



RESEARCH PAPER

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Diversity and status of Moth (Heterocera: Saturniidae) in Mt. Malambo, Datu Salumay, Marilog, Davao District, Philippines

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Abstract

The Saturniids are moths that are ecologically and economically important group of insects that are considered as source of silk. Aside from their ecological role as herbivores and prey for many other insects, their presence and abundance in a locality may tell us about their habitat, the abiotic effect independent species-host relationship, absence or presence of their food (host) and predator. There is no information regarding Saturniids from Mt. Malambo, Datu Salumay, Marilog District, Davao City. Thus, the goal of this paper is to provide information on species composition, ecological status and alpha diversity of the light attracted saturniids through light trapping that may serve as reference for prioritizing Mt. Malambo as a Protected Area. There are 12 species of Saturniids in Mt. Malambo. Seventy-five (75%) were locally rare and 25% of the species caught were common, 66% of the species caught were Mindanao Endemic, 16% were widely spread in South East Asian Countries, and 16% were reported as Island Endemic to Leyte (*Cricula luzonica leyteana* ssp) and Palawan (*Samia treadawayi*). These two are of new record in Mindanao. There are more species to be discovered based on the curve constructed by rarefaction. Diversity index using Shannon-weiner index showed low ($H' \log 10 = 0.978$) but Simpson diversity index value is close to 1 which means it is good ($D=0.875$). This data suggests that environmental change would probably have serious effects and is likely to be damaging the habitat of saturniids and other inhabitants.

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Introduction

Order Lepidoptera: Heterocera, Family Saturniidae are giant silkworm, emperor and royal Moths which are large and brightly colored that are often having translucent eyespots and distinct range of wingspan; Adults are large in size, heavy body covered in hair-like scales, lobed wings, reduced mouthparts, and small heads; They lack a frenulum (a bristle or row of bristles on the edge of the hind wing that keeps it in contact with the forewing) but the hind wings overlap the forewings, producing the same effect of an unbroken wing surface. They also bear feathery antennae (often bi-pectinate or tooth like comb in form, but sometimes quadri-pectinate), which are larger in males (Tuske *et al.*, 1996). Mostly are nocturnal and are attracted to light (Lemaire, 1988; Lemarre, 2015). In Great Britain, it was reported by Fox (2013) that between 1968 and 2007, the abundance of macro-moth decreased by 28%. Sweden (Franzen *et al.*, 2007) and Netherlands (Groenedijk *et al.*, 2011) studies on moths also reported similar negative trend. Mindanao, Philippines current trend on Macro-moth is not known. Moth are herbivorous (Kagata and Ohgushi, 2012) and prey for many other insects (Collins, 2013); their presence and abundance in a locality reflects about their habitat, the abiotic effect independent to species-host relationship, absence or presence of their food (host) (Kemp and Ellis, 2017) and predator (Wickramasinghe *et al.*, 2004). The family is economically important in silk industry as their cocoon is a good source of silk (Peigler, 2013).

Saturnids are distributed worldwide and its species richness is high in tropical region (Reigier *et al.*, 2008; Nieskerken *et al.*, 2011). In Philippines, there are only 23 species belonging to this family in the report of Nassig and Treadaway published in 1998 where 10 species can be found in Luzon, 14 species in Mindanao, 9 species in Negros and Mindoro. Some species were reported as site endemic to Mindoro (*Antheraea (Antheraea) semperi noeli* n. ssp.) and Palawan (*Antheraea (Antheraeopsis) paniki sahi* n. ssp., *Antheraea (Antheraea) rosieri imelda* n. ssp. and *A. gulata*). No information on Saturnids is known from Mt. Malambo, Datu Salumay, Marilog District, Davao City specifically.

Mt. Malambo is a petite mountain with an elevation of 1,379 masl (meters above sea level) (Selpa *et al.*, 2013) near Misagoksok Ranges and Mount Talemo (mapcarta.com, 2017). The aim of this paper is to provide information on species composition, ecological status and alpha diversity of the light attracted saturniids in Mt. Malambo. This paper may serve as reference for prioritizing Mt. Malambo as a Protected Area of which is the main motivation. Moreover, the knowledge we can get from this study will help improve the management of the forest as home for saturniids, their conservation and conservation of the other organisms that can be found at the study site of which is very significant.

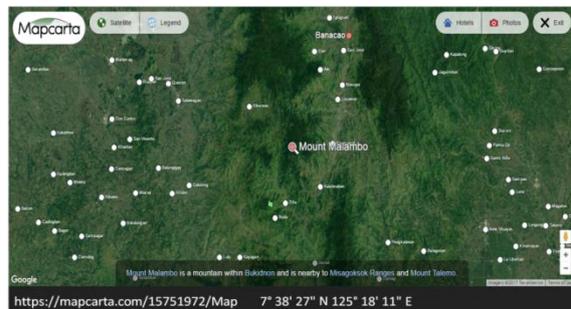


Fig. 1. Geographic location of Mt. Malambo, Marilog district, Davao City, Philippines.

Materials and methods

Entry Protocol and Establishment of the light traps

The permit to collect data was acquired from DENR XI authorities prior to sampling in Mt. Malambo (7° 38' 27" N 125° 18' 11" E), Datu Salumay, Marilog District, Davao City Philippines on the Months of February and March (Fig. 1). There are forest patches around the resort, caves and streams of water. During the sampling the understory vegetation in the resort was cut and cleaned. There were three light traps established in the study site: A.) One (1) 500watt bulb light trap was set at a function hall second floor balcony facing the Agroecosystem field and East forest patches around Busay spring Resort and the Montane and Mossy montane vegetations North-East (NE) Slope of Mt. Malambo (Fig. 2a & b); B) Fig. 3a & b shows light trap of two (2) 160 watt bulbs was also set facing South and South-East Forest of Busay, where there were caves and waters falling down to

the pool, and streams of waters from West Slope going down and to the South direction; C) One (1) 160 watt bulb light trap was also set in the guest House facing the West and North-West forest patch of the Busay natural spring resort (Fig. 4a & b).



Fig. 2. light trap set-up A and Fig. B The agroecosystem and forest patches.

Collection, Preservation of specimen and Data Analysis

Sampling starts at 5:30pm afternoon and ended at 4 am dawn. Samples attracted to light were collected through catching net and sometimes handpicked. Collected samples were euthanized in a box with some drops Ethyl acetate (EtAC) in a tissue paper and mounted in a board for preservation and exhibition in Central Mindanao University Museum. Method used by Nassig and Treadaway (1998) was adopted in assessing the status of Moth. Diversity index was determined using BIOPRO VER 2.0 and MVSP 3.22 (Kovach.com).

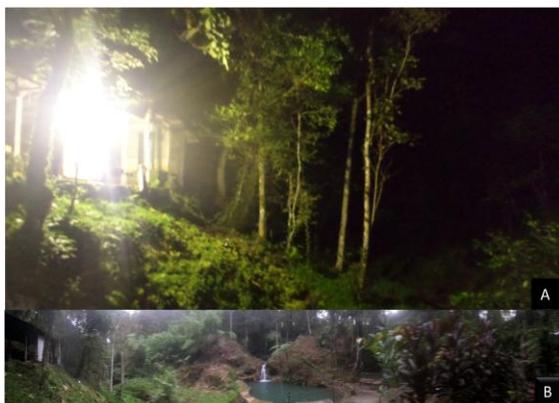


Fig. 3. A Lightrap B setup and Fig. 3B panoramic view of insect habitat attracted to light trap B.

Results and discussion

Table 1. Species Composition and status of Saturniids in Mt. Malambo.

Species	Status	
	Local	Conservation
1. <i>Actias philippinica</i>	Common	ME
2. <i>Antheraea halconensis</i>	Common	ME
3. <i>Antheraea larissa philippirissa</i>	rare	W
4. <i>Antheraea paniki</i>	rare	ME
5. <i>Antheraea platessa</i>	rare	W
6. <i>Antheraea semperi</i>	rare	ME
7. <i>Attacus Caesar</i>	common	ME
8. <i>Cricula luzonica kaereli</i>	rare	ME
9. <i>Cricula luzonica leyteana</i>	rare	Leyte endemic
10. <i>Loepa mindanaensis</i>	rare	ME
11. <i>Samia luzonica luzonica</i>	rare	ME
12. <i>Samia treadawayi</i>	rare	Palawan endemic

Legend: ME- Mindanao Endemic, W-Widespread.



Fig. 4. Light trap set up C Fig.4b Panoramic view for the habitat of insects attracted to the light trap.

A total of twelve (12) species of moth attracted to lights were recorded and 34 individuals were collected from the sampling area on the month of February and March 2017. The species composition is shown in Table 1. This number of species found is remarkable as all of these species are found in one site during the sampling and the sample represents 86% of the total species recorded from Mindanao as reported by Nassig and Treadaway (1998). There are host-plants for this species that were observed randomly distributed around the area and this is probably why the saturniids recorded were represented. These host-plants species for saturniids caterpillars are members of family Anacaradiaceae,

Annonaceae (*Annona mauricata* or locally known as abana, *Cananga odorata* a medicinal Ylang-Ylang herb and other species), Dipterocarpaceae (*Shorea* sp), Euphorbiaceae (*Codiaeum* sp) Fagaceae, Lauraceae (*Cinnamomum* sp.), Leguminosae, Magnoliaceae (*Magnolia* sp) Malvaceae (*Hisbiscus* sp.), Meliaceae (*Sweitenia mahogany*), Moringacea (*Moringa oleifera*), Myrtaceae, Pinaceae, Rosaceae, Verbenaceae (*Gmelina* sp) and other species that are probably host species of saturniids unrecorded in the area and which emerging season in not within the sampling period. The food or host-plants species mentioned were also documented as food of other saturniids species by Robinson *et al* (2002). Moreover, 75% of the species sampled were assessed as locally rare and the rest were common; 66% were Mindanao endemic, 16% were widely spread throughout South-East Asia and another 16% (N=2) of the species caught were reported as island endemic but the species are supposed to be endemic only to Leyte (*Cricula luzonica leyteana*) and Palawan (*Samia treadawayi*) (Nassig and Treadaway, 1998). This is probably due to the availability (presence and abundance) of their caterpillar host-plants found in Mt. Malambo.

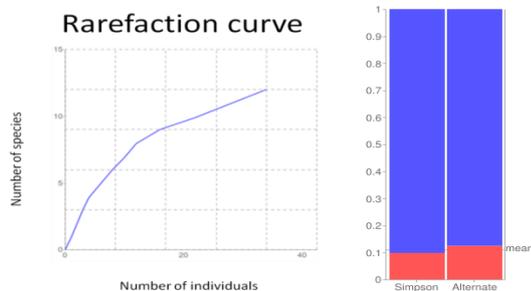


Fig. 5. a) Rarefaction curve and b) Simpson index of saturniids in Mt. Malambo.

Species richness rarefaction curve in Fig.5a shows that the slope did not reached plateau. This means that a large fraction of species remains to be discovered. This curve construction suggests more intensive sampling has to be done to yield additional species (Gotelli, 2001; Magurran, 2004). Shannon Diversity index for Saturniids in Mt. Malambo calculation generated by MVSP 3.22 is $H' \log_{10} = 0.978$ with an equitability index (E_H)=0.906. This value is below the Real ecosystem ranges between 1.5 and 3.5 (MacDonald, 2003).

However, Simpson diversity index (Fig. 5b) shows that diversity (D)= 0.875 and this value is close to 1 with evenness

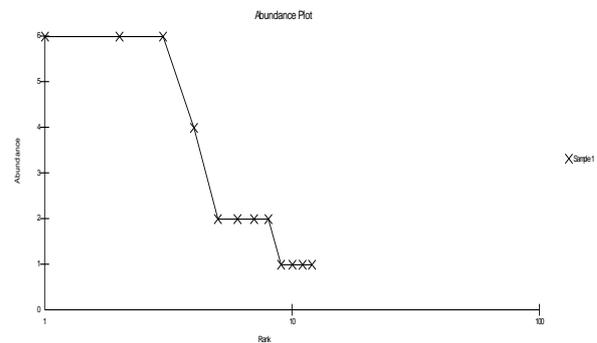


Fig. 6. Abundance plot (Rank) of Saturniids in Mt. Malambo, Marilog District, Davao City, Ph.

(E_D)= 0 .955 which means that diversity is not high diversity but good enough to infer richness (Maguran, 2004). Shannon Diversity index was higher on the Month of February where $H' = 0.954$ with N=11 species recorded and an evenness value $J' = 0.916$ compared to March with N=7 species, $H' = 0.802$ and evenness $J' = 0.949$. The Shannon values indicate that diversity in the area was low specifically in March. On the other-hand, Simpson index for February is $D = 0.870$ and $D = 0.826$ for the month of March which means diversity is still good. It was observed in Mt. Malambo that the moths attracted to light were more abundant after whole day 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 where there is low wind blow. This is probably because the weather affects the collecting of the samples and it would probably increase the species richness and abundance of the samples if we used higher intensity of light than 500W as more species will probably attracted. The observation in Mt. Malambo seemed to be consistent with the report of Jonason *et al* (2014) that species richness and abundance of moth catch through light trapping is influenced by light intensity, night temperature, humidity and time of the year. Furthermore Jonason *et al* (2014) observed that moth prefer warm nights. *Actias philippinica*, *Antherea halconensis* and *Attacus atlas* (Fig. 7 c) were the most dominant species comprising 17.6% each of all individuals caught (Fig. 6).

The two consecutive months shared 6 species, and out of total species recorded, four (4) species were found unique for the month of February, and only 1 species (*Anthereae paniki*) was recorded as unique for the month of March. During the Month of March is probably the emerging period for *A. paniki*. And the rest of the species recorded emerges on and between February and March when it is warmer.



Fig. 7. Some photos of Saturniids attracted to light *Samia luzonica luzonica* Fig. 7A, *Anthereae larissa philippirissa* Fig 7B, *Actias philippinica* Fig 7C.

Conclusion and Recommendation

There are 12 species of Saturniids in Mt. Malambo. Seventy five percent (75%) $N=9$ were locally rare with species individuals (n) >5 , and 25% $N=3$ of the species caught were common species with $n<5$. Sixty six (66%) ($N=8$) of the species caught were Mindanao Endemic, 16 % ($N=2$) were widely spread in South East Asian Countries, and 16% ($N=2$) which were reported as Island Endemic to Leyte (*Cricula luzonica leyteana* ssp) and Palawan (*Samia treadawayi*) can also be found in Mindanao. Therefore, these species are not island endemic. There are more species to be discovered based on the curve constructed by rarefaction. Diversity index is low ($H' \log_{10} = 0.978$) but Simpson diversity index value is close to 1 which means it is good ($D=0.875$). This suggests that environmental change would probably have serious effects and is likely to be damaging the ecosystem as a whole. The rarefaction result recommends intensive sampling to yield additional species. A whole year sampling and sampling at other regions for

comparative results and to know the species distribution at larger scale and also know which moth appears at which month/hour and what moths are abundant on each month at each hour with higher intensity of light is also recommended.

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