Species

Light-attracted silkworm moths (Saturniidae): Morphological characteristics, endemism and local status from Bacusanon, Pangantucan in Mindanao, Philippines

To Cite:
Viernes RMP, Suelo MS, Mohagan AB, Mohagan DP. Light-attracted silkworm moths (Saturniidae): Morphological characteristics, endemism and local status from Bacusanon, Pangantucan in Mindanao, Philippines. *Species* 2023; 24: e11s1011 doi: https://doi.org/10.54905/disssi/v24i73/e11s1011

Author Affiliation:
[1]Central Mindanao University (CMU), PhD student, Philippines
[2](CMU) PhD student, Faculty member (CMU Biology Department) and Head (CMU Zoological Museum), Philippines

[*]**Corresponding author**
Central Mindanao University (CMU) PhD student Joel Viernes' residence, Barangay Vintar, Valencia, Bukidnon, Northern Mindanao
Philippines
Email: ronacara256@gmail.com

Peer-Review History
Received: 07 November 2022
Reviewed & Revised: 11/November/2022 to 26/January/2023
Accepted: 30 January 2023
Published: 3 February 2023

Peer-Review Model
External peer-review was done through double-blind method.

Species
pISSN 2319–5746; eISSN 2319–5754

URL: https://www.discoveryjournals.org/Species

Rona Mae P Viernes[1*], **Michelle S Suelo**[1,2], **Alma B Mohagan**[2], **Dave P Mohagan**[2]

ABSTRACT

More than ninety percent (90%) of the diverse species of moths have fuzzy bodies, hairy antennae and may lack clubbed tips. Among these species are the silkworm moths or the family Saturniidae, which is among the biggest moths in the order Lepidoptera. There are still no published data regarding Saturniids from Bacusanon, Pangantucan, Bukidnon in Mindanao, Philippines. Thus, the purpose of this paper is to provide details about the morphological traits, endemism and local status of these light attracted Saturniids using the light trapping technique. There are about five (5) species and fifteen (15) individuals of saturniids in Bacusanon, Pangantucan, Bukidnon. According to the species' occurrences, 60% of the species caught were common and 40% were either rare or very rare. Nearly all species are widespread endemic, Mindoro endemic and are not listed in the IUCN. According to the data, disturbed environments are likely to have serious consequences, it may harm the habitat of Saturniids as well as other local residents and inhabitants and could possibly lead to the emergence of less abundant species.

Keywords: Saturniids, status, morphology, endemism

1. INTRODUCTION

The Philippines is a mega diverse country as well as a global biodiversity hotspot with high diversity of lepidopterans (Marchese, 2015). The archipelago has more than 7,100 islands and a complex geologic history that has contributed to generating its incredible species richness. Even small islands can have high species diversity (Brown et al., 2013, Badon & Lohman, 2020). The Order Lepidoptera, which includes more than 150,000 known species, is the second-largest family of butterfly species and moths in the insect kingdom (Kawahara, 2011). Lepidopterans, of which Mindanao is the home to a diversified and

abundant population, comprise 528 species, 219 (41.5%) of which are endemic (Mohagan & Treadaway, 2010). However, there are currently very few researches on Philippine moths and butterflies, especially in Mindanao.

Some members of the family Saturniidae entails the most spectacular and largest of all Lepidoptera species, varying from medium sized to very large sizes and comprises about 1, 600 described species distributed worldwide (Huis, 2019). Many species have well-developed eyespots, wing patterns or transparent patches on both the fore and hindwings, some have long tails on the hindwings and they are known to be remarkable (Aluthwattha, 2013).

Figure 1 Geographic location of Bacusanon, Pangantucan, Bukidnon, Philippines

Amidst the diversity of moths in the group of Lepidoptera and its contribution to the ecosystem, there are only a few articles that account the Saturniidae species found in the Philippines. According to Nässig and Treadaway, (1998), there are only 23 species of Saturniidae reported for the Philippine Islands. Saturniid moths are cited only in a few articles and the knowledge that can be found in Mindanao is very limited. No information of these moths was known or published from Bacusanon, Pangantucan, Bukidnon specifically.

Located there in province of Bukidnon's Pangantucan municipality is the barangay Bacusanon, the study site. Moreover, the knowledge that can we can acquire from this paper will provide information about the species morphology, endemism and local status of saturniid moths Bacusanon, Pangantucan, Bukidnon, Philippines and can be of use by the lawmaking bodies regarding strategies and ordinances for the conservation of this taxon in the area and gives additional outstanding value of our fauna.

2. MATERIAL AND METHODS

Entry protocol and establishments of the light traps

The study was carried out in Bacusanon, Pangantucan, Bukidnon, Philippines. As modified in Mohagan et al., (2017), light trapping technique was conducted to collect moth species. One light trap was established per night using a five hundred (500) watts mercury bulb powered by a portable generator that was set against a 3.5 x 2 white cloth sheet in an open area so that light can shine throughout the area. There were four study sites established.

Figure 2 (A) Light-trap in the first site and (B) Panoramic view.

Figure 3 (A) Preparation of the light-trap in the second site and (B) Panoramic view.

Collection, Preservation of specimen and Data Analysis

The study was conducted last October 16 to 22, 2020. Specimens were collected through handpicking and were directly injected with 95% ethanol in the thorax in order to paralyze. The collected moths were identified by use of journal and confirmed by experts in the CMU Museum.

Figure 4 (A) Light-trap in the third site and (B) Panoramic view.

Figure 5 (A) Bacusanon Central Elementary School and (B) Light-trap set-up

3. RESULTS

A total of 5 species and 15 individuals of the Saturniidae family were recorded and collected from the sampling area. These species were: *Attacus caesar*, *Cricula treadawayi trifenestrata*, *Samia luzonica*, *Antheraea paniki paniki* and the *Antheraea semperi semperi* respectively. Of these, 2 species were to the Philippines endemic such as the C. *treadawayi trifenestrata* and S. *luzonica*. The rest are Mindanao endemic like the A. *paniki paniki*, A. *semperi semperi* and A. *caesar* that is endemic in the East Visayan/Mindanao Region. Among these there is 1 species that were common namely the C. *treadawayi trifenestrata* and the others are rare such as the A. *semperi semperi* and the A. *caesar* while A. *paniki paniki* and *Samia luzonica* were recorded as very rare species according to their occurrence (Table 1).

Table 1 Endemism (Site endemic, Philippine endemic, Mindanao endemic) and Conservation Status (IUCN) of saturniid moths in Bacusanon, Pangantucan, Bukidnon.

Species	Endemism	Conservation Status
A. *paniki paniki* (*Nässig* & *Treadaway*, 1998)	Mindanao endemic	n/a
A. *semperi semperi* (Felder & Felder, 1861)	Mindanao endemic	n/a
A. *caesar* (*Maassen*, 1873)	Mindanao endemic (East Visayan/Mindanao Region)	n/a
C. *luzonica treadawayi trifenestrata* (*Nässig* & *Treadaway*, 1997)	Philippine endemic (Widely distributed southeast Asian species)	n/a
S. *luzonica* (*Watson*, 1914)	Philippine endemic	n/a

4. DISCUSSION

As reported by Nässig and Treadaway, (1998), the Mindanao Island as well as Luzon holds the largest number of autochthonous Saturniidae species is known, with 14 species and 12 species respectively followed by Negros and Mindoro, (1998). The nights of sampling are not always rainy and wet and temperature ranges from 17°c to 24°c. The difference in the weather and temperature did not affect the occurrence of saturniid moth but because they travel slower than the other species probably because these moths have wider wings to fly to the light source than most other species.

There were many differences between the composition in the different sites as the first site is facing Mt. Kalatungan but the area around the site is disturbed, the second site is an agro ecosystem, surrounded by banana plantation, coffee and corn plants, the third site is facing African tulip trees, in which almost all recorded species were collected and the last site is in the back of the Bacusanon Elementary School in which it is very disturbed and there were no data that was collected there.

Table 2 Ecological status of the Saturniid moths collected in Bacusanon, Pangantucan, Bukidnon (Rare, Very rare, Common, Very Common)

Species number	Ecological status	Coordinates	Longitude	Latitude	Time	Day collected	Site collected
Sp#1	Rare	347°N	124°42′28″E	7°54′34″E	11:36 PM	Day 1	Site 1
Sp#2	Rare	347°N	124°42′28″E	7°54′34″E	11:45 PM	Day 1	Site 1
Sp#3	Common	347°N	124°42′28″E	7°54′34″E	12:05 AM	Day 2	Site 1
Sp#4	Common	347°N	124°42′28″E	7°54′34″E	12:17 PM	Day 2	Site 1
Sp#5	Common	347°N	124°42′28″E	7°54′34″E	12:20 PM	Day 2	Site 1
Sp#6	Very rare	60°NE	124°42′40″E	7°54′51″E	11:35 PM	Day 3	Site 2
Sp#7	Common	60°NE	124°42′40″E	7°54′51″E	9:40 PM	Day 4	Site 2
Sp#8	Rare	60°NE	124°42′40″E	7°54′51″E	10: 54 PM	Day 4	Site 2
Sp#9	Common	178°S	124°43′32″E	7°52′23″E	10:49 PM	Day 5	Site 3
Sp#10	Common	178°S	124°43′32″E	7°52′23″E	12:47 AM	Day 5	Site 3
Sp#11	Rare	178°S	124°43′32″E	7°52′23″E	1:37 PM	Day 5	Site 3
Sp#12	Very rare	178°S	124°43′32″E	7°52′23″E	10:05 PM	Day 6	Site 3

Sp#13	Common	178°S	124°43′32″E	7°52′23″E	11:18 PM	Day 6	Site 3
Sp#14	Very rare	178°S	124°43′32″E	7°52′23″E	2:29 PM	Day 6	Site 3
Sp#15	Very rare	178°S	124°43′32″E	7°52′23″E	3:07 PM	Day 6	Site 3

The species morphology is shown in Table 2. Many species have different similarities and differences among their kinds. Most species are widespread endemic, Mindoro endemic and almost all species are not found in the IUCN as seen in Table 1. According to IUCN, with less than 10% that have been assessed for the Red List, if a species is not on the website, it is treated as Not Evaluated. In other websites, saturniid species are also not identified.

Table 3 Morphological characters of Saturniid moths collected in Bacusanon, Pangantucan, Bukidnon based on colors and features.

Species	Head	Antennae	Eyes	Thorax	Abdomen	Eyespots	Wings
Attacus caesar sp. 1	Brown	Light Brown	Dark brown	Dark brown w/ dark brown hairs/scales	Dark brown with hairs w/ circle shaped reddish & pink spots arranged vertically running til end of abdomen	Eyespots on both forewing and hindwing almost heart-shaped transparent pattern with a small transparent oblong-shaped spot on the forewing	Forewing upper side with dark greenish in color (w/ short dark brown scales), hindwing upper side a reddish color; consisting of black, white and red stripes arranged vertically along the middle part of the wings
Attacus caesar sp. 2	Black	Dark brown with golden tips	Black	Black with dark brown hairs	Light brown with hairs and with circle shaped red-black-white spots arranged vertically that runs until the end of the abdomen	Eyespots on both forewing and hindwing almost heart-shaped transparent pattern with two small transparent oblong-shaped spots on the forewing	Wings darker than sp#1. Forewing on upper side has dark greenish in color (w/ short dark brown scales) and golden tipped curvy end. Hindwing upper side w/ reddish stripes; w/ black, white and red stripes arranged vertically along the middle part of the wings
Cricula treadawayi trifenestrata sp. 1	Light brown	Light Brown	Light Brown	Color golden with pinkish scales/hairs	Yellow orange with yellow hair/scales	Two small transparent circle spots	Yellow-orange in appearance with hairy scales
Cricula treadawayi trifenestrata sp. 2	Light brown	Light Brown	Light brown	Light brown with yellow orange scales/hairs	Yellow orange with pink and yellow hair/scales	Three small transparent circle spots	Same appearance in color with Cricula sp. 1
Cricula treadawayi trifenestrata sp. 3	Orange	Light Brown	Brown	Hairy almost red orange	Yellow orange with yellow hair/scales	Two small transparent circle spots on the hindwing and	Hairy brownish-orange in appearance

				in color		one on the hindwing	
Samia luzonica sp. 1	Dominant brown	Light brown	Dark brown	Brown with brown scales/hairs	Hairy Dominant brown with a large white patch on its mesothorax	Hyaline/transparent and crescent moon shaped and an eyespot on the end of its wings	Dark brown with white pink median bands
Cricula treadawayi trifenestrata sp. 4	Light brown	Light Brown	Light Brown	Color golden w/ pinkish scales/hairs	Yellow orange with yellow hair/scales	Two small transparent circle spots on the hindwing and one on the hindwing	Hairy yellow-orange in appearance
Attacus caesar sp. 3	Dark brown	Dark brown (Wide)	Black	Dark brown w/ hairs	Brown with hairs & w/ circle shaped red spots arranged vertically that runs until the end of the abdomen	Eyespots on both forewing & hindwing almost heart-shaped transparent pattern with a small transparent oblong-shaped spot on the forewing	Forewing upper side almost olive green in color (w/ short dark brown scales), hindwing w/ reddish colour; darker than the other two.
Cricula treadawayi trifenestrata sp. 5	Dark brown	Light brown (slender with bristles)	Brown	Color golden with yellow orange scales/hairs	Yellow orange with yellow hair/scales	Two small transparent circle spots on the hindwing and one on the hindwing	Hairy brownish-orange in appearance
Cricula treadawayi trifenestrata sp. 6	Rich Yellow-orange	Brown (slender)	Brown	Color yellow orange with scales/hairs	Orange with hair/scales	Small transparent circle spots	Hairy yellow-orange in appearance
Attacus caesar sp. 4	Dark brown	Dark brown (Wide)	Black	Light brown colored with dark brown hairs	Dark brown w/ hairs & w/ circle shaped red-black-white spots arranged vertically that runs until the end of the abdomen. Red is not dominant unlike other	Eyespots on both forewing and hindwing with a big and small transparent oblong-shaped spot and on the forewing almost heart-shaped transparent pattern. And 1 small eyespot on the tip of the	Forewing upper side almost dark greenish in color (consisting of short dark brown scales), hindwing upper side has stripes consisting of black, white and red stripes arranged vertically along the middle part and lower of the wings. Hindwing have rich brownish-red color with black &

					species.	wings	yellow-colored markings on the tip of each wing.
Antheraea paniki paniki	Darkish red-brown in color	Dark brown (Wide antennaes)	Black	Dark reddish brown with red hairs	Brown color with a white line/hair that runs to its end	Forewing eyespots are rich orange	Colors ranging from reddish brown-brown-light brown with reddish hairy-like projections. A prominent yellow band is seen on top of its forewings.
Cricula treadawayi trifenestrata sp. 7	Orange in color	Orange (slender & smaller than others)	Black	Hairy red-orange in color	Red-orange body with red-orange hairs/scales	Small transparent circle spots	Color bright orange with a light-pink and black band that that seems noticeable. Also have scales/hairs and curvy bands all over its wings.
Antheraea semperi sp. 1	Red orange with hairs	Yellow (Wide antennaes)	Black	Red orange with hairs	Red orange with hairs	Eyespots in hindwings and forewings	Light orange yellow-colored wings. There are light-brown and dark brown bands on the margins with hairs/scales with brown curvy bands that that seems noticeable.
Antheraea semperi sp. 2	Red orange with hairs	Yellow (Wide antennaes)	Black	Red orange with hairs	Red orange with hairs	Eyespots in hindwings and forewings	Bright orange-yellow-colored wings. Light-brown and dark brown bands on the margins with hairs/scales with brown curvy bands that seems noticeable. The bright yellow and orange color on its wings makes it different from others.

It was also observed in the study site in Pangantucan, Bukidnon that the moths attracted to light were more abundant after whole afternoon heavy rain, during light rain and at 10:00 pm to 4:00 am. All species collected were attracted to 500W bulb and to the light trap set ups to where there is low wind blow. This is probably because the weather affects the collecting of the samples and it would probably increase the occurrences of the samples if higher intensity of light was used. The observation in the study site is a new record since there are no published data in Pangantucan.

Table 4 Measurements of the Saturniid moths collected in Bacusanon, Pangantucan, Bukidnon

Species number	Wings (in cm)							Eyes (in cm)	Antennae (in cm)	Legs (in cm)	Thorax (in cm)							
	Wh	L	Wi	Forewing		Hindwing					W	Length				Width		
				L	W	L	W					Pr-	Ms-	Mt	Ab	Pr-	Ms-	Mt
Sp#1	5.6	5.8	1.9	1.6	1.2	3.3	2.0	2.4	2.3	1.0	0.7	0.6	0.3	0.3	0.4	0.4	0.4	0.8
Sp#2	9.4	10.2	2.5	2.3	2.7	4.9	2.6	2.2	2.3	0.6	1.0	1.0	0.5	0.4	0.5	0.5	0.5	1.3
Sp#3	6.5	6.8	2.0	2.0	2.3	4.8	2.4	0.1	0.4	0.1	1.1	1.1	0.5	0.5	0.6	0.6	0.6	1.4

Sp#4	11.1	12.5	3.6	3.0	3.5	6.5	3.2	2.4	2.3	1.0	1.6	1.3	0.7	0.7	0.9	0.8	0.6	1.2
Sp#5	11.1	12.5	3.6	3.0	3.5	6.5	3.2	2.2	2.3	0.6	2.4	2.2	1.0	1.1	1.0	1.1	1.0	2.4
Sp#6	15.5	14.7	5.6	4.2	5.3	9.7	5.0	0.1	0.4	0.1	0.3	0.4	0.1	0.1	0.3	0.2	0.2	0.3
Sp#7	25.5	25.6	7.6	7.1	8.0	13.4	6.7	2.4	2.3	1.0	0.4	0.4	0.2	0.2	0.3	0.2	0.2	0.5
Sp#8	5.6	5.8	1.9	1.6	1.2	3.3	2.0	2.2	2.3	0.6	0.4	0.5	0.3	0.3	0.4	0.2	0.3	0.7
Sp#9	9.4	10.2	2.5	2.3	2.7	4.9	2.6	0.1	0.4	0.1	3.5	3.5	1.6	1.6	2.0	1.8	1.7	3.9
Sp#10	6.5	6.8	2.0	2.0	2.3	4.8	2.4	2.4	2.3	1.0	0.7	0.6	0.3	0.3	0.4	0.4	0.4	0.8
Sp#11	11.1	12.5	3.6	3.0	3.5	6.5	3.2	2.2	2.3	0.6	1.0	1.0	0.5	0.4	0.5	0.5	0.5	1.3
Sp#12	11.1	12.5	3.6	3.0	3.5	6.5	3.2	0.1	0.4	0.1	1.1	1.1	0.5	0.5	0.6	0.6	0.6	1.4
Sp#13	15.5	14.7	5.6	4.2	5.3	9.7	5.0	2.4	2.3	1.0	1.6	1.3	0.7	0.7	0.9	0.8	0.6	1.2
Sp#14	25.5	25.6	7.6	7.1	8.0	13.4	6.7	2.2	2.3	0.6	2.4	2.2	1.0	1.1	1.0	1.1	1.0	2.4
Sp#15	5.6	5.8	1.9	1.6	1.2	3.3	2.0	0.1	0.4	0.1	0.3	0.4	0.1	0.1	0.3	0.2	0.2	0.3

*LEGEND

Wh – Whole
L – Length
Wi – Width

Pr – Prothorax
Ms – Mesothorax
Mt – Metathorax

Ab –Abdominal

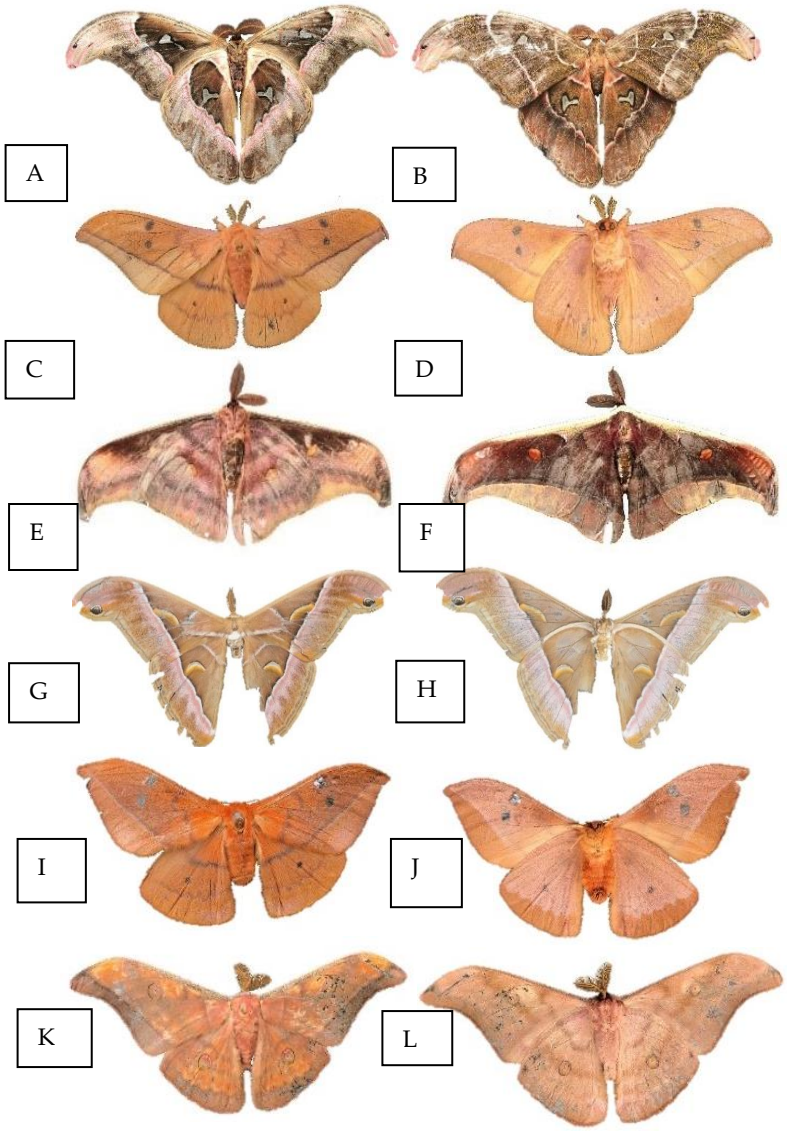

Figure 6 Some species that were collected. (A) *Attacus caesar* front; (B) *Attacus caesar* back; (C) *Cricula trifenestrata treadawayi* front; (D) *Cricula trifenestrata treadawayi* back; (E) *Antheraea paniki* front; (F) *Antheraea paniki back;* (G) *Samia luzonica* front; (H) *Samia luzonica*

back; (I) *Cricula trifenestrata treadawayi* front; (J) *Cricula trifenestrata treadawayi* back; (K) *Antheraea semperi semperi front and;* (L) *Antheraea semperi semperi* back.

5. CONCLUSIONS AND RECOMMENDATIONS

The study site in Bacusanon, Pangantucan, Bukidnon are home to 5 saturniid moth species. Most species are widespread endemic, Mindoro endemic and almost all species are not found in the IUCN. Moreover, sixty percent (60%) were common and forty percent 40% of the species caught were either rare or very rare according to their occurrences. Almost all species were Philippine endemic and only one few were Mindanao endemic. Only few were collected and this is probably due to its environment and only few available host plants in the area. The place is a Sumifro plantation and almost all the areas are disturbed or either planted with corn, coffee and bananas. The fact that there are only a few species of saturniids collected at a short period of time, the environmental changes and disturbance may have serious effects it is recommended for extensive sampling to yield additional species.

Acknowledgment

The author would like to acknowledge the Brgy Captain of Bacusanon, Pangantucan, Bukidnon, Hon Rodelio Magbanua, the owner of the private land, Mr Wilfredo S Suelo, the principal of Bacusanon Central Elementary school, Mrs Windylyn S Vallescas for allowing us to collect in their area and for the warm accommodation and also to the locals who helped us in the sampling. I would also like to state my heartfelt gratitude to Sir Dave Mohagan of the University Museum for the identification of the specimen collected and to the DOST for the funding of this research study. Thank you very much!

Author's contribution

Rona Mae P Viernes: Main author of the study, Conceived and designed the analysis, collected and gathered the data, performed the research and wrote the paper; Michelle S Suelo: Contributed data to the author by collecting data; Alma B Mohagan: Contributed research tools, helped revised the article and approved the version to be published; and Dave P Mohagan: Contributed to the identification of the specimens collected.

Funding

Department of Science and Technology - Science and Technology Regional Alliance of Universities for National Development (DOST-STRAND); Conference Presentation: During Center for Biodiversity Research and Extension in Mindanao (CEBREM) 10th anniversary.

Ethical approval

Silkworm moths (Saturniidae) from Bacusanon, Pangantucan in Mindanao, Philippines was observed in the study. The Animal ethical guidelines are followed in the study for species observation & identification.

Informed consent

Not applicable.

Conflicts of interests

The authors declare that there are no conflicts of interests.

Funding

The study has not received any external funding.

Data and materials availability

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

REFERENCES AND NOTES

1. Aluthwattha S. Family Saturniidae (Insecta: Lepidoptera) of Sri Lanka: An Over view. J Asia Pac Entomol 2013; 02(1):1–11.
2. Badon J, Lohman D. Butterfly range extensions in the Philippines and Indonesia. Philipp J Syst Biol 2020. doi: 10.26 757/pjsb2020c14001

3. Brown RM, Siler CD, Oliveros CH, Esselstyn JA, Diesmos P, Blackburn D, Moyle RG, Peterson A, Alcala A. Evolutionary processes of diversification in a model island archipelago. Annu Rev Ecol Evol Syst 2013; 44:411-435.
4. Huis A. Cultural significance of Lepidoptera in sub-Saharan Africa. J Ethnobiol Ethnomed 2019; 15:26. doi: 10.1186/s13002 01903051903063
5. Kawahara A. Molecular Biology and Genetics of the Lepidoptera (Contemporary Topics in Entomology Series). Fla Entomol 2011; 94(1):119-120.
6. Marchese C. Biodiversity hotspots: A shortcut for a more complicated concept. Glob Ecol Conserv 2015; 3:297-309. doi: 1 0.1016/j.gecco.2014.12.008
7. Mohagan AB, Treadaway CG. Diversity and Status of Butterflies across Vegetation Types of Mt. Hamiguitan, Davao Oriental, Philippines. J Asia-Pac Biodivers 2010; 1(1):1-24.
8. Mohagan DJ, Dela Cruz RY, Doblas GZ, Mohagan DP, Mohagan AB. Diversity and status of Moth (Heterocera: Saturniidae) in Mt. Malambo, datu Salumay, Marilog, Davao District, Philippines. Env Sci 2017; 11(1):210-215.
9. Nassig WA, Treadaway CG. The Saturniidae (Lepidoptera) of the Philippines, Nachrichten des Entomologischen Veriens Apollo, Frankfurt am Main (Germany) 1998; Suppl 17:223-424.