are also known to have an attribution to the high diversity of butterflies (Ramirez and Mohagan, 2012).

Lauan Eco Park is known to have various habitats, including agro-forested areas, lowland secondary forests, open canopies, ponds and riparian composed of different life forms like trees. As Mohagan et al., (2011) mentioned, butterflies tend to become richer in forest-type habitats than in disturbed areas. The area in Bood Promontory Eco Park might be exposed to disturbances as it is 1.5 km from the national highway to Cagayan de Oro. The area became a picnic destination spot because of its historical background and scenic view, where tables and a shed pavilion were available. In addition, areas in nearby streams and wetlands attract lepidopteran species since riparian areas possess a wide variety of environmental processes, especially with diverse vegetation that could offer shelter and food for butterfly species (Vu and Vu, 2011; Fajardo and Jumawan, 2015). It could also contribute to the heterogenous and diverse vegetation in Lauan Eco Park compared to Bood Promontory. Although Bood Promontory Eco Park is located near the Masao River, its vegetation is more on the monospecific growth of palm, bamboo and other shrub species. Moreover, the Masao River is connected to Butuan Bay, where the domination of *Nypa fruticans* is observed. Vu and Vu, (2011) reported that the low species richness of the bamboo forests in Vietnam was due to its simple vegetation. Furthermore, the area in Bood Promontory Eco Park is smaller and the vegetation is lesser than in Lauan Eco Park, which could attribute to its low diversity.

Overall, the result of the study implies that habitat heterogeneity is essential for butterfly diversity. Ecotourism-related activities could still negatively affect the surrounding environment and threaten the area's remaining fauna/flora species. Thus, proper management is highly recommended to protect and conserve the butterfly species and habitat within the Lauan and Bood Promontory Ecological Parks in Butuan City, Agusan del Norte.

Table 2 Diversity indices of butterflies in Lauan Eco Park and Bood Promontory Eco Park, Butuan City, Agusan del Norte, Philippines

Sampling Sites	Species Richness	Abundance	Dominance	Simpson	Shannon_H	Evenness
Lauan Eco Park	34	156	0.09198	0.908	2.921	0.546
Bood Promontory Eco Park	12	62	0.2142	0.7858	1.933	0.576

Table 3 T-test between Lauan Eco Park and Bood Promontory Eco Park in Butuan City, Agusan del Norte

Sampling site	Mean	SE	t	df	p
Lauan Eco Park	4.22	1.14	4.507	36	< .001
Bood Promontory Eco Park	1.68	0.759			

4. CONCLUSION

The two (2) Eco Parks in Butuan City are home to about 37 species belonging to 4 families and 24 genera. Thirty-three (34) species were observed in Lauan Eco Park, while twelve (12) species were recorded in Bood Promontory Eco Park. Twenty-seven (27) out of 37 species were common, one (1) rare species, one (1) rare Mindanao endemic and seven (7) Philippine endemic species; three (3) species were rare Philippine endemics and four (4) species were common Philippine endemics. Noteworthy to mention that the current study revealed two (2) new locality records of *Ptychandra lorquinii plateni* Semper, 1892 and *Mycalesis igoleta* Felder & Felder, 1863. The Shannon Diversity Index showed that Lauan Eco Park had a higher index with $H = 2.921$ than Bood Promontory Eco Park with $H = 1.933$. The high species richness, abundance and diversity of butterfly species and the presence of rare endemic species in the area indicate great importance for conservation and protection as a habitat for butterfly species. The study recommends further assessment of butterflies in Butuan City, not just in Eco Park and applying other methods/techniques to improve species richness data.

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Authors' contribution

Jeco Jed J Ruales - Conceptualization, methodology, data collection, validation, data analysis, writing - original Draft

Meljan T Demetillo - Conceptualization, validation, review & editing

Archie A Along - Conceptualization, validation, review & editing

Alma B Mohagan - Identification and validation of species, review & editing

Jess H Jumawan - Conceptualization, validation, supervision, review & editing

Informed consent

Not applicable.

Ethical approval

The Animal ethical guidelines are followed in the study for species observation & identification.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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