

Species Composition, Local Status and Endemism of Sphingidae Moth in the two vegetation types of Mt. Musuan, Long-term Ecological Research Site, Bukidnon, Philippines

Alma B. Mohagan¹, Jeanne C. Kuan², Brylle Vince Abrea², Marchie Magdula², Donna Joanne Ondap², Dave P. Mohagan³, Aldrin Hongco⁴, Fulgent C.P. Coritico⁵, and Victor B. Amoroso⁵

Faculty¹, Undergraduate Student², University Museum³, Graduate Student⁴, CEBREM⁵, and Central Mindanao University

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Abstract: One of the biggest groups of moths in the Sphingidae family is the hawk moth, often known as the sphinx moth, a nocturnal pollinators and bio indicators. They stand out from other moths by having large wings, thick bodies, and longest tongues. There are 1,450 species of Sphinx moth all over the world and 117 of them existed in the Philippines and Mindanao Island has 62 of them. Mt. Musuan, is one of the remarkable landmark of Central Mindanao University has been subjected to numerous studies of flora and fauna for several years. There were significant studies conducted on Hawkmoths but there were no published report about the species in this locality. This research was carried out on the two vegetation types of Mount Musuan, Maramag, Bukidnon in order to collect data on the composition, endemism, and local status of Hawkmoths. Sphinx moths were successfully collected using transects walks and light trap sampling in the two proposed vegetation sites using a white thin cloth and 500-watt light bulbs. A total of 9 genera and 14 species were recorded. The following are *Acosmeryx socrates*, *Ambulyx bakeri*, *Ambulyx johnsoni*, *Ambulyx staudingeri*, and *Ambulyx wilemani*. These were all endemic to the Philippines. There was 1 uncommon species and 13 common species recorded in their local status. The 14 species of sphinx moths comprised 35.7% endemism and these can be found on Mt. Musuan's two vegetation types.

Keywords: Hawk moth, Light trap. Mindanao, Musuan, Philippines

1. Introduction

Moths are known to have the ability to serve as bio-indicator and nocturnal pollinators but an agricultural pest (Dar et al., 2021). Hawk moths or Sphinx moths are one of the largest groups of moths that belong to Sphingidae family. They have a large wings, thick bodies, and longest tongues among any other moths (Steve Buchman) that collect nectar from flowers. They are considered as the fastest flying insect that can reach up to 50km/h. Their appearance resemble to jet fighters with their abilities to hover, fly backwards, and upside down (Chong, 2014). Sphingidae are a very diverse group (Chandra, et al 2013), that have more or less 1,450 species all over the world (Uehara & Honda, 2020). It was reported that 117 of them exist in the Philippines (Hogenes & Treadaway, 1998). And Mindanao Island has 62 species of them (Suelo & Mohagan, 2020). A total of 22 Hawk moths species were reported in Mt. Hamiguitan, Wildlife Sanctuary, San Isidro, Davao Oriental (Mohagan et al., 2018). While 13 Sphinx moth species were documented in the Agrosystem of Bacusanon, Pangantucan, Bukidnon (Suelo & Mohagan, 2020). Mt. Musuan, in Bukidnon, is a remarkable landmark of Central Mindanao University with latitude of 7.870599 and longitude of 125.069098, with an elevation of 646 meters above sea level. Mt. Musuan is home to a wide variety of animals and plants. Inhabitants of the area include certain Lepidopterans, such as butterflies and moths. Although significant studies on Hawk moths have been conducted, there are no published reports in this specific locality. This paper will provide the data on the species composition, local status and endemism in this area.

2. Methodology

This study was carried out in the two vegetation types of Mt. Musuan. The following stations were: Station 1. The Base, is located at (7.87699°N, 125.06966°E) and Station 2 the Peak at (7.88225°N, 125.06363°E) Mt. Musuan, Musuan, Maramag, Bukidnon, Philippines (Fig.1). The diverse sphinx moth species were documented using transects walk sampling (Fig. 3) and a light trap sampling from 7 PM until 4 AM. The light traps were put up for 9

hours. Light trap sampling was established at the lower (Base permanent plot) and higher elevations (Peak) of Mt. Musuan, Maramag, Bukidnon using a thin white cloth and 500-watt light bulbs (Fig. 4). The collected specimens were gathered, documented, and preserved using mothballs and triangular form tracing paper (Fig. 5). The Central Mindanao University Museum's Zoology Section identified, categorized, and assessed the status of the specimens using the checklist published by Hogenes and Treadaway (1998).



Figure 1: Base LTER Plot (A) and Peak LTER Plot (B) Mt. Musuan, Maramag, Bukidnon, Philippines.

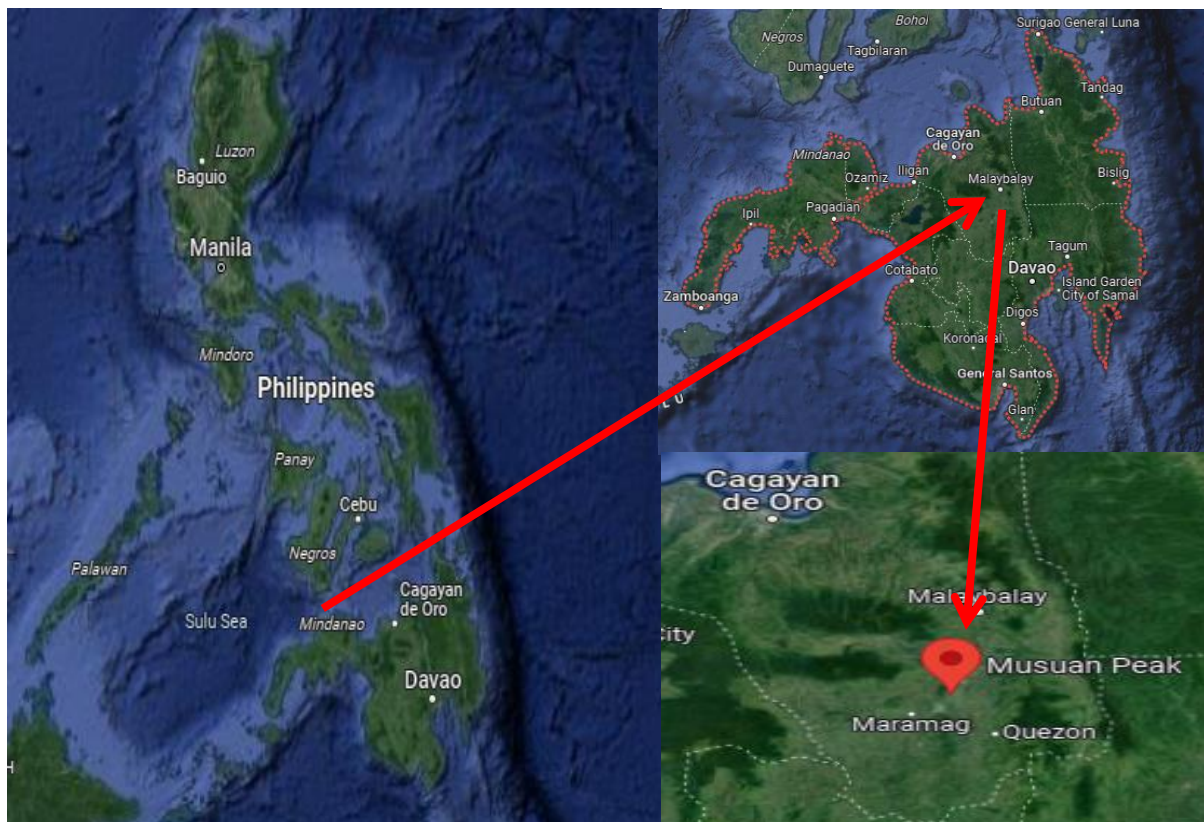


Figure 2: Geographical Location of the study sites: Map of the Philippines, Mindanao Island, and Mt. Musuan in the Province of Bukidnon.



Figure 3: One individual of *Psilogramma m. menephron* that is collected from transects walk.



Figure 4: Light trap installations in Base (A) and Peak (B) of Mt. Musuan.



Figure 5: Triangular shaped tracing paper

3. Results and Discussion

The study revealed a total of 44 individual Hawk moths which belong to fourteen (14) species under nine genera (9) of the Sphingidae family. The station 1 had seven (7) species: *Ambulyx johnsoni*, *Ambulyx wilemani*, *Daphnis b. hypothous*, *Hippotion boerhaviae*, *Theretra c. clotho*, *Theretra manilae*, and *Theretra rhesus*. The station 2 (peak of Mt. Musuan) had only two species namely: *Ambulyx bakeri*, and *Polyptchus trilineatus*. The following are the concordant species: *Acosmeryx socrates*, *Acherontoria lachesis*, and *Ambulyx staudingeri*, *Marumba amboenicus luzoni*, and *Psilogamma m. menephron* was on Mt. Musuan Table 1). The ecological status of the collected Sphinx moths were based on the checklist of Hogenes and Treadaway (1998) and revealed that five species are endemic to the Philippines such as, *A. socrates*, *A. bakeri*, *A. johnsoni*, *A. staudingeri*, and *A. wilemani*. Among the species collected, 11 were common and only *H. boerhaviae* was recorded as uncommon that have a distribution in Jolo, Leyte, Luzon, Mindanao, Negros, Palawan, Panay and, Sibuyan Hogenes and Treadaway (1998).

Nuneza *et al.* (2016) found just four (4) species of moths and one was sphinx moth in their study of the species richness of Lepidoptera in Bega Watershed, Prosperidad, Agusan Del Sur. One of the reasons why there are so few moth species captured is that the method utilized is simply sweep netting and not a light trap. Since those moths are nocturnal and attracted to light, you cannot expect to collect a high portion of moths using this method. Mohagan *et al.* (2018) recorded a higher species composition of sphingid moths with 22 species and 305 individuals in a protected natural forest (Mt. Hamiguitan Wildlife Sanctuary, San Isidro, Davao Oriental) and Ecotourist Area (Busay Garden Marilog District, Davao City) in the Philippines. The light trap setups utilized in this study were carried out in the tree vegetation types of Mt. Hamiguitan. Mohagan *et al.* (2019) found only 8 species of hawk moths distributed in 6 genera in their study on the species composition, endemism, and local status of Hawkmoths in the two proposed expansion sites of Mt. Hamiguitan Range Wildlife Sanctuary, Davao Oriental. Hence, the result obtained is relatively low when compared to the findings obtained in 2018; however, it must be considered that this is conducted in the two proposed expansion sites compared to 2018 conducted in three vegetation types.

In 2020 Suelo *et al.* discovered a higher species composition in their research on Morphological description and ecological status of Hawkmoths (Lepidoptera: Sphingidae) in Three Vegetation Types of Mt. Kitanglad, Lirongan, Lantapan, Bukidnon, Philippines. A total of 13 sphinx moth species from 9 genera were recorded. The same number of species composition were recorded in the study of Suelo & Mohagan (2021) on the endemism of Sphinx moth in the Agroecosystem of Bacusanan, Pangantucan, Bukidnon having a total of 13 Hawkmoth species under 9 genera. Mohagan *et al.* (2022) published a recent study on the Species Composition and Assessment of Sphingidae in Mt. Agad-Agad, Iligan City, Philippines. Mt. Agad-Agad has six species in four genera. According to their findings, weather conditions had no effect on hawkmoth composition between the two sites, but elevation and the type of vegetation did. The latest study of Mape *et al.* (2022) recorded 35 species in their study on Hawkmoths of Baguio City, Philippines: a Preliminary Checklist Derived from Photo-based Observation Records Available on iNaturalist and Philippine Lepidoptera Internet flat forms. So far, this study had achieved the highest rate of species composition. One of the aspects to consider is that this study was observed between January 2014 and August 2021.

The two stations have different vegetation types and elevations. Station 1, Mt. Musuan (Base) with a lower elevation has a higher species composition of trees, herbs and vines - the possible food plants of moth than Station 2. The station 2, Mt Musuan (Peak), with higher elevation (675 masl) has lower species composition. Hawkmoth diversity is higher in lower elevation places and decreases as elevation increases, according to a study by Mohagan *et al.* (2018). This may be related to the fact that their food plants are located at lower elevations which are shaded with trees and soil is wet.

Table 1: Species composition, Endemism, Distribution and Local Status of Sphinx Moth in Mt. Musuan, Maramag, Bukidnon, Philippines

S. no	Species	Site 1 (Base)	Site 2 (Peak)	Endemism	Distribution	Local Status
1	<i>Acosmeryx socrates</i> (Boisduval, 1875)	1	2	Endemic	Boh, Bon, Cal, Ceb, ley, Luz, Mdo, Neg, Pal, Pan, Sam, Taw	Common
2	<i>Acbentoria lachesis</i> (Fabricius, 1798)	1	1	-	Bal, ceb, Ley, Luz, Mar, Mdo, Mno, neg, Pal, Pan, Pol, Sam	Common
3	<i>Ambulyx bakeri</i> (Clark, 1929)	0	8	Endemic	Ceb, Ley, Luz, Mar, Mdo, Neg, Pan, Sam, Siq	Common
4	<i>Ambulyx johnsoni</i> (Clark, 1917)	5	0	Endemic	Ceb, Ley, Luz, Mar, Mdo, Mno, Neg, Pan, Sam, Siq, Bal, Pal	Common
5	<i>Ambulyx standingeri</i> (Rothschild, 1894)	4	1	Endemic	Boh, ceb, Jol, Ley, Luz, Mar, Mas, Mdo, Mno, Neg, Pan, Pol, Sam, Sga, Sib, Siq, Taw	Common
6	<i>Ambulyx wilemani</i> (Rothschild & Jordan, 1916)	1	0	Endemic	Ley, Luz, ,Mar, Mdo, Mno, Neg, Pan, Sam, Stu, Taw	Common
7	<i>Daphnis b. hypothous</i> (Cramer, 1779)	2	0	-	Bal, Boh, Ceb, Hom, Jol, Ley, Luz, Mdo, Mno, Neg, Pal, Pan, Pol, Sam, Sga	Common
8	<i>Hippotion boerhaaviae</i> (Fabricius. 1775)	1	0	-	Jol, Ley, Luz, Mno, Neg, Pal, Pan, Sib	Uncommon
9	<i>Marumba amboenicus luzoni</i> (Clark, 1935)	1	1	-	Bah, Boh, Ceb, Din, Jol, Ley, Luz, Mar, Mdo, Mno, Neg, Pan, Sam, Sib, Siq	Common
10	<i>Polyptchus trilineatus philippinensis</i> (Rothschild & Jordan, 1903)	0	1	-	Boh, Ceb, Ley, Luz, Mno, Neg, Pan, Siq	Common
11	<i>Psilogramma m. menephron</i> (Cramer, 1780)	2	9	-	Bal, Boh, Bon, Ceb, Dum, Jol, Ley, Luz, Mas, Mdo, Mno, Neg, Pal, Pan, Sam, Siq, Stu, Taw	Common
12	<i>Theretra c. clotho</i> (Drunky, 1773)	1	0	-	Bal, Boh, Bon, Ceb, Dum, Jol, Ley, Luz, Mas, Mdo, Mno, Neg, Pal, Pan, Sam, Sib, Siq, Stu, Taw	Common
13	<i>Theretra manilae</i> (Clark, 1992)	1	0	-	Ley, Luz, Mdo, Mno, Neg, Pal, Pan, Sam, Siq	Common
14	<i>Theretra rhesus</i> (Boisduval, 1875)	1	0	-	Bal, Boh, Bon, Ceb, Jol, Ley, Luz, Mas, Mdo, Mno, Neg, Pal, Pan, Sam, Sib, Siq	Common

Legend: Bab – Babuyanes	Luz – Luzon	Pol – Polilo Island
Bal – Balabac	Din - Dinagat	Sam - Samar
Boh – Bohol	Dum – Dumanon	Sga - Sarangani
Bon – Bongao	Mar - Marinduque	Sib - Sibuyan
Cal – Calamian	Mas – Masbate	Siq - Siquijor
Cat – Catanduanes	Mdo – Mindoro	Stu - Sicutuc
Ceb - Cebu	Mno – Mindanao	Jol - Jolo
Din – Dinagat	Neg – Negros	Taw – Tawi-Tawi
Dum – Dumarán	Pal - Palawan	
Ley – Leyte	Pan – Panay	

(Hogenes and Treadaway, 1998).

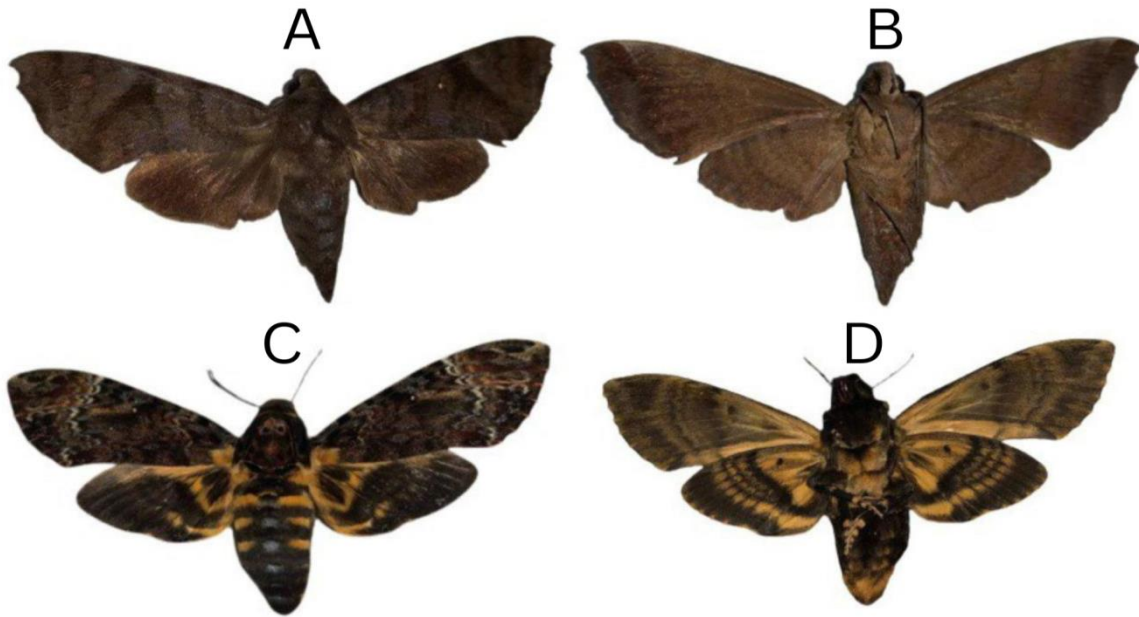


Figure 6. *Acosmeryx socrates* (A&B) and *Achentoria lachesis* (C&D) dorsal and ventral view.



Figure 7. *Ambulyx bakeri* (A&B) and *Ambulyx johnsoni* (C&D) dorsal and ventral view

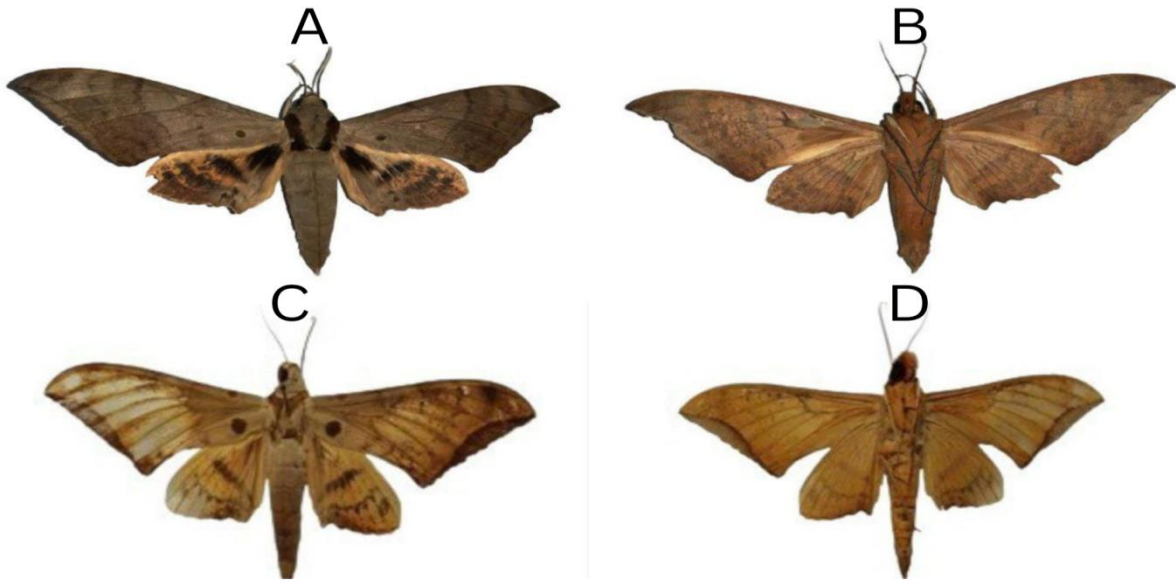


Figure 8. *Ambulyx staudingeri* (A&B) and *Ambulyx wilemani* (C&D) dorsal and ventral view.



Figure 9. *Daphnis h. hypothous* (A&B) and *Hippotion boerhaiviae* (C&D) dorsal and ventral view.

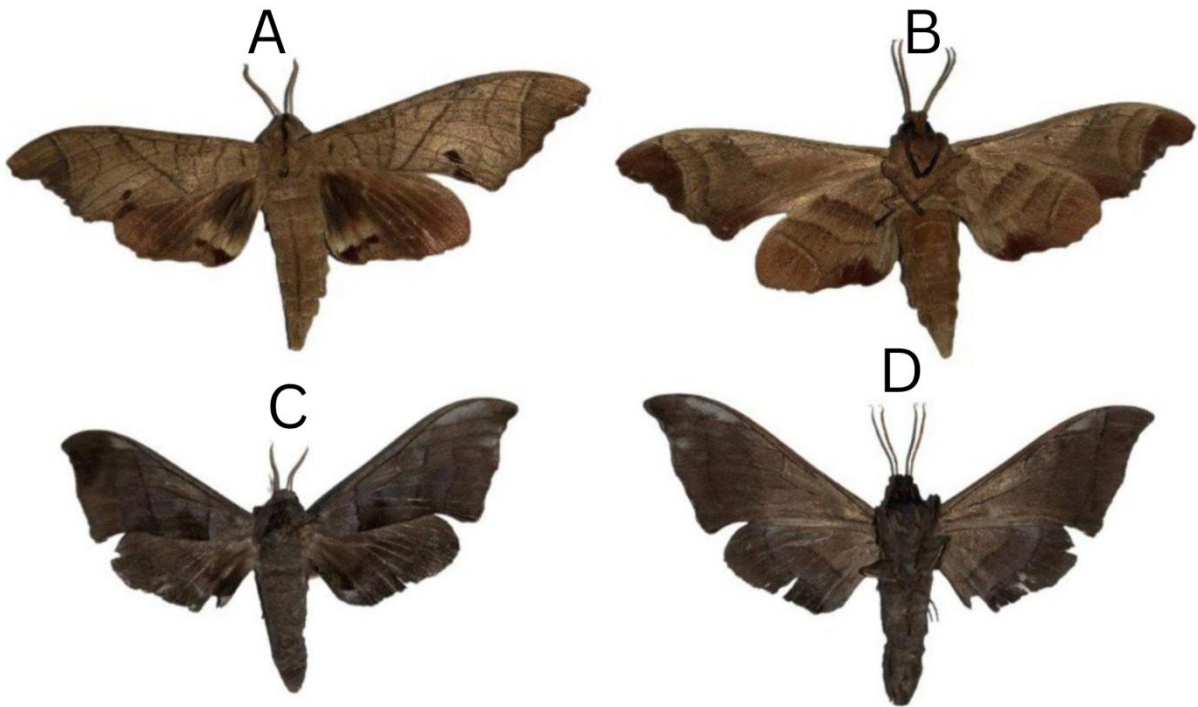


Figure 10. *Marumba amboenicus luzoni* (A&B) and *Polyphtchus trilineatus* (C&D) dorsal and ventral view.



Figure 11. *Psilogramma m. menephron* (A&B) and *Theretra c. clotho* (C&D) dorsal and ventral view.

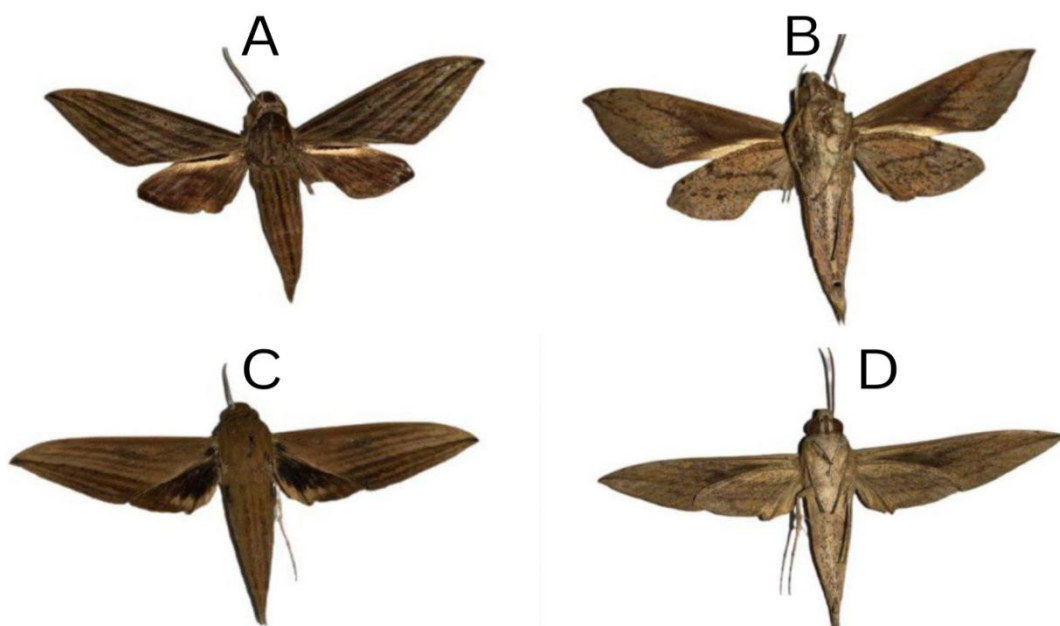


Figure 12. *Theretra manilae* (A&B) and *Theretra rhexus* (C&D) dorsal and ventral view.

4. Conclusion

Mt. Musuan is the home to 14 species of Sphinx moths. The local status revealed 13 common species and one uncommon species. The two vegetation types house 5 endemic species (35.7%) out of 14 recorded species in Mt. Musuan, Maramag, Bukidnon, Philippines, namely: *Acosmeryx socrates*, *Ambulyx bakeri*, *Ambulyx johnsoni*, *Ambulyx staudingeri*, and *Ambulyx wilemani*.

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