

Research Article

Species Composition and Assessment of Sphingid Moths (Heterocera, Sphingidae) in Mount Malimumu, Pantaron Mountain Range, Mindanao, Philippines

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ABSTRACT

High diversity of sphingid moth species can be found in tropical rainforests. Mount Malimumu of Pantaron Mountain Range, Mindanao, Philippines, has a vast rainforest, which is a Key Biodiversity Area. However, no records of sphingid moths have been known to occur in Mount Malimumu of the Pantaron Mountain Range. Thus, this study aimed to determine species composition and assess the local status of sphingid moths of Mount Malimumu. A 3 × 4 m white silk cloth and 250 V light bulbs were used for light trap sampling. Specimens collected were brought to the University Museum of Central Mindanao University. A total of 20 species distributed to 10 genera in 4 tribes was recorded. At least 8 species are endemic to the Philippines, i.e., *Ambulyx bakeri*, *Ambulyx staudengeri*, *Ambulyx johnsoni*, *Amplipterus panopus mindanaoensis*, *Meganoton rufescens philippinensis*, *Acosmeryx socrates*, *Cechenena transpacific* and *Theretra manilae*. Uncontrolled anthropogenic activities around the Mount Malimumu of Pantaron Mountain Range such as slash and burn, conversion of forest land to farmlands and overcollection of host plants may threaten these species.

Keywords: Pantaron Mountain Range; Key Biodiversity Area; ecological status; Philippine endemic.

INTRODUCTION

Sphingid moths commonly known as hawkmoths or sphinx moths, belong to the family Sphingidae and have a medium to large body size (Mohagan et al., 2019). This lepidopteran group is widely distributed and inventoried in every continent (Kitching & Cadiou, 2000; Yen et al., 2003). Global distribution of sphingid moths have been known from South Asia to the Sundaic region. This family has been documented from Cambodia, Java, Laos, Nepal, Northeast India, Peninsular Malaysia, the Ryukyu Archipelago, Southern China, Sumatra, Taiwan, Thailand, the Andaman Islands, Vietnam, Borneo and the Philippines (Pittaway & Kitching, 2008; Leong & Rozario, 2009). About 1,350 species of sphingid moths have been recorded around the world (except Antarctica) and their peak diversities are located mostly in tropical rainforests (Kitching & Cadiou, 2000; Karger et al., 2013). Furthermore, about 122 (9%) sphingid moth species have been documented in the Philippines (Hogenes & Treadaway, 1998).

Mount Malimumu is one the highest peaks of Pantaron Range located at Barangay Magkalungay, Municipality of San Fernando, Bukidnon, Mindanao, Philippines. The Pantaron Range is a major fragment of the central Cordillera of Mindanao Island (Gronemeyer et al., 2014). Research on biodiversity has been launched, which was spearheaded by the Center for Biodiversity Research and Extension in Mindanao (CEBREM) of Central Mindanao University, to include Pantaron Range as one of the NIPAS or National Integrated Protected Area System Act.

There are few studies of sphingid moths in terms of taxonomy and conservation, locally and internationally. Some researchers mostly focus their attention on the bio-pesticide and pest control of these highly destructive insects (Tigvattananont & Bumroongsook, 2016). While the overall diversity of sphingid moths in the Philippines is known (Hogenes & Treadaway, 1998), it is important to study the biodiversity at more local levels because of varying anthropogenic threats. A number of studies have investigated the diversity of sphingids elsewhere on Mindanao Island (Nuneza et al., 2016; Mohagan et al., 2019; Suelo et al., 2020 & 2023), but the sphingids of Mount Malimumu, Pantaron Range of the central highlands remain unreported. Thus, this study aims to determine the species composition and local status of sphingid moths of Mount Malimumu.

MATERIALS AND METHODS

Entry protocol

Necessary permits were obtained from the different community/agencies from the local people and Gratuitous Permit from the Department of Environment and Natural Resources.

Sampling stations, collection and preservation

The study was carried out in barangay Magkalungay, municipality of San Fernando, province of Bukidnon, on the island of Mindanao in southern Philippines (Fig. 1). The study was conducted from 21 to 28 October 2020. With the use of 3 × 4 m white silk cloth and 250 V light bulbs, light trap sampling was established from 6:00 pm to 2:00 am (Fig. 2). The sampling stations were done in a slope-to-ridge type location for the light to penetrate the deep parts of the forest. Vegetation type and habitat composition were documented during the sampling period.

Triangular-shaped glassine papers and mothballs were used to preserve the specimens. Specimens collected were brought to the University Museum of Central Mindanao University for permanent mounting.

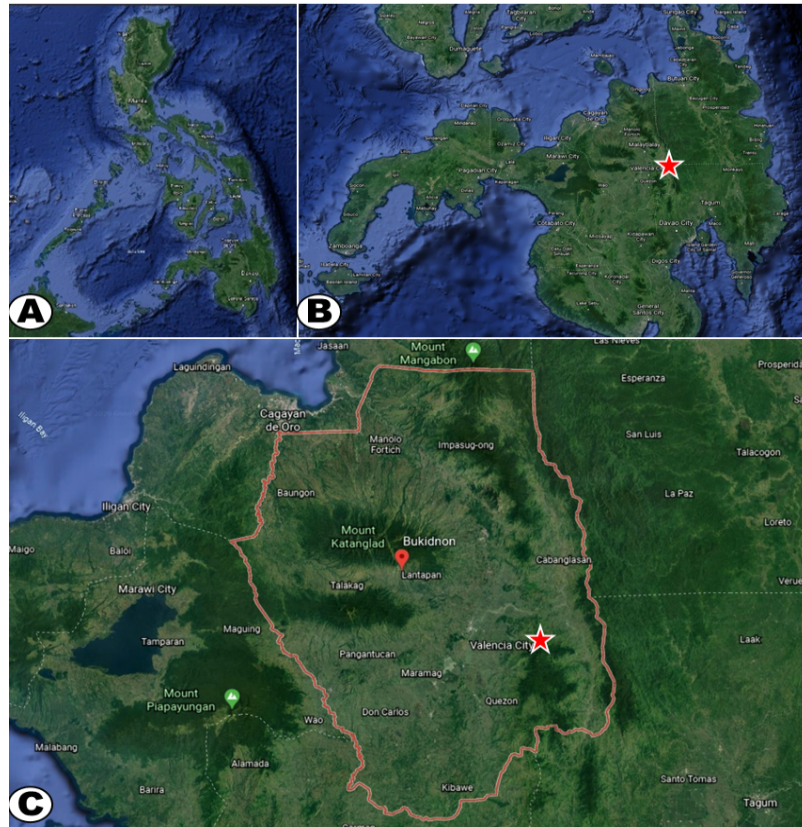


Figure 1: Study Site of Mount Malimumu, A) Map of the Philippines, B) Map of Mindanao, C) Map of Bukidnon showing the study station (red stars).



Figure 2: Light trap sampling, A) Researchers installing the light trap, B) Installed light trap, C) Close-up view of the light trap.

Taxonomic and conservation status

Identification, classification and status of the specimens were carried out using the checklist of Hogenes and Treadaway (1998) at the Central Mindanao University Museum's Zoology Section. Other published taxonomic papers such as Haber and Frankie (1987), Ghorpadé et al. (2013), Karger et al. (2013), Rafi et al. (2014), Nuneza et al. (2016), Mohagan et al. (2018; 2019) and Suelo et al. (2020; 2023) were also used.

RESULTS AND DISCUSSION

Species composition

Mount Malimumu of Pantaron Mountain Range has a total of 20 species distributed to 10 genera in 4 recorded tribes (Table 1). These species include *Acosmeryx socrates* Boisduval (1875), *Acosmeryx anceus subdentata* (Rothschild & Jordan 1903), *Ambulyx bakeri* (Clark 1929), *Ambulyx tattinum uichancoi* (Clark 1938), *Ambulyx staudengeri* (Rothschild 1894), *Ambulyx johnsoni* (Clark 1917), *Acherontia lachensis* (Fabricius 1798), *Agrius convolvuli* (Linnaeus 1758), *Amplipterus panopus mindanaoensis* (Inoue 1996), *Amplipterus panopus panopus* (Cramer 1779), *Cechenena helops helops* (Walker 1856), *Cechenena transpacific* (Clark 1923), *Marumba amboenicus luzoni* (Clark 1935), *Megacorma obliqua obliqua* (Walker 1856), *Meganoton rufescens philippinensis* (Clark 1938), *Pergesa actea* (Cramer 1779), *Psilogramma menephron menephron* (Cramer 1780), *Theretra nessus* (Drury 1773), *Theretra manilae* (Clark 1922) and *Theretra rhesus* (Boisduval 1875).

Table 1: Species composition of Sphingidae moths in Mount Malimumu, Pantaron Mountain Range, Mindanao, Philippines.

Subfamily	Tribe	Genus	Species	No. of individuals recorded
Sphinginae	Smerinthini	<i>Ambulyx</i>	<i>Ambulyx bakeri</i> (Clark 1929)	6
			<i>Ambulyx johnsoni</i> (Clark 1917)	2
			<i>Ambulyx staudengeri</i> Rothschild 1894	3
			<i>Ambulyx tattina uiochancoi</i> (Clark 1938)	1
		<i>Amplipterus</i>	<i>Amplipterus panopus mindanensis</i> Inoue 1996	6
			<i>Amplipterus panopus panopus</i> (Cramer 1779)	5
		<i>Marumba</i>	<i>Marumba amboenicus luzonica</i> Clark 1935	1
	Sphingini	<i>Acherontia</i>	<i>Acherontia lachesis</i> (Fabricius 1798)	2
		<i>Agrius</i>	<i>Agrius convulvoli</i> (Linnaeus 1758)	1
		<i>Meganoton</i>	<i>Meganoton rufescens philippinensis</i> Clark 1938	1
		<i>Psilogramma</i>	<i>Psilogramma menephron menephron</i> (Cramer 1780)	3
		<i>Megacorma</i>	<i>Megacorma obliqua obliqua</i> (Walker 1856)	1

Macroglossinae	Macroglossini	<i>Acosmeryx</i>	<i>Acosmeryx anceus subdentata</i> Rothschild & Jordan 1903	5
			<i>Acosmeryx socrates</i> (1875)	5
		<i>Pergesa</i>	<i>Pergesa actea</i> (Cramer 1779)	1
	Choerocampini	<i>Cechenena</i>	<i>Cechenena helops helops</i> (Walker 1856)	2
			<i>Cechenena transpacific</i> (Clark 1923)	1
		<i>Theretra</i>	<i>Theretra manilae</i> Clark 1922	9
			<i>Theretra nessus</i> (Drury 1773)	1
			<i>Theretra rhesus</i> (Boisduval 1875)	4

There are a total of 122 annotated list of hawkmoth species in the Philippines and about 62 recorded species in Mindanao (Hogenes & Treadaway, 1998). In comparison, the species collected in Mount Malimumu is about 17.09% of the total recorded Philippine species and 32.25% of the overall species recorded in Mindanao. Compared to studies conducted elsewhere in the Philippines, the 20 species obtained in this study is close in number to the 22 species recorded by Mohagan et al. (2018) from Mount Hamiguitan and Busay Garden, Marilog District, Davao City, but more than that recorded by Nuneza et al. (2016) in Bega Watershed, Agusan del Sur (only 1 species), Mohagan et al. (2019) in Mount Hamiguitan (8 species), and Suelo et al. (2020; 2023) in Mount Kitanglad with 13 and 7 species recorded respectively.

Assessment

At least 8 species were Philippine endemic namely, *Ambulyx bakeri*, *Ambulyx staudengeri*, *Ambulyx johnsoni*, *Amphypterus panopus mindanaoensis*, *Meganoton rufescens philippinensis*, *Acosmeryx socrates*, *Cechenena transpacific* and *Theretra manilae*. Forty percent of the species in the area are endemic to the Philippines.

The endemism of hawkmoths in Mount Malimumu is much higher compared to the data gathered by Mohagan et al. (2019) in the two proposed expansion sites of Mount Hamiguitan with only 3 endemic species recorded in the area.

Mount Malimumu has a secondary forest vegetation type, supporting the study of Shuize & Fielder (2003) that there was no direct significance between old-growth or primary forest and secondary forest in diversity and hawkmoths. The sampling season at Mount Malimumu was rainy and wet with a temperature of about 17°–22°C, which may be a result of its elevation of about 1,223 m asl because it was a lot cooler compared to the average temperature in San Fernando, Bukidnon, which are in the lowlands (385 m asl) and record temperature of 19°–29°C (Department of Science and Technology, 2024 onwards), a direct correlation to its elevation; the higher the elevation, the cooler the area. Mohagan et al. (2019) also stated that temperature and weather cannot affect the occurrence of hawkmoths during light trapping because they are furfuraceous and crepuscular species, meaning they can withstand heavy rainfall.

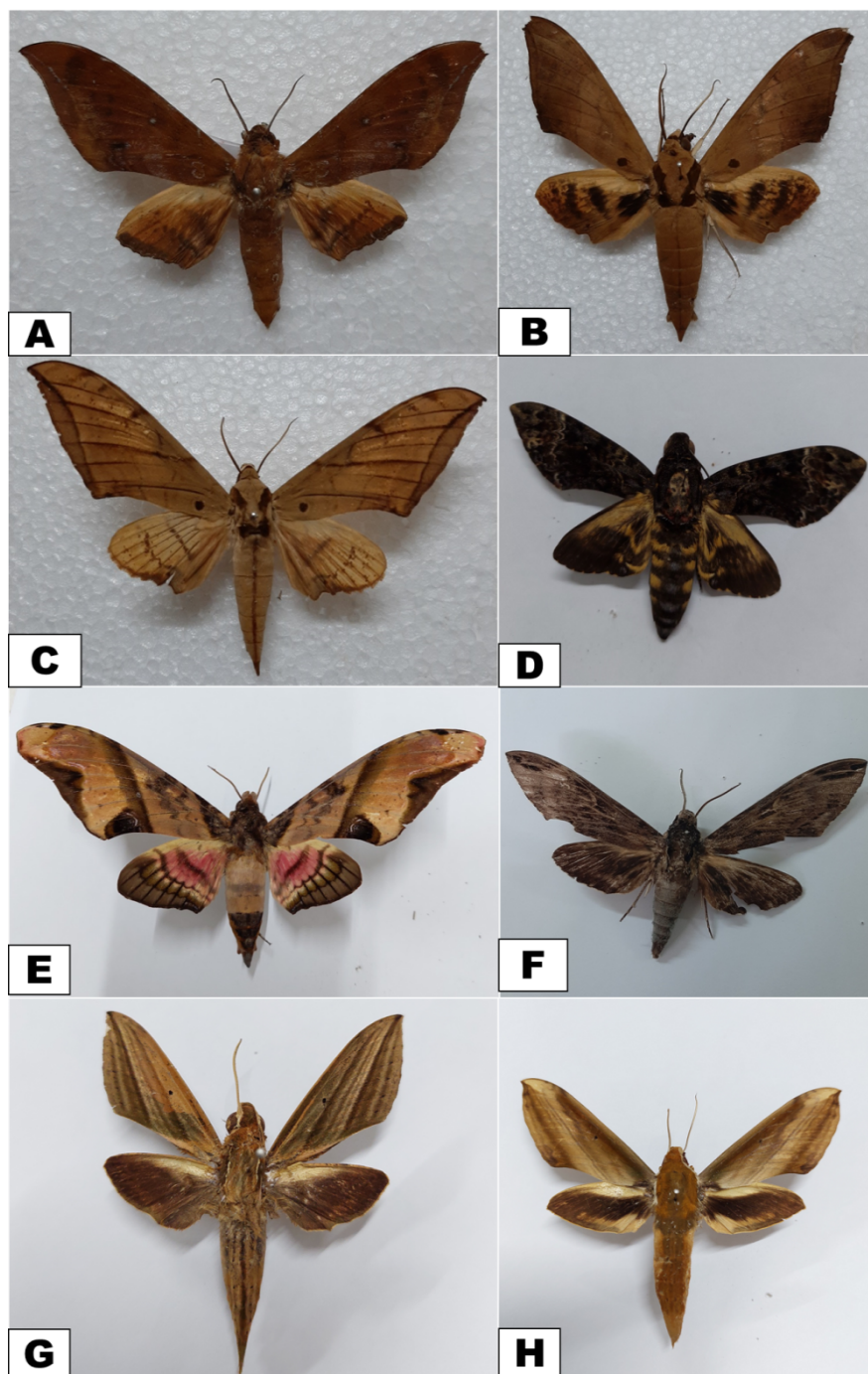


Figure 3: Some endemic species of sphingid moths in Mount Malimumu, Pantaron Mountain Range, **A)** *Ambulyx backer*, **B)** *Ambulyx staudengeri*, **C)** *Ambulyx johnsonii*, **D)** *Acherontia lachensis*, **E)** *Amplypterus panopus minandensis*, **F)** *Meganoton rufescens philippinensis*, **G)**, *Theretra manilae* and **H)** *Theretra nessus*

CONCLUSIONS

Mount Malimumu of Pantaron Mountain Range is home to 20 species of hawkmoths, with 8 Philippine endemic species. Hawkmoth species constitute 40 per cent of the species in the area. The ongoing widespread anthropogenic activities around the Mount Malimumu of Pantaron Mountain Range such as slash and burn method, conversion of forest lands to farmlands and over collection of host plants may threaten these species. Thus, it is recommended that the

protection of the forest reserve and surrounding areas be strictly imposed for the protection and conservation of these enigmatic species and their habitat.

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REFERENCES

- Department of Science and Technology. (2024, April 4). *PAGASA Public files*. <https://pubfiles.pagasa.dost.gov.ph/pagasaweb/files/climate/tendayweatheroutlook/day2.xlsx>.
- Ghorpadé K, Patil RR, Chandaragi MK (2013) Notes on Hawk Moths (Lepidoptera—Sphingidae) in the Karwar-Dharwar transect, peninsular India: a tribute to T.R.D. Bell (1863–1948). *Colemania*, 33: 1–16 pp.
- Gronemeyer T, Coritico FP, Wistuba A, Marwinski D, Gieray T, Micheler M, Mey FS, Amoroso VB (2014) Four new species of *Nepenthes* L. (Nepenthaceae) from the central mountains of Mindanao, Philippines. *Plants*, 3(2): 284–303.
- Harber WA, Frankie GW (1987) A tropical hawkmoth community: Costa Rican dry forest Sphingidae. *Biotropica*, 21(2): 155–172 pp.
- Hogenes W, Treadaway CG (1998) The Sphingidae (Lepidoptera) of the Philippines. *Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, Suppl.* 17: 17–132 pp.
- Karger DN, Abrahamczyk S, Kessler M (2013) Abundance and species richness of hawkmoths (Lepidoptera: Sphingidae) in the fragmented landscape of Santa Cruz (Bolivia). *Ecología en Bolivia*, 48(1): 46–51 pp.
- Kitching IJ, Calidou JM (2000) *Hawkmoths of the World: An Annotated and Illustrated Revisionary Checklist*. London: The Natural History Museum; Ithaca, NY: Cornell Univ. Press, 1–226 pp.
- Leong TM, Rozario VD (2009) Larval development and metamorphosis of the hawkmoth, *Theretra Suffusa* (Walker) (Lepidoptera: Sphingidae: Macroglossinae). *Nature in Singapore*, 2: 13–20.
- Mohagan AB, Tubongbanua RMT Jr, Amper DO, Hongco AL, Coritico FP, Gorme FS, Amoroso VB, Colong RD, Ponce RG (2019) Species composition, endemism and local status of hawkmoths (Heterocera: Sphingidae) in the two proposed expansion sites of Mt. Hamiguitan Range Wildlife Sanctuary, Davao Oriental, Philippines. *Biological Forum – An International Journal*, 11(1): 236–240 pp.
- Mohagan DJB, Solis E, Gorme F, Colong RM, Laraga SH, Doblaz GZ, Paraguas KGS, Mohagan DP, Mohagan AB, Bergquist T (2018) Hawkmoths (Heterocera: Sphingidae) diversity and status on selected vegetation types of a protected natural forest (Mt. Hamiguitan Wildlife Sanctuary, San Isidro, Davao Oriental) and ecotourist area (Busay Garden Marilog District, Davao City) Philippines. *International Journal of Current Research in Life Sciences*, 7(9): 2684–2690 pp.

- Nuneza KJM, Nuneza OM, Dupo ALB (2016) Species richness of Lepidoptera in Bega Watershed, Prosperidad, Agusan del Sur, Philippines. *Bulletin of Environment, Pharmacology and Life Sciences*, 5(8): 83–90 pp.
- Pittaway AR, Kitching IJ (2008) Sphingidae of the Eastern Palaearctic. <http://tpittaway.tripod.com/china/china.htm>.
- Rafi MA, Sultan A, Kitching IJ, Pittaway AR, Markhasiov A, Khan MR, Naz F (2014) The hawkmoth fauna of Pakistan (Lepidoptera: Sphingidae). *Zootaxa*, 3794(3): 393–418 pp.
- Schulze CH, FIELDER K (2003) Hawkmoth diversity in Northern Borneo does not reflect the influence of anthropogenic habitat disturbance. *Ecotropica*, 9: 99–102.
- Sublett CA, Cook JL, Janovec JP (2019) Species richness and community composition of sphingid moths (Lepidoptera: Sphingidae) along an elevational gradient in southeast Peru. *ZOOLOGIA*, 36: e32938.
- Suelo MS, Dela Cruz RYD, Luceño AJ, Mohagan AB (2020) Morphological description and ecological status of hawkmoths (Lepidoptera: Sphingidae) in three vegetation types of Mt. Kitanglad, Lirongan, Lantapan, Bukidnon, Philippines. *Biological Forum-AN International Journal*, 12: 18–28.
- Suelo MS, Dela Cruz RY, Doblas GZ, Batbatan CG, Tubongbanua Jr. RM, Cagas CLA, Dargantes, KSAT, Viernes RMP, Mohagan AB (2023) Sphinx moths (Family Sphingidae): Species composition, local status and endemism in Mt. Kitanglad, Intavas, Sumilao, Bukidnon, Philippines. *Species* 24, e3s1003.
- Tigvattananont S, Bumroongsook S (2016) Growth and development of *Macroglossum corythus* Walker (Lepidoptera: Sphingidae). *International Journal of Agricultural Technology*, 12(7.2):2131–2139.
- Yen SH, Kitching IJ, Tzen CS (2003) A new subspecies of Hawkmoth from Lanyu, Taiwan, with a revised and annotated checklist of the Taiwanese Sphingidae (Lepidoptera). *Zoological Studies*, 42(2): 292–306 pp.