

## **INVENTORY OF INSECTS GROUPS IN GUNUNG LEDANG, JOHOR, MALAYSIA**

**Maryati Mohamed<sup>1</sup>, Maricel C. David<sup>1</sup>,  
Noor Asyikin bte Mohd Razali<sup>1</sup> and Fadhil Ahmad Rajini<sup>2</sup>**

<sup>1</sup>Faculty of Science, Technology and Human Development  
Universiti Tun Hussein Onn Malaysia, 86400 Pt. Raja,  
Batu Pahat Johor, Malaysia.

<sup>2</sup>Taman Hutan Lagenda, Taman Negara Johor, Gunung Ledang Johor.  
*Corresponding email: cehlcdavid@gmail.com*

### **ABSTRACT**

The objective of this study is to find out the viability and potential of insects to be promoted as nature tourism product in Gunung Ledang, Johor, Malaysia. Gunung Ledang is a tourism site and people visit Gunung Ledang to enjoy the mountain ambience, trekking and climbing. To add on to existing tourism packages, a research to study on the potential of another form of nature-based tourism was carried out; which is called Entotourism as it focuses on using insects as an attraction. In this study point count method were used to observed and record all insects and survey questionnaires to find out whether entotourism have potential in Gunung Ledang. Presenting, eight common insects groups are frequently found are: ants, butterflies, termites, dragonflies, moths, beetles, cicadas and damselflies. This paper then discussed how tourists perceived insects. A total of 151 visitors responded to the questionnaires and results showed that 90.1% of tourist found insects as attractive and 88.7% would want to visit insects in a natural habitat. Meanwhile 83.4% agreed that entotourism

has potential in Gunung Ledang and 86.8% stated that entotourism could attract international tourists to Malaysia. In addition, 60.9% of tourists are interested in entotourism and 72.2% would want to know more about insects. In this research we have shown that entotourism has potential to be developed at Gunung Ledang.

**Keywords:** Gunung Ledang, insects, entotourism, potentials

### ABSTRAK

Objektif kajian ini adalah untuk mengetahui daya maju dan potensi serangga untuk dipromosikan sebagai produk pelancongan alam semula jadi di Gunung Ledang, Johor, Malaysia. Gunung Ledang adalah sebuah laman web pelancongan dan orang melawat Gunung Ledang menikmati suasana gunung, trekking dan mendaki. Untuk menambah kepada pakej pelancongan sedia ada, satu kajian untuk mengkaji mengenai potensi satu lagi bentuk pelancongan berasaskan alam semulajadi telah dijalankan; yang dipanggil Entotourism kerana ia memberi tumpuan kepada penggunaan serangga sebagai tarikan. Dalam kaedah ini kiraan titik kajian telah digunakan untuk mengkaji dan merekodkan semua serangga dan soal selidik kajian untuk mengetahui sama ada entotourism berpotensi di Gunung Ledang. Hasil menunjukkan lapan kumpulan serangga biasa yang kerap ditemui ialah: semut, rama-rama, anai-anai, papatung, rama-rama, kumbang, cengkerik dan damselflies. Kertas kerja ini kemudiannya dibincangkan bagaimana pelancong dilihat serangga. Seramai 151 pelawat maklum balas kepada soal selidik dan keputusan menunjukkan bahawa 90.1% daripada pelancong didapati serangga sebagai menarik dan 88.7% akan mahu untuk melawat serangga dalam habitat semula jadi. Sementara itu 83.4% bersetuju bahawa entotourism berpotensi di Gunung Ledang dan 86.8% menyatakan bahawa entotourism dapat menarik pelancong antarabangsa ke Malaysia. Di samping itu, 60.9% daripada pelancong berminat untuk entotourism dan 72.2% akan ingin tahu lebih lanjut mengenai serangga. Dalam kajian ini, kita telah menunjukkan bahawa entotourism mempunyai potensi untuk dibangunkan di Gunung Ledang.

**Kata kunci:** Gunung Ledang, serangga, entotourism, potentials

## INTRODUCTION

Gunung Ledang is the highest mountain in Southern Peninsular Malaysia with the peak at 1,276 metres and has been rated the sixth most difficult mountain to climb in the country. It is located in the district of Ledang, Johor (Figure 1). This mountain had been gazetted as a Johor National Park on October 3<sup>rd</sup>, 2005. The size of the park is 8,611 hectares. Gunung Ledang has a legend that is associated with the mystical Puteri (Princess) Gunung Ledang (JNPC, 2012); the beautiful princess becomes a fairy and made her home in the mountain in 400BC (JNPC, 2012). In addition, according to Razak (2012) it is recognized that the legend of the Mount Ledang princess has great potential to be utilised in tourism promotion and the legend has the power to lure tourists.

Alfred Russel Wallace, a contemporary of Charles Darwin, and a fellow originator of the theory of evolution, in 1854 visited the mountain and he recorded the presence of diverse types of flora and fauna. During the visit he fell under the spell of her hypnotic beauty (JNPC, 2012).



**Figure 1.** Gunung Ledang is in the district of Ledang, in the north western party of the state of Johor, Peninsular Malaysia, (JPC, 2012).

Gunung Ledang or Mount Ophir (as it was called by the British), is partly in Malacca but its peak stands in Johor. Scaling the peak is not possible in one day, but it is worth following the steep tracks some of the way. The mountain is a popular spot for picnic and camping, with weekenders flocking to the Puteri Falls, one of the beautiful waterfall. The primary forest that blankets the mountain is especially rich in fauna and flora (Alexander, 2006).

There are various kinds of activities in Gunung Ledang that people will enjoy such as bird-watching, camping, swimming, biking and walking through the jungle, picnic by cascading waterfalls and flowing streams. It is also a place where people can learn about flora (plants) and fauna (wildlife and insects). A night walk is another favourite activity, where people can have a chance to see nocturnal species. Gunung Ledang is also an ideal venue for team-building exercise. Nature photography enthusiasts will also find a number of ideal subjects (e.g. flora and fauna) and scenic views (Asean Biodiversity, 2008). In addition, Gunung Ledang is a place for scientific expeditions where people come from different institutions to study the biodiversity and conserve the ecosystem.

The objectives of the study are: (1) to do inventory of insects species in Gunung Ledang, (2) to identify insect groups that have potential as nature tourism product in Gunung Ledang and (3) to study potential of entotourism in Gunung Ledang, Johor, Malaysia. With the main aim of investigating the potential of insects to be promoted as a tourism attraction, a study was carried out during 2011-2013.

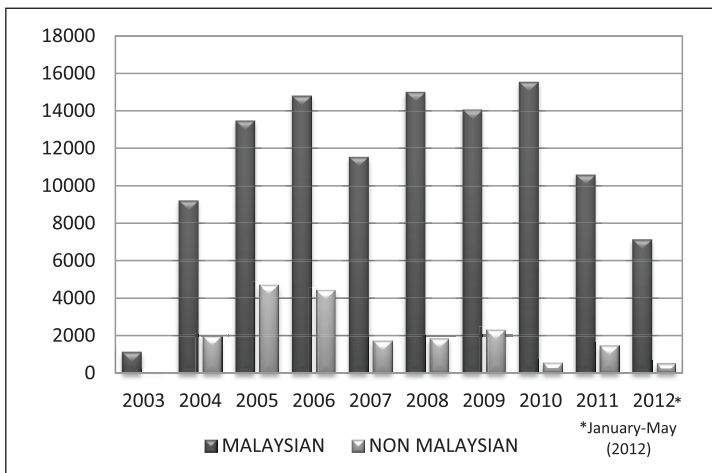
Information about biodiversity of Gunung Ledang gathered from staff of the PTNJ/JNPC (Johor National Parks Corporation) during the briefing for a student visit in March 2013, as well from other sources are summarized in Table 1.

**Table 1.** The species records in Gunung Ledang and from Malaysia (MONRE, 2007\*)

<b>Animals</b>	<b>Ledang/Malaysia (% in ledang)</b>
Mammals	34 species/286* (12)
Amphibian	9 species /158* (7)
Reptiles	10 species /268* (4.5)
Birds	204 species /736* (28)
Fish	9 species / 449* (2)

Compared to the present status of biodiversity in Malaysia, Mammals in Gunung Ledang accounts for about 12%. For birds there is higher representation of 28%, while fish is only 2%. For a relatively small area with restricting environment (being a highland) Gunung Ledang has something to offer for nature-interested tourist. Although, from the MONRE (2007) record there is about 150,000 species of invertebrates including insects (the world has about 1 million species), at the present moment there are lacking published record of insects from Gunung Ledang. While the presence of insects is apparent, it is surprising not to find published records of them, except for certain groups like cicadas (29 species) and ants (47 morphospecies) from recent seminar presentation during the 2<sup>nd</sup> September 2013 Seminar on Scientific Expedition of Gunung Ledang (Abstract book on An Expose of Biodiversity, 2013).

According to Gunung Ledang record (2012), Figure 2 shows the statistics for number of tourists of Malaysian and Non-Malaysian origin visiting Gunung Ledang. Gunung Ledang started operation from 2003 until present time. The graph shows that from the year 2003 until May 2012 the number of tourists visiting Gunung Ledang fluctuated. Another point is that Non-Malaysian visitors are comparatively very few about 0.2% - 0.9%.



**Figure 2.** Statistics of Tourist visited Gunung Ledang from the year 2003 to January until May 2012. (Gunung Ledang, 2012)

Maryati (2000) defines entotourism as *“one type of tourism where people leave home for at least a few days to spend elsewhere to see and enjoy the sights of insects and at the same time learning some aspects of the insect life”*. Insects are introduced as nature tourism product and promoted as an important organism group in the public education to increase awareness on conservation of environment (Maryati 2000).

Entotourism is not a totally new idea. As examples, there are several butterfly farms around the country, including Kuala Lumpur, Penang, Sabah, and the Cameron Highlands, which is known as the butterfly capital of Malaysia (Eliot and Bickersteth, 2002). For the record, there are 120 species of butterflies in Malaysia and more than 100 species are magnificently coloured (Eliot and Bickersteth, 2002).

In some other countries like China and Japan, insects like Odonata (dragonflies and damselflies), and rhinoceros beetles have a long history of being a part of recreation and tourism activities (Lemelin, 2009). In North America and Europe, dragonfly gathering like educational outings is also increasing in popularity (Lemelin, 2007). Odonata are also used as bio-indicators for wetland quality in Europe, Japan, The United States of America and Australia, and flagship species for certain tourism attraction (Lemelin, 2007).

## METHODOLOGY

To align to the subject matter, tourism, observations for insects present were carried out along a less visited tourist trail in the research site and during tourist active hours (from 8.00am to 12.30pm – and from 1.00pm – 5.30pm). However, as observed in the research, visibility of insects is depends on humidity, daylight and rains. Observations were carried out during these dates: April, 15-19<sup>st</sup> 2012; June, 10-15<sup>th</sup> 2012; October, 5, 8 & 10<sup>th</sup> 2012 and December, 20-24<sup>th</sup> 2012. For all these dates observations were carried out at two trails. In this paper results were only from the main, less visited trail (Figure 3).

### Visual observation

The visual observation method used was to determine kinds of insect mostly seen during the specific time of the day. This was done by

walking the 250 m tourist trail once in the morning session from A to B (4.5h) and then walking back from B to A in the afternoon session (4.5h) (Figure 5) in the first visit. In the second visit insects were observed B to A in the morning session and A to B in the afternoon session. The protocol was repeated during other visits.

From April 2012 to December 2012, 17 days were spent for visual observations (Table 2). All insects seen were recorded using the point count method.

**Table 2.** Table shows the duration of fieldwork for different months with the dates and duration of observation

Month	Days of observation	Date
*April	4 days	*15 to 19
June	5½ days	10 to 15
October	2½ days	5, 8 and 9
December	5 days	20 to 24

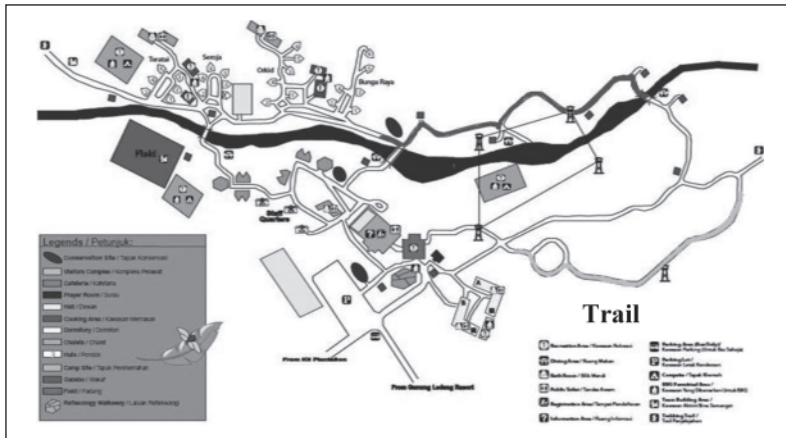
(Note: \*April, 15: observation carried out in afternoon session only (1/2day): April, 16-17 and 19: morning and afternoon session (3days) and April, 18 morning session only (1/2day) with a total of 4 days of observation

### Point count method

The tourist trail used is not a straight (Figure 3). The 250 m trail was divided into 20 m segments. Each of the 250 m trails was divided into 11 segments of 20 meters and the last segment of 30 meters. There were 13 counting points. Walking at a steady pace an observer will stop at each counting point and survey all insects seen within a circle of 10m radius around her for duration of 10 mins. All insects seen are noted into the datasheet. This observation was completed within 4.5hours in the morning and 4.5hours in the afternoon session. This method had been employed by Malim and Maryati (2000) in Tabin Limestone Scientific Expedition, Sabah.

### Data Collecting: Recording

In this research two methods were carried out on insects. Firstly insects were recorded and secondly insects were collected. Recording is to note types and frequency of occurrence of insects and done by writing down insect groups seen or observed along a trail into a



**Figure 3.** Tourist trail used at Gunung Ledang, Johor.

prepared datasheet. Collecting of insects samples or samplings were done whenever possible for insects like ants, termites and beetles along the trail. However, high flying insects such as butterflies, dragonflies and damselflies were not possible to catch and these were collected on separate occasions during December.

### **Insect Identification**

For identification of insects, references such as those by Yoshiaki, (2006); Corbet and Pendlebury, (1992); Lawrence and Britton, (1991) and Hill & Abang, (2010); Tho, (1992); Orr, (2005) and after specimens were cross-referred at Pusat Sistematik Serangga, UKM.

### **Questionnaire**

To obtain information on tourist perception of entotourism, a survey was carried on 151 tourist respondents. Interviews were conducted using questionnaires, prepared in both Malay and English language.

The type of survey questions used are closed-ended questions where respondents are allowed to choose one of the two answer choices, which are also called “dichotomous” (e.g. Yes or No). Another type of question is allowing respondents to choose one of many answer choices, which is also called “multi-chotomous” (Fisher and Foreit, 2002). The types of questions asked also have implications on the format of the response, which in turn has implications for the way in



which the data can be analyzed or answered. The survey was carried out from June 7, 2013 and September 1 to 2 & 21, 2013 on a total of 151 respondents.

### Data Analysis

Results are analyzed statistically by using Statistical Package for Social Science (SPSS) version 20.0 software, in order to get the frequencies, percentages and cross tabulation between some of the important elements in the questions.

## RESULTS

### Types of insects

In total, 17 days observation was done. The results show that generally insects such as Ants, termites, beetles, dragonflies, damselflies, butterfly, moth, and cicadas are available for most of the sampling periods. Some photograph of insects shown below. These insects were commonly seen during the specific time of the day which is 8:00am to 12:30pm and 1:00pm to 5:30pm. Table 3 shows the total number of individuals of insect groups observed visually along the tourist trail. In this study 1041 insect individuals were observed within the 17 days. Composition of insect groups (Table 4) showed that ants from the order Hymenoptera is most abundant. Next is the butterflies followed by termites and beetles. The three lesser abundant groups were the damselflies, dragonflies and cicadas.

**Table 3.** Total numbers of common insects species group from tourist trail in Gunung Ledang

Common group of Insects	No. of individuals	Percentage (%)
Ants	736	71
Butterflies	139	13
Termites	97	9
Beetles	22	2
Moths	18	2
Damselflies	12	1
Dragonflies	10	1
Cicadas	7	1
<b>Total</b>	<b>1041</b>	<b>100</b>

Table 4. Diversity of insects in Gunung Ledang

Common group of insect	Family	Species	No. of individuals
<b>Ants</b>			<b>736</b>
	Formicidae	<i>Camponotus gigas</i> <i>Polyrhachis</i> sp. <i>Diacamma</i> sp. <i>Odontomachus</i> sp. <i>Oecophylla smaragdina</i> <i>Anoplolepis gracilipes</i> <i>Crematogaster inflata</i> <i>Crematogaster</i> sp.	
<b>Butterflies</b>			<b>139</b>
	Nymphalidae	<i>Lexias dirtea</i> <i>Lexias pardalis</i> <i>Athyma nefte subrata</i> <i>Cirrochroa orissa</i> <i>Cirrochroa emalea</i> <i>Charaxes dumfordi</i> <i>Agatasa calydonia calydonia</i>	

Papilionidae	<i>Papilio (Princeps) palinurus palinurus</i> <i>Papilio (Princeps) iswara iswara</i> <i>Papilio memnon agenor</i> <i>Pachliopta (Losaria) neptunus neptunus</i> <i>Papilio (Princeps) polytes romulus</i>
Lycaenidae	<i>Jamides alecto ageladas</i> <i>Archopala athada athada</i> <i>Paralaxita orphan laocoon</i> <i>Zemeros emesoides emesoides</i>
Pieridae	<i>Eurema hecabe contubernalis</i> <i>Leptosia nina malayana</i>
Hesperiidae	<i>Celaenorrhinus ladana</i> <i>Eetion elia</i>
Termitidae	<i>Hospitalitermes medioflavus</i> <i>Hospitalitermes bicolor</i> <i>Hospitalitermes umbrinus</i> <i>Macrotermes carbonarius</i> <i>Odontotermes sp.</i>
<b>Termites</b>	<b>97</b>

Kalotermitidae	<i>Cryptotermes</i> sp.	<b>22</b>
Rhinotermitidae	<i>Schedorhinotermes sarawakensis (minor)</i>	
<b>Beetles</b>		
Cerambycidae	<i>Epepeotes lateralis</i> <i>Gnoma confuse</i>	
Scarabaeidae	<i>Xylotrupes gideon</i> <i>Anomala</i> sp. <i>Mimastra submetallica</i>	
Chrysomelidae	<i>Chabria angulicollis</i> <i>Mimastra submetallica</i>	
Elateridae	<i>Limoniscus violaceus</i>	
Erotylidae	<i>Episcapha 4-maculata</i> <i>Wiedemann</i>	
Histeridae	<i>Hololepta plana</i>	
Passalidae	<i>Odontotaenius disjunctus</i>	<b>10</b>
<b>Dragonflies</b>		
Aeshnidae	<i>Gynacantha basigitata</i>	

Libellulidae	<i>Orthetrum testaceum</i> <i>Orthetrum glaucum</i> <i>Zyxomma petiolatum</i> <i>Acisoma panorpiodes</i> <i>Orthetrum chrysis</i> <i>Orthetrum testaceum</i> <i>Orthetrum glaucum</i> <i>Trithemis festiva</i> <i>Trithemis aurora</i> <i>Neurothemis fluctuans</i> <i>Diplacodes trivialis</i>	12
Calopterygidae	<i>Vestalis</i> sp.	
Amphipterygidae	<i>Devadatta argyroides</i>	
<b>Moths</b>		18
Geometridae		
<b>Cicadas</b>		7
Cicadidae	<i>Purana ubina moulton</i> <i>Purana guttularis walker</i>	

### Ants (Order: HYMENOPTERA)

Ant is one of the most frequently encountered insect groups in Gunung Ledang with a total of 736 individuals. Some photographs are shown below:



(4a) *Camponotus gigas* is commonly known as giant ant because of the length which can reach about 30mm (3cm). *Camponotus gigas* can be found everywhere in Gunung Ledang and mostly foraging alone because of the giant size they can protect themselves and never afraid to forage alone. (5b) *Polyrhachis* is one of the larger groups of ants in Gunung Ledang and this species can easily recognised because of the round shape of abdomen and a lot of **spines**. The spine is to protect them from being attacked by predators. *Polyrhachis* can be found under the rock, leaf-litter and tree plant.



(4c) *Diacamma* or *Hunter Ant* is black in colour and has a unique petiole structure with the node armed dorsally with a pair of spines.

(4d) *Odontomachus* or well known as long-jaw or trap-jaw ants ant and it is commonly found in leaf litter and along visitors walking trail with the GPS coordinates of (N 02p20'34.3' E102p37'13.).

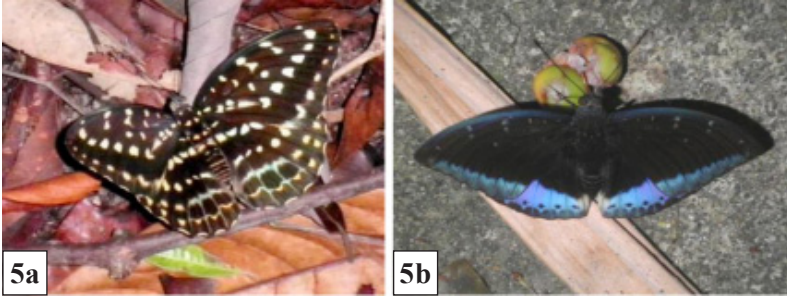


(4e) *Oecophylla smaragdina* has a distinctive orange body and commonly known as weaver ants. *Oecophylla smaragdina* are best known for their unique nest; constructed using tree leaves and using larval silk. (4f) *Anoplolepis gracilippes* is common ants and can be found everywhere and feeds almost anything found on the floor, such as fallen flowers, fruits, seeds, dead arthropods and carcasses of other animals.



*Crematogaster* is the heart-shaped gaster ants and known as acrobat ants because of their propensity to arc the gaster upward, (4g) *Crematogaster inflata* is black in colour with yellow metanotum.

### Butterflies and Moths (Order: LEPIDOPTERA)

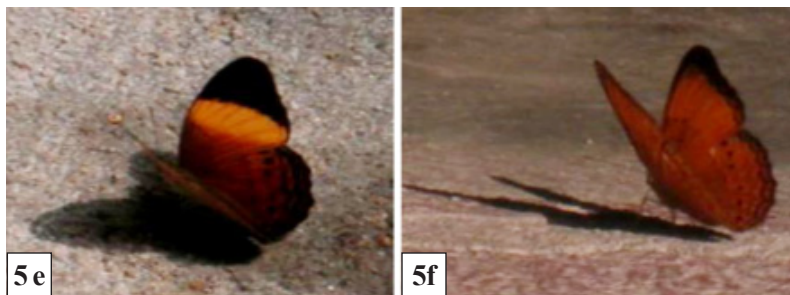


The Photograph shows (5a) the female *Lexias dirtea* resting on leaf-litter while (5b) is the male *Lexias dirtea* sucking the juice of the *fruit* through the proboscis. They are belonging to family Nymphalidae.



(5c) *Lexias pardalis* and (5b) *Lexias dirtea* are almost similar but the two species can be separated by the colour of their antennal club which is at the apical portion of (5c) *Lexias pardalis* is yellowish brown while (5b) *Lexias dirtea* is entirely black. (5d) Colour Sergeant is the common name of *Athyma nefte subrata* which can be seen on bright sunny day. The wings are marked with broad orange-brown stripes.





(5e) *Cirrochroa orissa* is commonly known as Banded Yeoman and is the commonest species of *Cirrochroa* in Malaysia. (5f) Malay Yeoman is the common name of *Cirrochroa emalea* found on the tourist walking trail near the river.



These are two magnificent species (5g) *Charaxes durnfordi durnfordi* (♂) coloured chestnut brown with pale grey lunulate markings in the blackened outer area on the forewing and (5h) *Agatasa calydonia calydonia* (♂) is yellowish white forewing and the bluish-white hindwing are broadly bordered with black are found on 40m to 60m trail.



(5i) The beautiful *Papilio (Princeps) palinurus palinurus* wings are black, green dusted band running from mid-costal on the forewing to mid-dorsum on the hindwing and (5j) male *Papilio (princeps) iswara iswara* has white patch on the hindwing. They are belonging to family Papiplionidae.



(5k) The colour of male *Jamides alecto ageladas* is purple blue with black border on the forewing and a series of spots on the hindwings with filament tail and belongs to Lycaenidae family while (5l) *Eurema hecabe contubernalis* underside wings has a dark brown markings and belongs to Pieridae family. These two species are common in Gunung Ledang flying near the visitor complex area.

### Termites (Order: ISOPTERA)



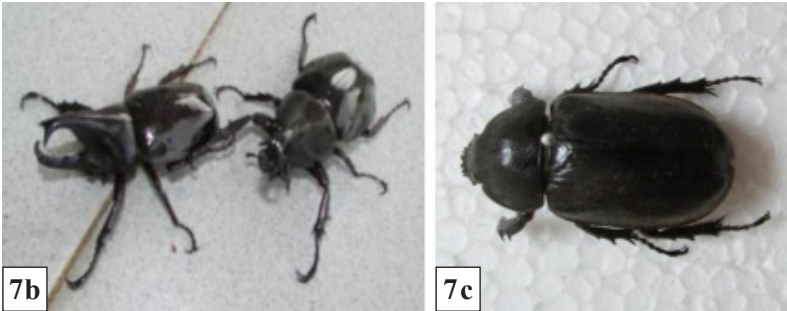
(6a) *Hospitalitermes medioflavus* is distinct in having a yellow abdomen and a dark chestnut brown head. (6b) *Macrotermes carbonarius* is coloured black, very large species with long mandibles.

### Beetles (Order: COLEOPTERA)

During the study collection of beetles in Gunung Ledang yielded 9 families, 12 genera and 10 species, most are morphologically intriguing. Some photographs are shown below.



(a) *Gnoma confuse* are with longhorn and oblong body. They are belonging to Cerambycidae family which is found on the segment 20-40m in Gunung Ledang.



(7b) *Xylotrupes gideon* male (7c) *Xylotrupes gideon* female belongs to Scarabaeidae family and subfamily Dynastinae and commonly known as rhinoceros beetles. The scarab beetles male has bearing horns while female has no horn.



(7d) *Anomala* sp. is a genus of Scarabaeidae and subfamily Rutelinae, which is usually brightly coloured and metallic and commonly known as leaf beetles.

(7e) *Mimastra submetallica* body is yellow in colour and moderately elongate from the family of Chrysomelidae and subfamily of Galerucinae.

### Dragonflies and Damselflies (Order: ODONATA)



Aeshnid are mainly medium sized to very large dragonflies. The **(8a)** *Gynacantha basiguttata* is common in forested swampy areas, hangs from low vegetation by day and flies at dawn and dusk. This species is one of the common species in Peninsular Malaysia.



**(8b)** *Orthetrum testaceum* one of the largest of the red dragonflies. This species is commonly found in open, disturbed habitats, including drains, ponds and gardens.

**(8c)** A blue male *Orthetrum glaucum*. Base on hindwing with well-defined dark brown patch, its margin rounded while the female is brown in colour with obscure ochre markings. Common in ditches and ponds in degrade open habitat.

### Cicadas (Order: HEMIPTERA)



(9a) Cicadas on the tree trunks during their molting time.

### Observation Time

Tourists generally visit during day time. Visibility of insects depends on humidity and daylight. In this research, insect observation times were (1) morning session (8.00 – 12.30PM) and (2) afternoon session (1.00 – 5.30PM) with about 4.5hours length of observation time for each session.

Total visits were four times and effort made shown in (Table 2); Table 3 shows the total 1041 insect individuals by time. To summarize, there is no general trend as to abundance of insects being seen in the morning and afternoon session. Insects can be seen at all time of the day. The difference being there are some more common and abundant groups of insects than others such as: ants, butterflies and termites.

**Table 5.** Total number of insects during the morning and afternoon session

Time	Ants	Butterfly	Termites	Beetles	Moths	Damselfly	Dragonfly	Cicadas	Total
8-12.30	430	67	47	16	6	3	6	3	<b>578</b>
1-5.30	306	72	50	6	12	9	4	4	<b>463</b>
Total	<b>736</b>	<b>139</b>	<b>97</b>	<b>22</b>	<b>18</b>	<b>12</b>	<b>10</b>	<b>7</b>	<b>1041</b>

The table 4 shows the total number of insects observed at the different 20m segment of the 250 m trail. The observation carried out of 17days with a total of 1005 insect individuals. Ants, butterflies and termites could be seen in each of every 20m segments, while beetles, dragonflies, damselflies and moths are commonly found in 20-60 m segments.

**Table 6.** Total number of insects from less visited trail by meter at each 20m segment

Meter	Ants	Butterflies	Termites	Beetles	Moths	Damselflies	Dragonflies	Cicadas	Total
0m-20m	42	10	4	1	1	0	0	0	<b>58</b>
20m-40m	42	24	7	9	1	5	2	0	<b>90</b>
40m-60m	60	14	23	4	2	1	3	1	<b>108</b>
60m-80m	65	10	3	1	2	0	0	1	<b>82</b>
80m-100m	53	17	2	0	3	0	0	0	<b>75</b>
100m-120m	52	8	11	1	1	0	0	0	<b>73</b>
120m-140m	55	15	15	1	1	0	1	0	<b>88</b>
140m-160m	63	11	9	0	1	0	0	0	<b>84</b>
160m-180m	50	7	8	4	2	0	2	0	<b>73</b>
180m-200m	44	3	4	0	2	1	0	1	<b>55</b>
200m-220m	56	5	1	0	1	0	2	0	<b>65</b>
220m-240m	73	4	1	0	0	0	0	1	<b>79</b>
240m-250m	63	7	3	0	0	1	0	1	<b>75</b>
<b>Total</b>	<b>718</b>	<b>135</b>	<b>91</b>	<b>21</b>	<b>17</b>	<b>8</b>	<b>10</b>	<b>5</b>	<b>1005</b>

Table 4 shows the highest numbers of insects by 20m segments is located in 40-60m segment with the GPS coordinates of (N 02p20'37.8" 'E 102p37'13.9") the area is covered with fallen trees on the trail (Figure 4a). Some beetles and termites can be found inside the bark of the trees, while ants crawling on the tree trunks, and the butterflies and dragonflies were flying around the area. This



typical scenario is easily seen perhaps because the trail is open area and surrounded by the big and small trees which can produce flowers and flowers can produce multiple florets that can then produce abundant nectar. A total of 108 insects individuals comprises of Ants with about 60 individual, termites with a total of 23 individual, and butterflies with a total of 14 individuals are encountered.

### **Potential of entotourism – do tourist like to see insects?**

The survey was conducted on June 7, 2013 and September 1-2 & 21, 2013 and carried out on 151 respondents. To gauge respondent perception on insects, they were asked to list down types of insects they saw in Gunung Ledang and where they see them. In addition, they were asked whether these insects attract their attention and finally to asked if they would like to get more information on these insects. The response was good. Most respondents (62.1%) noted ants; 48.3% noted butterflies, 34.5% noted termites, 29.3% beetles, 27.6% dragonflies and 20.7% mantis.

A 84.1% of the 151 respondents indicated that they are attracted to the insects and 72.2% of tourists would want to know more about insects. It seems that people going to Gunung Ledang although, not for the purpose of seeing insects are aware of the presence of insects and do want to know more about them.

In addition 84.1% of tourists stated they were attracted when they see insects such as butterfly, beetles, odonates, ants, termites, bee, grasshopper, cicadas and mantids or stick insects.

On the attraction factor, 69.5% thought colour is the main attraction, while for 32.5% stated size, 40.4% for sound and small 6.9% of respondents stated smell or odour.

At first impression 68.9% thought that insects are unique, while 37.1% thought insects are beautiful. About 27.2% thought insects are amazing while a small 7.3% stated dirty and 5.2% were ugly. 27.2% stated biological behaviour as an attraction factor.

This is further emphasised when 61% of tourists responded are interested in the concept of entotourism and 83.4% of tourist think that entotourism has potential in Gunung Ledang. About 86% indicated that entotourism can attract international tourist to Malaysia, and 90.1% of tourists agreed that insects are attractive creatures.



Tourist admitted that they would prefer to see live insects (93%) and 88.7% would like that to happen in natural setting like Gunung Ledang. In terms of participating by paying, there was a low response when 46% indicated they would be willing to pay from RM5-9 while 35% would be willing to pay RM10-19.

With regard to souvenir made from insects, 52.3% agreed to the idea while 47.7% disagreed. The amount they would be willing to pay for souvenir shows that some 44% will not buy, but below RM50, 53% will buy and a small 3% will buy between RM50 to RM100, while there is 1% still willing to spend above RM 150.

## DISCUSSIONS

### *a. Potential of entotourism*

As seen from results above, insect has potential to be a new nature tourism product. Kelvin *et al.*, (2006) adapting those from United Nation Development Programme (UNDP) listed seven criteria for good tourism products. They are; endemism, rarity, reliability of sightings, morphological attractiveness, behavioural enticement, safety and linkage to local cultures. The insect as a group comply with most of the criteria for good tourism product. Insects are generally safe, being small and mostly phytophagous (plant eaters). Insects at Gunung Ledang are reliable; able to be seen at time of day and at all locations. Thirdly, insects are unique being small but variable in its morphological characteristics as well as behaviour. Some insects are also associated with the culture of local people, whereby cicadas is a respected insect by the ethnic Jakun in Johor (Ghazali, *et. al.*, 2010). In addition, insects are important to people. In this aspect it will be good to point out that most insects are useful contrary to the common assumption that all insects are bad. Perhaps equally important is the fact that Gunung Ledang today is very much accessible and as such ants of Ledang are also accessible to tourists.

Based on people's opinion it is clear that people are interested in insects and are ready to learn more about them. Although very few are of the opinion there are ugly and nasty many do see their beauty and uniqueness.

Currently the number of tourist coming to Gunung ledang is relatively low. People come to enjoy the environment by trekking and climbing. Perhaps it timely that their attention is diverted to another form of tourism that will educate them on another group of living things in the world. Especially for younger adults and children, using insects would make them wonder further on to other animal groups, both in terms of diversity and importance. Secondly the number of foreign tourist to Gunung Ledang has been low. By diversifying tourism products, in this case using insects, we believe that more specialized and inquisitive international tourist would be attracted to visit Gunung Ledang.

In most cases local people living around an area would have better idea of organisms and interactions with organisms around them. In this case the local ethnics indigenous to Gunung Ledang, the Temuan could be providing their services in doing entotourism. When guiding tourist, these ethnics could also be relating insects to their culture and this would enhance tourist knowledge on the richness of the culture. In turn local entotourism could be seen as an alternative livelihood for the local ethnics.

Eventually, financial gain through entotourism could be providing some financial resource needed to maintain and conserve the biodiversity.

## CONCLUSIONS

Gunung Ledang is of national and international importance – economic as well as heritage values. Being covered with lowland, hill and submontane forest, this ecosystem is rich in biodiversity, performing different ecological functions. Conservation of biodiversity can comes in different approaches – like establishing the uniqueness and importance of insects and providing for needs of people to know more about insects. Entotourism has potential to be developed at Gunung Ledang and this may further contribute to the overall management of the park, eventually leading to a better conserved protected area. Knowing the importance of insects would provide basis for their protection and conservation. Bringing in local ethnics to organize entotourism would enhance local economy and provide for the alternative livelihood for them.

## ACKNOWLEDGEMENT

Universiti Tun Hussein Onn Malaysia (Vot. C030 Biodiversity of Fauna) for the funding provided to participate in the conference and the scholarship to study. Johor National Parks Corporation for allowing us to carry out our research in Lagenda National Park (*Taman Negara Lagenda*), Ledang and to all the staff who helps us during the fieldwork. Nature photographer, Mr. Jeffrey Siow for some of the photographs used in the paper.

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