



Faculty of Resource Science and Technology

**The Stag Beetle (Coleoptera: Lucanidae) Assemblages  
of Sarawak Based on Museum Collections**

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Bachelors of Science with Honours  
(Animal Resource Science and Management Programme)  
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THE STAG BEETLE (COLEOPTERA: LUCANIDAE) ASSEMBLAGES OF SARAWAK  
BASED ON MUSEUM COLLECTIONS

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This project is submitted in partial fulfillment of the requirements for the degree of Bachelor  
of Science with Honours  
(Animal Resource Science and Management)

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15<sup>th</sup> of May 2017

UNIVERSITI MALAYSIA SARAWAK

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Final Year Project Report

Masters

PhD

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# The Stag Beetle (Coleoptera: Lucanidae) Assemblages of Sarawak Based on Museum Collections

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## ABSTRACT

Fundamental knowledge on most insect taxa of Borneo are still very much lacking despite challenges faced because of the degradation of their natural habitats, the rainforest. Compiling data on the assemblages of stag beetles in Sarawak is important for conservation efforts, as collecting information on the biodiversity of a region must be carried out to initiate an effective conservation plan. This study examined the stag beetle (Coleoptera: Lucanidae) assemblages of Sarawak as well as providing an annotated checklist based on specimens deposited at the Universiti Malaysia Sarawak (UNIMAS) Insect Reference Collections and Forest Research Centre, Kuching. Each specimen was examined based on morphological characteristics. A total of 658 specimens representing one subfamily, five tribes, 15 genera and 38 species were studied. The most common species of stag beetle in Sarawak is *Prosopocoilus occipitalis* with a wide range of localities and the three extremely rare species are *Neolucanus muntjac* Gestro, 1881, *Aegus krieschei* Nagel, 1928 and *Aegus rungusiorum* Ikeda, 2000. An annotated checklist for each species is presented. This study shows that base-line information on insects such as the stag beetle species assemblages could be retrieval from museum systematics collections.

**Key words:** stag beetle, assemblages, Lucanidae, Sarawak, annotated checklist.

## ABSTRAK

*Pengetahuan asas mengenai kebanyakan taxa serangga di Borneo masih banyak yang belum diketahui di samping cabaran yang dihadapi disebabkan oleh kemusnahan tempat tinggal semulajadi mereka, iaitu hutan hujan. Pengumpulan data mengenai kumbang sepi di Sarawak adalah penting sebagai usaha pemuliharaan, kerana pengumpulan maklumat ini akan membantu ke arah pelan pemuliharaan yang efektif. Kajian ini memfokuskan himpunan kumbang sepi (Coleoptera: Lucanidae) di Sarawak dan menyediakan senarai semak berilustrasi berdasarkan sampel yang disimpan di Universiti Malaysia Sarawak (UNIMAS) Insect Reference Collections dan Forest Research Centre, Kuching. Setiap spesimen dinilai berdasarkan ciri morfologi. Sebanyak 658 spesimen yang mewakili satu subfamili, lima tribus, 15 genera dan 38 spesies telah dinilai. Spesis kumbang sepi yang paling banyak ditemui di Sarawak ialah *Prosopocoilus occipitalis* dengan kadar taburan yang luas dan tiga spesis yang paling jarang ditemui ialah *Neolucanus muntjac* Gestro, 1881, *Aegus krieschei* Nagel, 1928 dan *Aegus rungusiorum* Ikeda, 2000. Senarai semak berilustrasi telahpun disediakan. Kajian ini menunjukkan informasi garis asas bagi serangga seperti himpunan spesis kumbang sepi boleh didapati daripada koleksi sistematik muzium.*

**Kata kunci:** kumbang sepi, komposisi, Lucanidae, Sarawak, senarai semak berilustrasi.

## Table of Contents

Declaration	i
Acknowledgements	ii
Abstract	iii
Table of Content	iv
List of Tables	v
List of Figures	vi
List of Abbreviations	vii
<b>CHAPTER 1: INTRODUCTIONS</b>	<b>1</b>
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1 Classification and distribution	3
2.2 Previous studies	5
2.3 General biology	6
2.4 External structure	7
2.5 Life cycle	8
<b>CHAPTER 3: MATERIALS AND METHOD</b>	<b>9</b>
<b>CHAPTER 4: RESULTS AND DISCUSSION</b>	
4.1 Species composition	10
4.2 An account of the stag beetles of Sarawak	16
<b>CHAPTER 5: CONCLUSION</b>	<b>45</b>
<b>CHAPTER 6: REFERENCES</b>	<b>46</b>
<b>CHAPTER 7: APPENDICES</b>	<b>48</b>



## List of Tables

<b>Table</b>	<b>Title</b>	<b>Page no.</b>
Table 1	The number of stag beetles species recorded in Sarawak based on museum collections from 1982-2015	11
Table 2	Total number of Lucanidae specimens examined from each repository: UNIMAS Insect Repository and Forest Research Centre	13-14
Table 3	Checklist of Sarawak Stag beetle species based on Checklist Taxa of Borneo (Tung, 2016)	53-58

## List of Figures

<b>Figure</b>	<b>Title</b>	<b>Page no.</b>
Figure 1	<i>Odontolabis dalmani</i> .	7
Figure 2	Relative abundance of the stag beetle species as reflected in the number of specimens in the insect collections studied as of February 2017.	15
Figure 3	<i>Neolucanus muntjac</i> recorded in Lambir Hill.	16

## List of Abbreviations

UNIMAS	Universiti Malaysia Sarawak
IUCN	International Union for Conservaton of Nature
km <sup>2</sup>	kilometre square
ICZN	International Code of Zoological Nomenclature
SFD	Sarawak Forestry Department
cm	centimetre
mm	millimetre
%	percent
♂	male
♀	female
LDF	Lower Dipterocarp Forest
HDF	Hill Dipterocarp Forest
MF	Montane Forest

## **1.0 Introduction**

Vast amount of biological and ecological information could be acquired from museum collections preserved over the years. Nevertheless, the importance of museum materials are often belittled and ignored as they are sometimes considered as of low scientific values, likened to stamp collections. Indeed these materials are of great importance and contribute to the retrieval of fundamental biological and ecological information of local and regional fauna as stored on these collections, specimen and labels.

Fundamental knowledge on most insect taxa of Borneo are still very much lacking despite challenges faced because of the degradation of their natural habitats, the rainforest. The task to document local insect faunas will be such an enormous effort which possibly renders as an unfinished business. Despite that, fundamental studies in gathering base-line information are still possible. Base-line biological and ecological information on these species could be retrieved from museum systematic collections. These could subsequently be employed in a rapid assessment of their species assemblages and diversity. Results from such studies should not belittled as they contribute to our knowledge on the species assemblages of the studied fauna. This information could eventually contribute to our knowledge on the status of our biodiversity data as exploitation of natural resources and disturbance of their natural habitats continues.

One of the groups of insects which are of interest to many researchers worldwide is the stag beetles of the family Lucanidae. The world fauna of this beetle is well studied. Nevertheless, the stag beetle fauna of Borneo still awaits much study. Besides Tung (2016), not much is known of the stag beetles of Sarawak.

In Europe, the stag beetles are classified as endangered or protected and has been included in Annex II of the EC Habitats Directive and is classed as a 'European Protected Species'. Their status under IUCN is 'near threatened' in 2010 across Europe. This analysis can only be done with the presence of complete taxonomic checklist for the area of study. Hence, local faunistic studies of this group are necessary and very much needed.

The objectives of this study were as follows:

1. To study the assemblages of the stag beetle fauna in Sarawak.
2. To present an annotated checklist of the stag beetles of Sarawak.

## **2.0 Literature Review**

### **2.1 Classification and Distribution**

The beetles from the order Coleoptera is the largest group of insects comprising over 350,000 species worldwide. The stag beetles from the family Lucanidae is relatively a small family with about 1,500 described species throughout the world (Didier & Seguy, 1953; Benesh 1955; Bartolozzi 1989; Holloway 2007 and Paulsen 2013). They are easily adaptable in most environmental conditions and hence, they form a rich component of biodiversity, particularly in the tropics.

Members of this family have distinguishable characteristics such as large mandibles, robust body, clubbed and often geniculate antennae. Males are often hornless but bear a large mandible that make them easily recognised. Male stag beetles use their large mandible to attract female and excavate home in rotting logs.

There are 228 described species from two subfamilies (i.e. Aesalinae and Lucaninae) in Malaysia, Singapore and Borneo (Tung, 2016). However, documentation on the stag beetle species in Malaysia and Sarawak are still lacking and not widely reviewed (Lawrence & Newton, 1995).

The stag beetles can be found globally (Lawrence & Newton, 1995; Holloway, 2007; Araya, 2011). However, like any other insect fauna, their species assemblages are different in different geographical regions. Globally, the Lucanidae is represented by seven subfamilies, namely Aesalinae, Nicaginae, Syndesinae, Lampriminae, Penichrolucaninae and Lucaninae (Lawrence & Newton, 1995 and Holloway, 1960). Aesalinae consists of the tribe Aesalini while the subfamily Lucaninae consists of seven tribes, namely Figulini,

Nigidiini, Odontolabini, Allotopini, Cyclommatini, Lucanini and Aegini. In Malaysia, two subfamilies are known, namely Aesalinae and Lucaninae (Smith, 2006).

The family Lucanidae is currently known to consist of 43 genera throughout Peninsular Malaysia and Borneo (Tung, 2016). In Peninsular Malaysia, there are 113 species recorded while Borneo is represented by 182 species. Both Peninsular Malaysia and Borneo are known to share 67 species out of the total of 228 known to occur in both Peninsular Malaysia and Borneo (Tung, 2016).

There are several similar species between Peninsular Malaysia, Borneo and Singapore because in the past, the Malay Archipelago (Malay Peninsula, Borneo, Sumatra and their satellite island including Palawan and Balabac) were united in a continent named Sundaland (Huang and Lin, 2010). Before the land separation occurred, local beetle fauna used to distribute evenly during scavenging or feeding on food plants. (Tung, 2016) Similarity in most of forest type (secondary forest and peat-swamp forest) and climate (hot and wet all-year-season) are also known as another contributing factors (Jensen and Das, 2008).

Borneo is made up of 73% Indonesia, 26% Malaysia and 1% Brunei (Tung, 2016). Malaysia is known as home to the oldest rainforest and listed as one of mega-diversity countries in the world. In South-east Asia, Sarawak stores a huge area of primary dipterocarp forest (near 1 billion km<sup>2</sup>) and the “Heart of Borneo” is also located in Sarawak. This type of forest is not only the habitat for more than 2,000 species of trees and plants; it also has a diverse range of animal and insects (WWF, 2009). Continuous

human disturbance, deforestation, glaciation and deformation of Sundaland should have effect on the population dynamics (Holloway, 1972 and Kim and Farewell, 2015). Thus, better understanding on the effect of forest disturbance and mitigation plan to conserve should be achieved through conducting more studies.

## **2.2 Previous Studies**

There are several local and international studies and articles published on Lucanidae as early as 1980's until today. Hill and Abang (2010) discussed on distinctive features of Lucanidae in Borneo. Some highlighted local species are *Cladognathus giraffa*, *Cyclommatus tarandus* (today is known as *Cyclommatus (C.) rangifer*), *Eurytrachelus titanus* which was recognised as the largest species living in Sarawak (7 cm), *Odontolabis* spp., *Prosopocoilus biplagiatus* and others. They also agree on the facts that habitat preference of Lucanidae is in rotting trees or roots and they feed on nectar, tree sap and fruit flowers.

The “Stag Beetles (Coleoptera: Lucanidae) of Peninsular Malaysia, Singapore and Borneo (with a complete taxonomic checklist)” by Tung (2016) is another informative reference to the stag beetle of Borneo. Most of the content in this book is primarily based on his own yearly observation. In this book, the author is discussing on history and taxonomic work, geography and climate, identification, biology, collecting and studying, nomenclature, rearing and breeding in captivity, localised distribution and species checklist from Peninsular Malaysia and Borneo with illustrations of all the species found there.

Harvey *et al.* (2011) published a paper on “Bionomics and distribution of the stag beetle *Lucanus cervus (L.)* across Europe”. Method of study is by contacting 41 researchers from



all countries and compiling data on various life history and body length of the chosen species. They conclude that population of stag beetle has been decline in all over Europe mostly due to habitat loss.

Lawrence and Newton (1995) in their published paper entitled “Families and Subfamilies of Coleoptera (with selected genera, notes, reference and data on family-group names)” states that there has been no attempt to review and document the names of all beetle families and subfamilies since the introduction of formal rules governing such names into the International Code of Zoological Nomenclature (ICZN 1961). This fact then supported by Kim and Farrell in 2015 through their paper; “Phylogeny of world stag beetle (Coleoptera: Lucanidae) reveals a Gondwanan origin of Darwin’s stag beetles”. This paper emphasised that there has been almost no study of lucanid relationship and evolution, even though stag beetle is one of earliest branching lineages of scarab beetles.

### **2.3 General Biology**

As mentioned in Tung (2016), adult of stag beetle is slow moving and nocturnal. Sometimes, they can also be found during the day in wet and humid environment. They prefer cool, damp habitat and not only found in thick primary jungle but also at montane forests (500-2000 m) (Holloway, 2007; Abang, 2010; Tung, 2016). Adults consume overripe fruits such as banana, starfruits, guava and soursop. Most species can be collected all year round, while some species such as *Allotopus mollenkampii*, *Rhaetulus didieri* and *Echinoaesalus* sp. are seasonal and can be found in very specific condition (Tung, 2016).

## 2.4 External Structure

Obviously, stag beetle can be distinguished by their characteristic mandibles. Males usually have larger mandibles for scavenging food, suitable for in-wood habitat and mating. The most upper part of the body is called mentum. There lies eye (ocelli), antenna, flagellum, head and mouthparts (Benisch, 2007). Besides their characteristic mandibles, Lucanidae can also be differentiated by having antennal club with 3-8 segments and a large pronotum (Figure 1). The larvae are usually scarabaeiform (C-shaped).



Figure 1: *Odontolabis dalmani* (Hope & Westwood, 1845)

## 2.5 Life Cycle

Lucanidae starts their life as egg or ova which usually can be found at rotten logs, fallen trees or rotten roots and tree stumps (Hill & Abang, 2010; Tung, 2016; Holloway, 2007). After that the egg will hatch into larvae and consume soft core of trees until they reach

adult. However, before they turn into third and last instar (hardened elytra) the larva will moult twice. After that the insect will not grow anymore as they have accomplished a complete growth. These life phase is called complete metamorphosis. Studies on the life cycle of the stag beetles is still lacking in Malaysia. Generally, stag beetle are economically known as agricultural pest as they cause damage to plant, especially flower and flower stalks (Schenk, 2006).

### **3.0 Materials and Method**

This study was based on voucher specimen deposited at two repositories in Kuching, Sarawak that are Sarawak Forest Department (SFD) and the Insect Reference Collection of the Faculty Resource Science and Technology Museum, UNIMAS.

SFD is a government organization which is located at Jalan Datuk Amar Kalong Ningkan, Kuching, Sarawak. Insect Reference Collection of the Faculty of Resource Science and Technology was established in 1995. It is located at the first floor of Faculty of Resource Science and Technology, UNIMAS. There are various entomological collection were collected there.

From these voucher specimens, data such as locality, collecting date and collector's name were recorded. The total number of each stag beetles also has been counted. The morphological characteristics of each species were described based on the observation. Thus, observation through compound microscope or using magnifier also has been applied in order to get detailed information of their characteristics. All individual of the stag beetles were examined to measure their total length using 15 cm ruler.

Description were based on the morphological characteristics such as its general appearance (size, shape and colour) and the form of various body part (antennae, mandibles, legs, wings, bristles, mentum and pronotum) were then described and recorded. Information on diagnostic characteristics used for identification of specimens were based on Tung (2016) and Hill & Abang (2010). Then, annotated checklist of all the species were constructed based on the morphological characteristics of voucher specimens. Representative for each

species were photographed using Nikon D3100 lens kit 18-55 mm 1:3.5-5.6 G. Eventually, data for all the specimens were recorded according to sex, locality, date collected (day/month/year) and collector in a database.

## 4.0 Results and Discussion

### 4.1 Species Composition

Overall, both repositories studied hold a total of 658 specimens of stag beetles collected over the last 34 years in Sarawak from 1982-2015. All of the specimens are well preserved and represent the stag beetles species assemblages occurring in various forest types in Sarawak. As revealed by this study, the Lucanidae of Sarawak comprised of one subfamily, five tribes, sixteen genera and thirty eight species (Table 1). The tribe Lucanini is the most speciose tribe comprising of 60.47% (398 individuals) of the total representation of these beetles in Sarawak followed by the tribe Odontolabini (33.73%) and Aegini (17.35%). Tribe Lucanini is the most speciose tribe because it covers wide number of genera and species. So, the probability to be the most speciose tribe is high.

The tribe Lucanini is represented by eight genera, namely *Hexarthrius*, *Prosopocoilus* (*Metopodontus*), *Prosopocoilus* (*Hoplitocranum*), *Prosopocoilus* (*Cyclotropus*), *Prosopocoilus* (*Prosopocoilus*), *Prosopocoilus* (*Macrodorcinus*), *Serrognathus* (*Serrognathus*), *Serrognathus* (*Eurythraceilus*) and *Dynodorcus*. Among all, the most dominant genus is *Prosopocoilus* with three species and thirty individuals represented.

Table 1: The number of stag beetle species recorded in Sarawak based on museum collections from 1982-2015

Subfamily	Tribes	No. of Genus	No. of Species	No. of Individuals	Percentage (%)
Lucaninae	Nigidiini	1	1	1	0.15
	Odontolabini	2	10	222	33.73
	Cyclommatini	1	5	23	3.5
	Lucanini	8	13	398	60.47
	Aegini	3	9	114	17.35
<b>Total</b>	<b>5</b>	<b>15</b>	<b>38</b>	<b>658</b>	<b>100</b>

The tribe Odontolabini is represented by two genera, namely *Odontolabis* and *Neolucanus*. Among all, the most dominant genus is *Odontolabis* with eight species and one hundred and thirty-three individuals represented.

Aegini is represented by three genera, namely *Aegus (Gnaphaegus)*, *Aegus (Aegus)* and *Aegus (Tumidaegus)*. Among all, the most dominant genus is *Aegus (Aegus)* with five species and eight individuals represented.

Nigidiini is the tribe with the least species. It represented by only one individual of *Calcodes aeratus* from the genus *Calcodes*. There is also no data on locality and date collected on the specimen. According to Tung (2016), Nigidiini tribe especially *Calcodes aeratus* can be easily found in lowland dipterocarp forest to upper hill dipterocarp forest. Although the status of occurrence for this tribe is common, the rare number of specimens from this study may indicate that they are not as common as previously reported.

Most of the specimens are found in the FRC compared to the UNIMAS Insect Collections as the UNIMAS collections are more recent in establishment compared to FRC (Table 2). The FRC Collection has a much larger insect holdings compared to that of UNIMAS Insect Collections because of the ongoing Lambir Canopy Biology Program in Sarawak by the Center of Ecological Research, Kyoto University since July 1992 until now. All their collections are deposited at the Forest Research Centre.

Table 2: Total number of Lucanidae specimens examined from each repository: UNIMAS Insect Repository and Forest Research Department in 2017

Species	Total no. of Specimens		
	UNIMAS	FRC	Total
Genus <i>Calcodes</i> Westwood, 1834			
<i>C. aeratus</i> Hope, 1834	0	1	1
Genus <i>Odontolabis</i> Hope, 1842			
<i>O. alces</i> Fabricius, 1775	0	9	9
<i>O. brookeana</i> Snellen von Vollenhoven, 1861	0	12	12
<i>O. chewi</i> Schenk, 2003	0	1	1
<i>O. dalmani</i> Hope & Westwood, 1845	1	93	94
<i>O. femoralis</i> Waterhouse, 1887	2	0	2
<i>O. gazella</i> Fabricius, 1787	1	0	1
<i>O. latipennis</i> Hope & Westwood, 1845	0	1	1
<i>O. leuthneri</i> Boileau, 1897	0	14	14
Genus <i>Neolucanus</i> Thomson, 1862			
<i>N. muntjac</i> Gestro, 1881	0	6	6
Genus <i>Cyclommatus</i> ( <i>Cyclommatus</i> ) Parry, 1864			
<i>C. (C.) titanus</i> Nagel, 1936	0	1	1
<i>C. (C.) canaliculatus</i> Ritsema, 1891	3	5	8
<i>C. (C.) chewi</i> Mizunuma, 1994	0	1	1
<i>C. (C.) lunifer</i> Boileau, 1985	0	1	1
<i>C. (C.) rangifer</i> Schonherr, 1817	6	6	12
Genus <i>Hexarthrius</i> Hope, 1843			
<i>H. mandibularis</i> Deyrolle, 1881	0	17	17
Genus <i>Prosopocoilus</i> ( <i>Metopodontus</i> ) Westwood in Hope, 1845			
<i>P. M. astacoides</i> Hope, 1840	0	10	10
Genus <i>Prosopocoilus</i> ( <i>Hoplitocranum</i> ) Jokowlew, 1896			
<i>P. H. attenuates</i> Parry, 1864	0	2	2
<i>P. H. flavidus</i> Parry, 1862	0	1	1
Genus <i>Prosopocoilus</i> ( <i>Cyclotropus</i> ) Oberthur & Houlbert, 1913			
<i>P. C. occipitalis</i> Hope & Westwood, 1845	31	158	189
<i>P. C. sericeus</i> Westwood, 1844	0	11	11
Genus <i>Prosopocoilus</i> ( <i>Prosopocoilus</i> ) Westwood, 1845			
<i>P. P. buddha</i> Hope, 1842	0	2	2
<i>P. P. forceps</i> Snellen von Vollenhoven, 1861	0	15	15
<i>P. P. zebra</i> Olivier, 1789	1	12	13
Genus <i>Prosopocoilus</i> ( <i>Macrodorcinus</i> ) Maes, 1990			
<i>P. M. tigrinus</i> Didier, 1928	0	133	133
<i>P. M. passaloides</i> Hope & Westwood, 1845	0	1	1
Genus <i>Serrognathus</i> ( <i>Serrognathus</i> ) Motchulsky, 1861			
<i>S. S. titanus</i> Boisduval, 1835	0	1	1
Genus <i>Serrognathus</i> ( <i>Eurythracelus</i> ) Thomson, 1862			
<i>S. E. reichei</i> Hope, 1842	0	2	2



**Table 2 (contd.)**

Genus <i>Dynodorcus</i> Didier, 1931			
<i>D. curvidens</i> Hope, 1840	0	1	1
Genus <i>Aegus</i> ( <i>Gnaphaegus</i> ) Maes, 1992			
<i>A. G. krieschei</i> Nagel, 1928	0	1	1
<i>A. G. squalidus</i> Hope & Westwood, 1845	0	1	1
Genus <i>Aegus</i> ( <i>Aegus</i> ) W. S. MacLeay, 1819			
<i>A. A. acuminatus</i> Fabricius, 1801	1	2	3
<i>A. A. acutangulus</i> Nagel, 1941	0	1	1
<i>A. A. impressicollis</i> Parry, 1864	1	1	2
<i>A. A. punctipennis</i> Parry, 1864	1	0	1
<i>A. A. rigouti</i> Nagai, 1994	1	0	1
Genus <i>Aegus</i> ( <i>Tumidaegus</i> ) Bomans, 1988			
<i>A. T. dusunorum</i> Ikeda, 2003	0	1	1
<i>A. T. rungusinorum</i> Ikeda, 2000	1	0	1
<b>Total</b>	<b>50</b>	<b>608</b>	<b>658</b>

The most abundant species among all 38 species was *Prosopocoilus* (*Cyclotropus*) *occipitalis* Hope & Westwood 1845, with a total of 189 individuals recorded in both repositories. *Prosopocoilus* (*Cyclotropus*) *occipitalis* is very common and has a wide distribution in many countries. Their localities in Sarawak are widespread from Belaga to Kota Samarahan. They are collected from various localities such as Belaga, Bintulu, Lambir, Kuching, Kota Samarahan and Similajau. Due to its easily adaptive characteristic, *P. (C.) occipitalis* comes in great number among the other species.

The second highest abundant species is *Prosopocoilus* (*Macrodorcinus*) *tigrinus* with 133 individuals. However, not much is known about this species. To date, *P. (M.) tigrinus* is known to only occur in the Crocker Range, Sabah (Tung, 2016). During this survey, all 133 individuals of *P. (M.) tigrinus* are found in Lambir Hills National Park. This is a new finding for the locality of *P. (M.) tigrinus* other than the Crocker Range.

*Odontolabis dalmani* was the third highest for the most abundant species (93 individuals). This species is very variable in mandible shapes (Tung, 2016). Even though there will be some differences in mandible pattern, as long as their mentum and pronotum is dull black and elytra is shiny, they are still considered as same species with different subspecies (Tung, 2016).

So far, only these three species had recorded a significant high value while others are found in below 50 individuals (Figure 2).

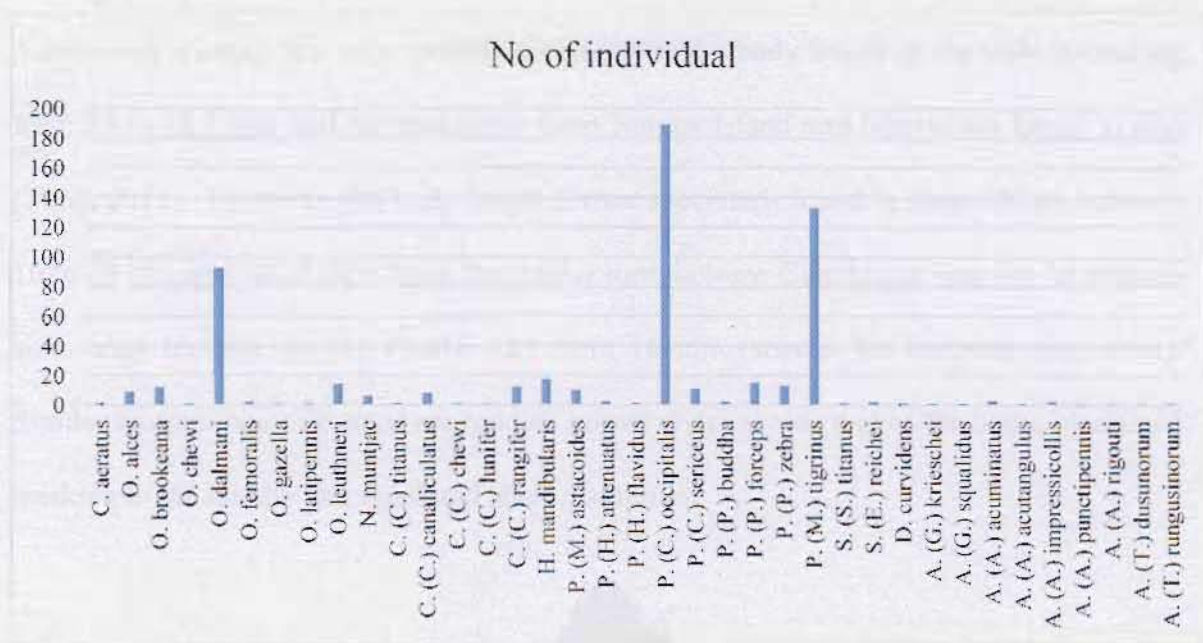


Figure 2: Relative abundance of the stag beetle species as reflected in the number of specimens in the UIRC and SFD studied as of February 2017.

All species recorded in Sarawak were from the tribe Lucaninae. Tung (2016) reported that there are some species recorded and found in Sarawak but were not encountered during the museum survey. For example *Figulus quasismilis*, *F. concatenates*, *F. serratus* and *F. sarawakensis*. The absence of these species in the collections studied was possible due to

their rarity in occurrence. *Figulus* species has very small mandibles and striated elytra. They can be easily misidentified as Passalidae.

From the 38 species found in Sarawak, 24 species could be considered as common species, 11 as rare species while three species as extremely rare species. The three extremely rare species are *Neolucanus muntjac* Gestro, 1881 (6 individuals), *Aegus Gnaphaegus krieschei* Nagel, 1928 (1 individual) and *Aegus Tumidaegus rungusiorum* Ikeda, 2000 (1 individual). All of them are found in Lambir Hills in northern Sarawak.

*Neolucanus muntjac* is a very variable species, with the body length of the male measuring from 25 to 28.5 mm and representative from Natuna Island and Siberut are larger in size (Tung, 2016). However, the body length for six specimens found in Sarawak are between 16 to 28 mm and all of them have the similar morphology. Conclusion that can be made is size range for this species should start from 16 mm (special for Sarawak specimens). Similar morphologies detected are reddish brown elytra at side end of the body, blackened marking in the middle and small and short mandibles.



Figure 3: *Neolucanus muntjac* recorded from Lambir Hills

Appendix 1 shows a total of 38 species are found in Sarawak out of 183 Lucanidae species reported in Borneo (Tung, 2016). On the other hand, 20.22% from the list of Bornean species are reported from Sarawak as of May 2017. Sarawak as the 'Heart of Borneo' is possibly home for many more species of stag beetles and it is very likely that many more species are yet to be discovered and documented.

#### 4.2 An Account of the Stag Beetles of Sarawak

An account of all the 38 species of stag beetle fauna of the family Lucanidae as provided in Tung (2016) are noted as follows:

*Calcodes aeratus* (Hope, 1835)

Plate 1 (a)

Body length: ♂ 10.5-34.6 mm; ♀ 15-19.6 mm

Habitat preference: LDF to upper HDF

Status of occurrence: Common

Remarks: This stag beetles have rather smooth but shiny elytra. Males have tinted greenish brown body while the females are smaller and more brownish. However, form *mesodonta* (of the male) whose mandibles resemble a crescent with tooth-like protrusions on the inner side, is rarely obtained. Females are smaller in size and bear shorter mandibles. Their mentum and pronotum are reduced with more rounded edges while those of the males are more squarish and somewhat angular. Both sexes are strongly attracted to lighted lamp post and houses of the aborigines especially during the months from May to August.

Geographical distribution: Southern Myanmar to Peninsular Malaysia, Natuna Island and Borneo.

*Odontolabis alces* (Fabricius, 1775)

Plate 1 (b)

Body length: ♂ 40.3-88.3 mm; ♀ 35.2-50.4 mm

Habitat preference: HDF to MF

Status of occurrence: Rare in Peninsular Malaysia and Borneo but fairly common elsewhere

Remarks: Although *Odontolabis alces* (Fabricius) is fairly common throughout its range of distribution, it survives in great rarity in Borneo. This remarkable insect is large and polished black all over. The average length of the male is between 60 and 70 mm, although form *mesodonta* can grow to a length more than 80 mm.

Geographical distribution: (Eastern) India to the Philippines and Borneo.

*Odontolabis brookeana* (Snellen von Vollenhoven, 1861)

Plate 1 (c) – (e)

Body length: ♂ 32-53 mm; ♀ 25-31.4 mm

Habitat preference: LDF to upper HDF

Status of occurrences: Common

Remarks: Often males of form *ampiodonta* are seen in collections. The other form is *amphiodonta*. The top centre portion of the mentum and the edges of the pronotum are reddish. The elytra are smooth and light yellow which have a tendency to turn brownish brown in dried specimens. Underneath, there are two reddish orange patches on the thorax and a yellow pubescent mouthpart. The female is smaller and has a squarish mentum with a large black rectangular patch edged with orange yellow sides. Its elytra are almost completely orange yellow except near the top upper part which is often slightly blackened. Its mandibles are also small and reduced.

Geographical distribution: Large Sunda Islands.

*Odontolabis chawi* Schenk, 2003

Body length: ♂ 48.4-63 mm

Habitat preference: HDF

Status of occurrence: Rare

Remarks: This is indeed a rare insect which only been taken singly in Ranau and Mamut (Sabah) in Borneo. The male is polished black with a greenish hue especially on its elytra.

Geographical distribution: Borneo

*Odontolabis dalmani* (Hope & Westwood, 1845)

Plate 1 (f) - (i)

Body length: ♂ 44-76.6 mm; ♀ 42.2-48.6 mm

Habitat preference: Lower MF

Status of occurrence: Common

Remarks: This species is very variable and is represented by many distinct subspecies throughout its range of distribution. It has dull black mentum and pronotum but its elytra are smooth with glossy light brown to deep reddish brown and black. The normal male of form *amphiodonta* has saw-like mandibles while the form *mesodonta* has long, protruding mandibles and extremely rare.

Geographical distribution: Myanmar, Thailand, Peninsular Malaysia, Sumatra, Natuna Island and Borneo.



Plate 1

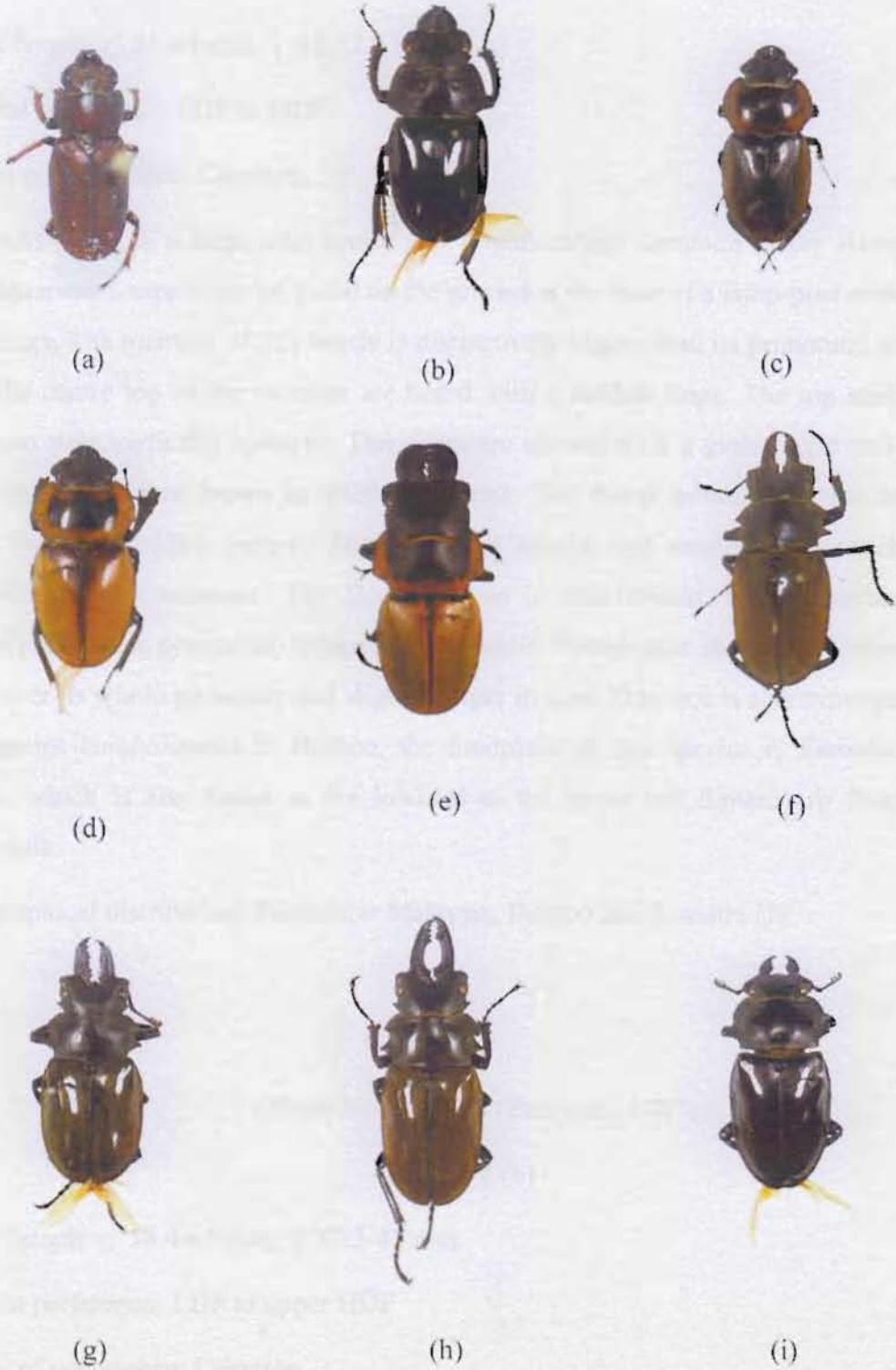


Plate 1: *Calcodes aeratus* (a ♂); *Odontolabis alces*; (b ♂); *Odontolabis brookeana* (c ♀) (d-c ♂); *Odontolabis dalmani* (f-h ♂) (g ♀).

*Odontolabis femoralis* Waterhouse, 1887

Plate 2 (a)

Body length: ♂ 51-94 mm, ♀ 42-52.8 mm

Habitat preference: LDF to MDF

Status of occurrence: Common

Remarks: This is a large stag beetle and is particularly common at the Kinabalu Park Headquarters where it can be found on the ground at the base of a lamp-post or the floor of buildings. The mentum of this beetle is distinctively bigger than its pronotum. Its mentum and the centre top of the mentum are tinted with a reddish tinge. The top section of the mentum rises vertically upwards. The elytra are smooth with a glossy light yellow which may sometimes turn brown in dried specimens. The thorax beneath and the second and hind legs are reddish yellow. The female is similar but smaller with much reduced mandibles and commoner. The Bornean race is *waterstradti* Von Rotherburg differs slightly from the peninsular subspecies *femoralis* Waterhouse in having a more reddish tone over its whole pronotum and slightly larger in size. This race is also synonymous with subspecies *kinabaluensis* In Borneo, the foodplant of this species is *Embelia coriacea* Wall., which is also found in the lowland to the upper hill dipterocarp forests of the peninsula.

Geographical distribution: Peninsular Malaysia, Borneo and Sumatra (?)

*Odontolabis gazella* (Fabricius, 1787)

Plate 2 (b)

Body length: ♂ 38.4-65 mm; ♀ 37.3-45 mm

Habitat preference: LDF to upper HDF

Status of occurrence: Common

Remarks: This insect is not uncommon in Thailand, Vietnam, Peninsular Malaysia and Borneo, but it is rather rare in Java. To date, no male of form *telodonta* has been taken and the usual form is *amphi-donta*. Infrequently, males has black mentum and pronotum but its elytra are smooth and yellow. However, subspecies *inaequalis* Kamp from Nias Island is a



glossy, reddish brown all throughout including the elytra while another race, *zebui* Schenk, from Mount Chamah, Kelantan, Peninsular Malaysia, has dirty reddish brown elytra. The female is distinguish by an exceptionally broad black median band over its deep yellowish orange elytra. This stag beetle has been bred in the Cameron Highlands by Benjamin Harink on rotten oak wood and feeding the larvae with fruit jelly and banana juice.

Geographical distribution: Thailand, Vietnam, Peninsular Malaysia, Large Sunda Island and Philippines.

*Odontolabis latipennis* (Hope & Westwood, 1845)

Plate 2 (c) – (e)

Body length: ♂ 41.6-79.5 mm, ♀ 35.8-48.6 mm

Habitat preference: LDF and HDF

Status of occurrence: Common

Remarks: A fairly common stag beetle, it is strongly attracted to lighted premises and lamp-posts in the middle of the night. Its body, especially the elytra, has a chestnut to dark reddish brown hue and extreme examples may be polished black making this species resembles *Odontolabis fratellus* Leuthner above. Its mandible are thick, cleaver-shaped and the inner sides are serrate. Its female is commoner and has a much reduced mentum with indistinctive mandibles. The nominate subspecies *planiceps* Didier is found only in the island of Ambon of Indonesia. A third race *fratella* Leuthner is from Borneo and the Philippines. The biology of this species has been studied and bred by Japanese stag beetle enthusiasts.

Geographical distribution: Peninsular Malaysia, Sumatra, Nias, Borneo and the Philippines.

*Odontolabis leuthneri* Boileau, 1897

Plate 2 (f)

Body length: ♂ 39-78.3 mm; ♀ 33-36.6 mm

Habitat preference: LDF to MF

Status of occurrence: Common throughout its range but rare in Borneo.

Remarks: This insect is quite common in Borneo but is rather rare in the Malay Peninsula. It resembles *Odontolabis dalmani* (Hope & Westwood) but its elytra are polished black without any reddish hue. Its mandibles are usually irregular and tough, with form *mesodonta* having crescent-like mandibles with toothed inner sides. The female is commoner than the male. In Borneo, this species is represented by subspecies *brunneus* Nagel which is almost inseparable from the nominate race found in the peninsula. It shares similar foodplant (*Embelia coriacea* Wall.) with *O. femoralis* Waterhouse above.

Geographical distribution: Peninsular Malaysia, Borneo and Indo-China (?)

*Neolucanus muntjac* Gestro, 1881

Plate 2 (g)

Body length: ♂ 25-28.5 mm

Habitat preference: HDF and MF

Status of occurrence: Extremely rare

Remarks: This species has not much superficial difference from the above species, *N. cingulatus* Parry, and this was that reason why it has been treated as its subspecies. It has a smooth but darker reddish brown elytra and without a blackened V-shape marking in the middle. It also has small and short mandibles. Representatives from both Natuna and Siberut Islands are larger in size, resemble more of *N. cingulatus* but the mentum and pronotum are black with a very faint hue of red instead of reddish brown. Both these insects are depicted above for comparison. To date, the females of this species is still ignotus or unknown.

Geographical distribution: Borneo, Natuna Island and Siberut Island

Plate 2



(a)



(b)



(c)



(d)



(e)



(f)



(g)

Plate 2: *Odontolabis femoralis* (a ♂); *Odontolabis gazelle* (b ♂);  
*Odontolabis latipennis* (c-e ♂); *Odontolabis leuthneri* (f ♂); *Neolucanus*  
*muntjac* (g ♂).

*Cyclommatus (Cyclommatellus) titanus* Nagel, 1936

Plate 3 (a) – (c)

Body length: ♂ 23-41mm, ♀ 17.5-18 mm

Habitat preference: HDF

Status of occurrence: Common

Remarks: This stag beetle is light chocolate brown and often dirty looking. The mandibles are thick, rough, bent downwards and with saw-like tips. There is an irregular notch on the mentum. Like other species in this genus, the mentum of the male is bigger than the pronotum.

Geographical distribution: Borneo.

*Cyclommatus (Cyclommatus) canaliculatus* Ritsema, 1891

Plate 3 (d)

Body length: ♂ 21.4 -53.5 mm, ♀ 17.6-24.3 mm

Habitat preference: LDF to MF

Status of occurrence: Common

Remarks: The general colour of this species is dark reddish to wood brown. The mandibles are long, finely granulated and sub-opaque with bifurcated tips and straight outer margins. On its inner side, there is a tooth at about one third of the length near to the base. The apical part of the mandibles is somewhat glossy. There is a large flattened notch on the mentum. The sides of the pronotum have an angular tooth. The elytra are rough and covered with minute punctures. The female is smaller and has small mentum and mandibles. This species is rather prolific and is represented in different subspecies throughout its range: subspecies *canaliculatus* Ritsema in Nias, Sumatra and Peninsular Malaysia; *consanguineus* Boileau in Borneo; *freygessneri* Ritsema in Java; and *infans* DeLisle in Sulawesi. The race *consanguineus* is also represented in Kalimantan and southern Borneo, and may be erroneously named as *ramii* Wakatake & Sakamaki, 2002 although there are authorities who recognize the latter as an intraspecific taxon.

Geographical distribution: Peninsular Malaysia, Large Sunda Islands and Sulawesi.

*Cyclommatus (Cyclommatus) chewi* Mizunuma, 1994

Body length: ♂ 30.4-82.2 mm, ♀ 23.5-27 mm

Habitat preference: HDF to MF

Status of occurrence: Rare

Remarks: This is a remarkably handsome insect with long mandibles almost the length of the body. Endemic to the Crocker Range of Sabah in Borneo, the male has finely granulated, lustre brownish green to reddish golden mandibles, mentum and pronotum. The elytra are reddish brown to chestnut. Sometimes, the insect including the legs is completely reddish golden. It is much sought after by collectors. The female is smaller is much reduced mentum and mandibles which are finely granulated and black. The elytra are usually chestnut. This species has been bred and its biology has been studied.

Geographical distribution: Borneo

*Cyclommatus (Cyclommatus) lunifer* Boileau, 1905

Body length: ♂ 30-50 mm; ♀ 23-24.5 mm

Habitat preference: LDF to upper HDF.

Status of occurrence: Common

Remarks: Although this species is common throughout its range, it is scarce in Peninsular Malaysia. It has reddish brown mandibles, mentum and pronotum, and of which are all finely granulated. Some specimens have a strong greenish hue over the mandibles and mentum which may also extend to the upper half of the pronotum. There is a distinctive thick, strong and toothed protrusion at the anterior of the mentum. The elytra and the legs are polished brownish yellow. The female is small and inconspicuous. This species has been bred by some Japanese collectors.

Geographical distribution: Southern Myanmar to Peninsular Malaysia, Sumatra and Borneo.

*Cyclommatus (Cyclommatus) rangifer* Schonherr, 1817

Plate (e) – (g)

Body length: ♂ 25.5-67.8 mm; ♀ 22.4-26 mm

Habitat preference: LDF to upper HDF.

Status of occurrence: Common.

Remarks: A fairly common insect which is often reared and bred by insect enthusiasts. The males loves fighting each other, and they are used as asprot for such fighting competitions by insect enthusiasts. The general superficialies of the males resemble those of the preceding *Cyclommatus montanellus* above although it is slightly smaller in size and usually lacks of the bluish green hue. The female is inconspicuous and is reddish brown all over. In Borneo, it is represented by subspecies *robustior* Kriesch while in Peninsular Malaysia by *stenosomus* DeLisle (which is described from a holotype deposited in the Museum d'Histoire Naturelle, Geneva). It was formerly known as *C. tarandus* (Thunberg) and changed to *C. rangifer* Schonherr as the former name was preoccupied.

Geographical distribution: Borneo and Peninsular Malaysia.

*Hexarthrius mandibularis* Deyrolle, 1881

Plate 3 (h) – (i)

Body length: ♂ 48.8 – 112 mm; ♀ 41.5 – 52.4 mm

Habitat preference: LDF to lower MF

Status of occurrence: Common

Remarks: A fairly common insect with thick, long protruding, antler-like mandibles with small teeth along the inner edges and a pair of big teeth in the middle. The tip of each mandible is slightly forked. Some authorities, however, consider the Sumatran race as subspecies *Hexarthrius sumatranus* Mizunuma. This species differs from the following *H. parryi* Hope in having shiny black elytra. Like *H. parryi*, the female is also black and somewhat flat. This species has been bred on rotten stem of a hardwood tree on substrate. The eggs take about one month to hatch. In captivity, the life of a male larva is about 12

months and for a female larva is between nine and 12 months before pupation. The imago emerges from the pupa after a month.

Plate 3



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)

Plate 3: *Cyclommatus titanus* (a-c ♂); *Cyclommatus (Cyclommatus) canaliculatus* (d ♂); *Cyclommatus (Cyclommatus) rangifer* (e-g ♂); *Hexarthrius mandibularis* (h ♂) (i ♀).



*Prosopocoilus (Metopodontus) astacoides* (Hope, 1840)

Plate 4 (a) – (b)

Body length: ♂ 31 – 59 mm; ♀ 22 -24.5 mm

Habitat preference: Lowland DF to MF

Status of occurrence: Common

Remarks: A common stag beetle, this insect is strongly attracted to light traps and lighted homes of the aborigines. It is also occasionally seen looking for food on rotting logs and bark of injured tree trunks in the forest. Males of form *mesodonta* are comparatively rare. The commoner male forms are those of *amphiodonta* and *mesodonta*. The insect has dark brownish black mentum and pronotum, but the elytra well as the inner base of the mandibles are dark reddish brown. Sometimes, a more blackish median line is seen on the mentum, pronotum and elytra. On the underside, the tibiae of the legs and the base of the second pair of legs are reddish brown. The female has dark brownish black mentum and pronotum, while the elytra are light reddish brown and smooth. Throughout its range, there are five described subspecies. This species has been reared and bred in Thailand.

Geographical distribution: India, Myanmar, Andaman, Peninsular Malaysia, Sumatra and Nias.

*Prosopocoilus (Hoplitocranum) attenuatus* (Parry, 1864)

Plate 4 (c) – (e)

Body length: ♂ 18 – 23.7 mm; ♀ 17.6 – 20 mm

Habitat preference: Upper HDF and MF

Status of occurrence: Common

Remarks: This highland species is light brown and the commonest male-form is *amphiodonta*. Males are frequently attracted to lighted premises at the wee hours of the night. The males are light dull yellowish brown and often pubescent are found all over the mentum, pronotum and elytra, especially at the sides and the legs. The mentum has a notch

at the frontal section. There is a light reddish hue on the mandibles and the frontal section of the mentum. The females are smaller and have two slightly raised, latitudinal black lines on the pronotum which may sometimes run down to one each on the elytra. They seem to be rarer than the males.

Geographical distribution: Peninsular Malaysia, Sumatra and Borneo.

*Prosopococoilus (Hoplitocranum) flavidus* (Parry, 1862)

Plate 4 (f)

Body length: 15.7 – 44 mm, 19 – 21.5 mm

Habitat preference: LDF to upper HDF

Status of occurrence: Rare

Remarks: Confined to the primeval forest, this insect may sometimes be obtained using light traps. The male has a slender, light brown body, although its mandibles, mentum, pronotum and legs are somewhat darker. The elytra are smooth and produce a glossy effect. The mandibles are fairly straight, saw-toothed on the inner sides and the tips are distinctly forked. The female is smaller but rarer.

Graphical distribution: Peninsular Malaysia, Sumatra and Borneo.

*Prosopococoilus (Cyclotropus) occipitalis* (Hope & Westwood, 1845)

Plate 4 (g) – (j)

Body length: ♂ 23.5 – 55 mm; ♀ 17.6 – 26 mm

Habitat preference: Lowland DF to MF

Status of occurrence: Common

Remarks: Indeed this is the commonest of *Prosopococoilus* species in the country and often taken at light traps. The male has dark brownish yellow mandibles and mentum. There is a

somewhat circular depression on the mentum with ridged and blackened edges. On the center of the pronotum, there is a blackened star-like marking. Both the pronotum and the elytra are smooth. Males of form *telodonta* are very rarely seen or taken. This insect enjoys a wide range of distribution from the Far East to the Large and Lesser Sunda Islands. In Peninsular Malaysia, it is represented by *preangerensis* (Oberthur & Houlbert, 1913) while in Borneo by *asteriscus* Thomson. The main difference between the two subspecies is that the Bornean race is generally darker in colour particularly at the mandibles.

Geographical Distribution: Taiwan to Peninsular Malaysia, the Philippines, Large Sunda Islands and Lesser Sunda Islands.

Plate 4



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)



(j)

Plate 4: *P.(M.) astacoides* (a-b ♀); *P.(H.) attenuates* (c-e ♂); *P.(H.) flavidus* (f ♂); *P.(C.) occipitalis* (g-h ♂) (i-j ♀).

*Prosopocoilus (Cyclotropus) sericeus* (Westwood, 1844)

Plate 5 (a) – (b)

Body length: ♂ 20.5 – 39.2 mm; ♀ 17.5 – 20 mm

Habitat preference: Lowland DF to upper HDF

Status of occurrence: Common

Remarks: This stag beetle resembles *Prosopocoilus ereci* Bomans above with much of its mentum, pronotum and elytra covered with fine, dull, yellowish brown pubescence. Its mentum bears a deep 'V' shape depression. The tips of its mandibles are saw-like with at least six teeth. The female is small and also covered with fine but loose hairs. In Peninsular Malaysia, this species is represented by subspecies *taronii* Lacroix & Ratti.

Geographical distribution: Thailand, Peninsular Malaysia, Large Sunda Islands and Nias.

*Prosopocoilus (Prosopocoilus) buddha* (Hope, 1842)

Plate 5 (c)

Body length: ♂ 28 – 62.7 mm; ♀ 20.7 – 29.5 mm

Habitat preference: Upper HD and MF

Status of occurrence: Rare

Remarks: This handsome stag beetle has black mandibles, mentum and pronotum. There is a broad 'V' shaped notch on the mentum. The elytra are smooth and deep dark reddish brown. Males of form *mesodonta* are rare and highly priced. The female is smaller with a stronger tinge of red on its elytra. Throughout its wide range of distribution, there are a number of named subspecies. The subspecies from the peninsula has been named as *kuijteni* Bomans replacing the former *erberi* Lacroix which is now confined to the Sumatran race. The Bornean subspecies is *annae* Bomans.

Geographical distribution: (Uttar Pradesh) India, Thailand, Indo-China, the Philippine, Peninsular Malaysia, Sulawesi and Large Sunda Islands.

*Prosopocoilus (Prosopocoilus) forceps* (Snellen von Vollenhoven, 1861)

Plate 5 (d) – (g)

Body length: ♂ 23 – 49.2 mm; ♀ 23 – 30.4 mm

Habitat preference: Lowland DF to upper HDF

Status of occurrence: Rather rare in Peninsular Malaysia and Sumatra but common in Borneo.

Remarks: This insect is rare in the peninsula and Sumatra but common in Borneo. In Peninsular Malaysia, it is represented by subspecies *eligmonotus* Lacroix and in Borneo by subspecies *nakamotoi* Mizunuma. The male has dirty brown mandibles, mentum and pronotum which are covered with fine granules. The mandibles are thick, strong and straight. The pronotum is distinctively large, broad and somewhat rectangular. It is slightly larger than the pronotum. The elytra and legs are paler brown, smooth and shiny in the central section but the sides are covered loosely with pubescence. The underside of the body has a reddish hue.

Geographical distribution: Peninsular Malaysia, Borneo and Sumatra

*Prosopocoilus (Prosopocoilus) zebra* (Olivier, 1789)

Plate 5 (h) – (o)

Body length: ♂ 20 – 54.2 millimetres; ♀ 19.8 – 30.4 millimetres

Habitat preference: Hill DF to MF

Status of occurrence: Rare

Remarks: This is generally a rare beetle, although the female may turn up more in collections. The beetle has an overall ground colour with distinctive black bands on the sides of the pronotum and centre as well as the shoulder of each elytron. Males of form *amphiodonta* are commonly seen in collections and those of form *mesodonta* are extremely rare. It is also found in Java, Indonesia and the Philippines is a closely affiliated species,

*Prosopocoilus vittatus* Deyrolle, which can be differentiated in having finely granulated, reddish brown mentum and unmarked pronotum.

Geographical distribution: Myanmar to Peninsular Malaysia, Large Sunda Islands and the Philippines

Plate 5



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)



(j)



(k)



(l)



(m)



(n)



(o)

Plate 5: *P.(C.) sericeus* (a ♂)(b ♀); *P.(P.) Buddha* (c ♀); *P.(P.) forceps* (d-g ♂);  
*P.(P.) zebra* (h-i ♂)(j-o ♀).



*Prosopocoilus (Macrodocinus) tigrinus* Didier, 1928

Plate 6 (a – d)

Body length: ♂ 17 – 27.5 mm; ♀ 19 – 19.5 mm

Habitat preference: MF

Status of occurrence: Rather rare

Remarks: Little is known about this elusive insect. It is quite rare and known to occur only in the Crocker Range in Sabah. The beetle has a slender body, tan in colour with a tinge of dull light brown. The mandibles, mentum, pronotum, elytra and legs are minutely granulated. There are fine, yellowish orange hairs along the tibiae of the legs. The female comes in two different colour forms: one, the usual black form and two, the rarer and smaller, light brown form.

Geographical distribution: Borneo

*Prosopocoilus (Macrodocinus) passaloides* (Hope & Westwood, 1845)

Plate 6 (e)

Body length: ♂ 19.2-32.3 mm; ♀ 19-20.3 mm

Habitat preference: HDF to MF

Status of occurrence: Common

Remarks: This beetle resembles a passalid, hence its specific name. It is not an uncommon insect and often seen in small numbers in rotting tree trunks in the forest. It is dull black and its mentum, pronotum, elytra and legs are minutely granulated. So far, I have only seen males of form *amphiodonta*. The female is smaller and bears more resemblance to a small passalid beetle. Its body is either dull brown or black.

Geographical distribution: Thailand, Peninsular Malaysia, Andaman Islands and Large Sunda Islands.

*Serrognathus (Serrognathus) titanus* (Boisduval, 1835)

Plate 6 (f)

Body length: ♂ 32-107.3 mm; ♀ 36.5-52 mm

Habitat preference: LDF to MF

Status of occurrence: Common

Remarks: Often taken using light traps, this large stag beetle is also a favourite pet for insect enthusiasts here and abroad. It is robust and has thick mandibles with a central saw-like protuberance. It also has distinctive orange coloured labrum and long, narrow, black maxillae at the mouthparts between the mandibles. The mentum and the pronotum are large, but the elytra are distinctively short especially when in comparison with the mentum and pronotum. The mentum, pronotum and elytra are smooth and polished black. The indistinctive female is small, black and bear light latitudinal striations on her elytra that may sometimes be obsolete. Thai beetle lover have bred and studied the biology of the Sumatran representative of this genus.

Geographical distribution: Peninsular Malaysia to Large Sunda Islands, Nias, Sulawesi and the Philippines.

*Serrognathus (Eurytrachelus) reichei* Hope, 1842

Plate 6 (g)

Body length: ♂ 19.4-65.7 mm; ♀ 20-30 mm

Habitat preference: LDF to MF

Status of occurrences: Common

Remarks: This species has been collected in Taiping and Sahom (in the state of Perak), Cameron Highlands (in Pahang) and Singapore. In Borneo, it has also been taken from Mount Poi, Mount Murud, Mount Dulit (in Sarawak) and the Crocker Range, Mount Kinabalu and Trus Madi (in Sabah). Superficially, this stag beetle resembles *Serrognathus (Eurytrachelus) mandibularis* Mollenkamp above but is slightly smaller in size and its

arrow-pointed mandibles curve more deeply inwards. In some males, the elytra have a light brownish hue. The female is also black with slight brownish tinge but its elytra are finely marked with striae. The basal tooth on the mandibles make it looks like a strongly bifurcate tip on each of the mandible.

Remarks: A common insect.

Geographical distribution: Peninsular Malaysia and Borneo.

*Dynodorcus curvidens* Hope, 1840

Plate 6 (h)

Body length: ♂ 27-78.6 mm; ♀ 27-42.4 mm

Habitat preference: LDF to upper HDF

Status of occurrences: Common

Remarks: Closely resembles *Dynodorcus antaeus* Hope, this entirely black stag beetle has longer and slightly less curved mandibles compared to *Dynodorcus antaeus*. Synonymous with both *Dorcus dehaani* Hope, 1842 and *Dorcus klugii* Thomson, 1862, it is commoner than *D. antaeus* and can be found even at lowland dipterocarp forest. Some extreme examples may be completely reddish brown. The middle tooth on the mandibles is located at the middle or higher than the middle inner edge. The female is smaller with lightly striated elytra. Throughout its range of distribution, more than 10 subspecies have been named and described. In Peninsular Malaysia, Borneo Sumatra and Thailand, it is represented by subspecies *volscens* (Didier & Seguy) which was formerly treated as a subspecies of *Dorcus parryi* Thomson.

Geographical distribution: North-east India, Assam, Myanmar, north Thailand, north-Vietnam, Peninsular Malaysia and Borneo.

*Aegus (Gnaphaegus) krieschei* Nagel, 1928

Body length: ♂ 18-23 mm; ♀ 17-19 mm

Habitat of preference: HDF to MF

Status of occurrences: Very rare

Remarks: Originally named as *Xenostomus krieschei* by Nagel, this is an indeed rare species in the hills of Borneo. It is distinguished by the strong perforations on its mentum, pronotum and elytra which are all thickly covered with short brownish pubescence. The pronotum has rounded anterior angles. The clypeus is rather broad with truncated angles. The mandibles are slender and armed with an obtuse and un-bifurcated tooth. The pronotum also has rounded anterior angles but there is an indistinctive longitudinal groove on the disc. The elytra are vaulted and rounded at the tip.

Geographical distribution: (Mount Murud, Sarawak) Borneo.

*Aegus (Gnaphaegus) squalidus* (Hope & Westwood, 1845)

Plate 6 (i)

Body length: ♂ 16-24.4 mm; ♀ 15-16.8 mm.

Habitat preference: HDF to MF.

Status of occurrences: Common in Peninsular Malaysia but rare in Borneo.

Remarks: In the Malay Peninsula and Sumatera, this highland species is represented by subspecies *ericsoni* Boileau. It is closely related to *Aegus capreolus* Boileau but it is larger in size with a broader mentum and its mandibles are longer, thicker, armed with an obtuse tooth at the mid-length and bifid tips. The female is almost inseparable from *A. capreolus* Boileau except being larger.

Geographical distribution: Peninsular Malaysia and Large Sunda Islands.

Plate 6

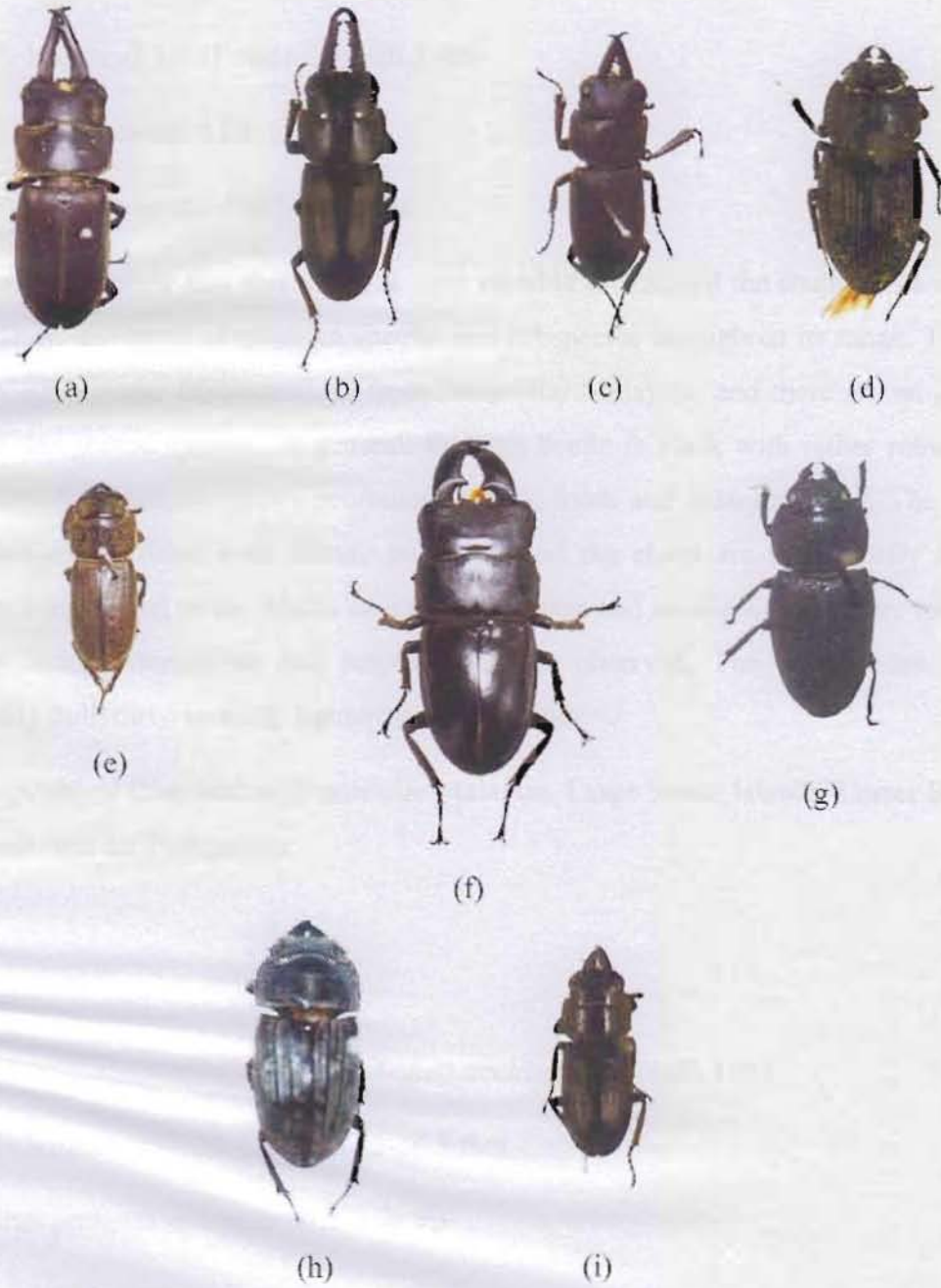


Plate 6: *P.(M.) tigrinus* (a-c ♂)(d ♀); *P.(M.) passaloides* (e ♀); *S.(S.) titanus* (f ♂);  
*S.(E.) reichei* (g ♀); *D. curvidens* (h ♀); *A. (G.) squalidus* (i ♂).

*Aegus (Aegus) acuminatus* (Fabricius, 1801)

Plate 7 (a – b)

Body length: ♂ 14-41 mm; ♀ 16-20.8 mm

Habitat preference: LDF to MF

Status of occurrence: Fairly common

Remarks: In view that this insect is very variable in size and the shape of its mandibles, it has been identified as different species and subspecies throughout its range. The nominate race, *acuminatus* (Fabricius), is from Peninsular Malaysia, and there are an additional of nine recognized species. In general, the stag beetle is black with rather robust body and thickened mandibles with a prominent middle tooth and enlarged basal. The sides of the pronotum are filled with minute punctures and the elytra are prominently marked with deep longitudinal striae. Males of form *mesodonta* and *mesodonta* are quite rare, and often only forms *prionodonta* and *amphiodonta* are observed. The females are smaller and usually dull, dirty-looking, lighter brown in colour.

Geographical Distribution: Peninsular Malaysia, Large Sunda Islands, Lesser Sunda Islands and the Philippines.

*Aegus (Aegus) acutangulus* Nagel, 1941

Body length: ♂ 13-24.2 mm; ♀ 15-16.5 mm

Habitat preference: Upper HDF and MF

Status of occurrence: Common

Remarks: Comparatively, this highland stag beetle has slender, somewhat elongate body whose mandibles are distinctly short but with a prominent, rather pointed, tooth near the base and a bifid apex. The edge of the mentum below the eyes is sharply pointed. The female is small with reduced head and mandibles.

Geographical distribution: (Crocker Range, Sabah) Borneo

*Aegus (Aegus) impressicollis* Parry, 1864

Body length: ♂ 17-33 mm; ♀ 18-20 mm

Habitat preference: Upper HDF to MF

Status of occurrence: Rather rare in Peninsular Malaysia but common in Borneo.

Remarks: In the Malay Peninsula, this species has been collected from the Cameron Highland although it is found commonly in many of the mountains of Borneo. This is quite a large *Aegus* beetle with long mandibles that may grow up to half the length of the body. Males are rather handsome insects, wholly black, densely covered with light brown pubescence along the sides of the mentum, pronotum and elytra. Males of form *mesodonta* and *mesodonta* are common especially in Borneo with mandibles strongly bifurcated near the tip and in the latter form the apex may be further bifid. There is a stout but blunt tooth near the base. Both forms are prized collectors' items. In lesser forms, the mandibles are more sickle-shaped with only basal tooth that is more pointed. Females are uninteresting with small, dentate mandibles. Formerly, the Bornean race was described as *ratcliffei* Nagai while the Philippine race was known as *patrici* Nagai. Both races have been reduced to synonyms in recent years.

Geographical distributions: Peninsular Malaysia, Large Sunda Islands and (Palawan and Mindanao) the Philippines.

*Aegus (Aegus) punctipennis* Parry, 1864

Plate 7 (c)

Body length: ♂ 18.7-48.7 mm; ♀ 18.8-24.8 mm

Habitat preferences: Upper HDF and MF

Status of occurrences: Common

Remarks: The males may grow up to a length of more than 45 mm, making it one of the largest and most robust members of the *Aegus* genus. The mentum and the pronotum are similar in size and width. The frontal part of the mentum is irregular. The mandibles are thick, robust with an extraordinary thicken and blunt tooth that sometimes curved

downwards. The elytra are comparatively short and lightly striated. The insect is somewhat shiny black.

Geographic distribution: Borneo.

*Aegus (Aegus) rigouti* Nagai, 1994

Body length: ♂ 17.5-21.6 mm; ♀ 15.8-17.7 mm

Habitat preference: Upper HDF and MF

Status of occurrences: Rare.

Remarks: Another highland species, it is often confused with *Aegus acutangulus* Nagel which shares similar habitat. It is separated in having narrower mandibles with the lower tooth near base almost similar in size with the mid-length tooth. The apical area of the temple is more rounded. The insect is generally black and covered with light brownish pubescence. The female is distinguishable. From that *A. acutangulus* in having a more broadened mentum.

Geographical distribution: (North-western) Borneo.

*Aegus (Tumidaegus) dusunorum* Ikeda, 2003

Plate 7 (d)

Body length: ♂ 25.2-28.4 mm; ♀ 20-21 mm

Habitat preferences: Montane and upper montane forests.

Status of occurrences: Rare.

Remarks: This stag beetle is endemic to Borneo. It has a lustrous black body, especially its elytra. In the males, the length of the mentum and the pronotum is almost the same as the length of the elytra. Both these are finely granulated, but the elytra are striated. The mandibles are triangular in shape with pointed tips, and there are two small teeth at the



interior of the base. The females are small and have reduced mandibles. The holotype of this beetle was captured in Sipitang, Sabah, Borneo, and is deposited in Kanagawa Prefecture Museum of Natural History in Japan.

Geographical distribution: (Sipitang, Sabah, Borneo).

*Aegus (Tumidaegus) rungusiorum* Ikeda, 2000

Plate 7 (e)

Body length: ♂ 15.6-50 mm; ♀ 13.7-35.5 mm

Habitat preference: LDF to upper HDF

Status of occurrences: Extremely rare.

Remarks: This Bornean stag beetle has a lustrous black elytra with striations. Males have greatly enlarged mandibles. The body is fairly flat resembling the body of species of the *Dorcus* genus.

Geographical distribution: (Banggi Island, Sabah) Borneo.

Plate 7



(a)



(b)



(c)



(d)



(e)

Plate 7: *Aegus acuminatus* (a ♂) (b ♀); *Aegus punctipennis* (c ♂); *A.(T.) dusunorum* (d ♀); *A.(T.) rungusiorum* (e ♂).

## 5.0 Conclusion

Only one subfamily is found in Sarawak that is Lucaninae. The Lucaninae subfamily represents 5 tribes, 15 genus and 38 species.

The most common species in Sarawak in *Prosopocoilus Cyclotropus occipitalis* with very wide distributions followed by *Prosopocoilus Macroborcinus tigrinus* and *Odontolabis dalmani*. Three extremely rare species found are *Neolucanus muntjac* Gestro, 1881, *Aegus krieschei* Nagel, 1928 and *Aegus rungusiorum* Ikeda, 2000.

An annotated checklist of stag beetle have been prepared and is always needs improvements from time to time. This study also proves that assemblages of insects could be retrieved from museum systematics collection thus museum collection is always important for research and knowledge purpose.

Lastly, not much is known on stag beetles in Sarawak in addition with degradation of their natural habitat, the rainforest.

## 6.0 References

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## Appendices

### Appendix 1

Table 2: List of species recorded in Sarawak

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Family **Lucanidae** Latreille, 1804

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Subfamily **Aesalinae** MacLeay, 1819

Tribe **Nigidiini**

Genus *Calcodes* Westwood, 1834

*C. aeratus* Hope, 1834

Tribe **Odontolabini** Parry, 1870

Genus *Odontolabis* Hope, 1842

*O. alces* Fabricius, 1775

*O. brookeana* Snellen von Vollenhoven, 1861

*O. chewi* Schenk, 2003

*O. dalmani* Hope & Westwood, 1845

*O. femoralis* Waterhouse, 1887

*O. gazella* Fabricius, 1787

*O. latipennis* Hope & Westwood, 1845

*O. leuthneri* Boileau, 1897

Genus *Neolucanus* Thomson, 1862

*N. muntjac* Gestro, 1881

Tribe **Cyclommatini** Maes, 1992

Genus *Cyclommatus* (*Cyclommatus*) Parry, 1864

*C. (C.) titanus* Nagel, 1936

*C. (C.) canaliculatus* Ritsema, 1891

*C. (C.) chewi* Mizunuma, 1994

*C. (C.) lunifer* Boileau, 1985

*C. (C.) rangifer* Schonherr, 1817

Tribe **Lucanini** Latreille, 1804

Genus *Hexarthrius* Hope, 1843

*H. mandibularis* Deyrolle, 1881

Genus *Prosopocoilus* (*Metopodontus*) Westwood in Hope, 1845

*P. M. astacoides* Hope, 1840

Genus *Prosopocoilus* (*Hoplitocranum*) Jokowlew, 1896

*P. H. attenuates* Parry, 1864

*P. H. flavidus* Parry, 1862

Genus *Prosopocoilus* (*Cyclotropus*) Oberthur & Houlbert, 1913

*P. C. occipitalis* Hope & Westwood, 1845

*P. C. sericeus* Westwood, 1844

Genus *Prosopocoilus* (*Prosopocoilus*) Westwood, 1845

*P. P. forceps* Snellen von Vollenhoven, 1861

*P. P. zebra* Olivier, 1789

Genus *Prosopocoilus* (*Macrodercinus*) Maes, 1990

*P. M. tigrinus* Didier, 1928

*P. M. passaloides* Hope & Westwood, 1845

Genus *Serrognathus* (*Serrognathus*) Motchulsky, 1861

*S. S. titanus* Boisduval, 1835

Genus *Serrognathus* (*Eurythracelus*) Thomson, 1862

**Figure 4 (continued)**

*S. E. reichei* Hope, 1842

Genus *Dynodorcus* Didier, 1931

*D. curvidens* Hope, 1840

Tribe **Aegini** Maes, 1992

Genus *Aegus* (*Gnaphaegus*) Maes, 1992

*A. G. krieschei* Nagel, 1928

*A. G. squalidus* Hope & Westwood, 1845

Genus *Aegus* (*Aegus*) W. S. MacLeay, 1819

*A. A. acuminatus* Fabricius, 1801

*A. A. acutangulus* Nagel, 1941

*A. A. impressicollis* Parry, 1864

*A. A. punctipennis* Parry, 1864

*A. A. rigouti* Nagai, 1994

Genus *Aegus* (*Tumidaegus*) Bomans, 1988

*A. T. dusunorum* Ikeda, 2003

*A. T. rungusinorum* Ikeda, 2000

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## Appendix 2

Table 3: Checklist of Sarawak species based on Checklist Taxa of Borneo (Tung, 2016)

Species	No. of individu
<b>Echinoaesalus</b>	
<i>E. arayai</i>	0
<i>E. hidakai borneoensis</i>	0
<i>E. yongi</i>	0
<b>Echinoaesalus (Zelenkaesalus)</b>	
<i>E. (Z.) sabahensis</i>	0
<i>E. (Z.) timidus</i>	0
<b>Figulus</b>	
<i>F. borneensis</i>	0
<i>F. concatenates</i>	0
<i>F. impressicollis</i>	0
<i>F. kinabaluensis</i>	0
<i>F. laticollis</i>	0
<i>F. marginalis</i>	0
<i>F. mediocris</i>	0
<i>F. powelli</i>	0
<i>F. punctifrons</i>	0
<i>F. quasisimilis</i>	0
<i>F. rugosus</i>	0
<i>F. sarawakensis</i>	0
<i>F. scaritiformis</i>	0
<i>F. serratus</i>	0
<i>F. subcastaneus</i>	0
<b>Cardanus</b>	
<i>C. boileaui</i>	0
<i>C. costatus</i>	0
<i>C. sulchithorax</i>	0
<b>Penichrolucanus</b>	
<i>P. copricephalus</i>	0
<i>P. hirohiro</i>	0
<i>P. martini</i>	0
<b>Novonigidius</b>	
<i>N. fujitai</i>	0
<i>N. nagaii</i>	0
<i>N. ornatifrons</i>	0
<b>Nigidius</b>	
<i>N. helleri</i>	0
<i>N. kinabaluensis</i>	0
<i>N. obesus</i>	0
<b>Calcodes</b>	



**Table 3 (continued)**

<i>C. aeratus</i>	1
<i>C. cephalotes</i>	0
<i>C. cupreiventris</i>	0
<i>C. rubens</i>	0
<i>C. striatus</i>	0
<b>Odontolabis</b>	
<i>O. alces</i>	9
<i>O. antelope</i>	0
<i>O. benmartinii</i>	0
<i>O. brookeana</i>	12
<i>O. castelnaudi</i>	0
<i>O. chewi</i>	1
<i>O. dalmani</i>	176
<i>O. datukpauli</i>	0
<i>O. eremicola</i>	0
<i>O. femoralis</i>	2
<i>O. fratellus</i>	0
<i>O. gazelle</i>	1
<i>O. hitam</i>	0
<i>O. imperialis</i>	0
<i>O. katurai</i>	0
<i>O. lacordairei</i>	0
<i>O. latipennis</i>	1
<i>O. leuthneri</i>	14
<i>O. lowei</i>	0
<i>O. schenki</i>	0
<i>O. snellenvonnollenhoveni</i>	0
<i>O. somneri</i>	0
<b>Neolucanus</b>	
<i>N. borneensis</i>	0
<i>N. cingulatus</i>	0
<i>N. muntjac</i>	6
<b>Allotopus</b>	
<i>A. mollenkampii</i>	0
<b>Cyclommatus (Cyclommatellus)</b>	
<i>C. (C.) borneensis</i>	0
<i>C. (C.) Bucephalus</i>	0
<i>C. (C.) Taurus</i>	0
<i>C. (C.) titanus</i>	1
<b>Cyclommatus (Cyclommatus)</b>	
<i>C. (C.) canaliculatus</i>	8
<i>C. (C.) chewi</i>	1

(continued)

<i>C. (C.) dehaani</i>	0
<i>C. (C.) giraffe</i>	0
<i>C. (C.) insignis</i>	0
<i>C. (C.) lunifer</i>	1
<i>C. (C.) maritiini</i>	0
<i>C. (C.) montanellus</i>	0
<i>C. (C.) rangifer</i>	12
<i>C. (C.) squamosus</i>	0
<b>Lucanus</b>	
<i>L. validus</i>	0
<b>Hexarthrius</b>	
<i>H. mandibularis</i>	17
<i>H. parryi</i>	0
<b>Chewlucanus</b>	
<i>C. hirasawai</i>	0
<i>C. itiokai</i>	0
<b>Prosopocoilus (Metopodontus)</b>	
<i>P. (M.) kannegieteri</i>	0
<i>P. (M.) astacoides</i>	10
<b>Prosopocoilus (Hoplitocranum)</b>	
<i>P. (H.) attenuates</i>	2
<i>P. (H.) flavidus</i>	1
<i>P. (H.) mohnikei</i>	0
<b>Prosopocoilus (Cyclotropus)</b>	
<i>P. (C.) erici</i>	0
<i>P. (C.) forficatus</i>	0
<i>P. (C.) occipitalis</i>	189
<i>P. (C.) oweni</i>	0
<i>P. (C.) rubens</i>	0
<i>P. (C.) sericeus</i>	11
<b>Prosopocoilus (Prosopocoilus)</b>	
<i>P. (P.) aulicus</i>	0
<i>P. (P.) Buddha</i>	2
<i>P. (P.) forceps</i>	15
<i>P. (P.) kamanita</i>	0
<i>P. (P.) squamilateris</i>	0
<i>P. (P.) zebra</i>	13
<b>Prosopocoilus (Macroborcinus)</b>	
<i>P. (M.) tigrinus</i>	266
<i>P. (M.) passaloides</i>	1
<b>Macroborcus (Pogonodorcus)</b>	
<i>M. (P.) elegantula</i>	0

(continued)

<b>Serrognathus (Serrognathus)</b>	
<i>S. (S.) bandaensis</i>	0
<i>S. (S.) titanus</i>	1
<b>Serrognathus (Eurytrachelus)</b>	
<i>S. (E.) mandibularis</i>	0
<i>S. (E.) reichei</i>	2
<b>Serrognathus (Lasiodarcus)</b>	
<i>S. (L.) taurus</i>	0
<b>Serrognathus (Brantodorcus)</b>	
<i>S. (B.) thoracicus</i>	0
<b>Serrognathus (Ditomoderus)</b>	
<i>S. (D.) mirabilis</i>	0
<b>Dynodorcus</b>	
<i>D. antaeus</i>	0
<i>D. curvidens</i>	1
<b>Velutinodorcus</b>	
<i>V. tricuspis</i>	0
<b>Eulepidius</b>	
<i>E. luridus</i>	0
<b>Gnaphaloryx (Gnaphaloryx)</b>	
<i>G.(G.) opacus</i>	0
<b>Bartolozziolucanus</b>	
<i>B. kadazanorum</i>	0
<i>B. ohbayashii</i>	0
<i>B. pallidus</i>	0
<b>Metallactulus</b>	
<i>M. parvulus</i>	0
<b>Aegus (Gnaphaegus)</b>	
<i>A. (G.) borneensis</i>	0
<i>A. (G.) capreolus</i>	0
<i>A. (G.) dilaticollis</i>	0
<i>A. (G.) krieschei</i>	1
<i>A. (G.) squalidus</i>	1
<b>Aegus (Aegotypus)</b>	
<i>A. (A.) acanthinus</i>	0
<i>A. (A.) armatus</i>	0
<i>A. (A.) auritus</i>	0
<i>A. (A.) naomii</i>	0
<i>A. (A.) trilobatus</i>	0
<b>Aegus (Aegus)</b>	
<i>A. (A.) acervus</i>	0
<i>A. (A.) acuminatus</i>	3

(continued)

<i>A. (A.) acutangulus</i>	1
<i>A. (A.) bigibbosus</i>	0
<i>A. (A.) bisacutus</i>	0
<i>A. (A.) bison</i>	0
<i>A. (A.) chelifer</i>	0
<i>A. (A.) crassincrenatus</i>	0
<i>A. (A.) curtisi</i>	0
<i>A. (A.) dilaticollis</i>	0
<i>A. (A.) eschscholtzii</i>	0
<i>A. (A.) exilis</i>	0
<i>A. (A.) helleri</i>	0
<i>A. (A.) hikidai</i>	0
<i>A. (A.) horni</i>	0
<i>A. (A.) impressicollis</i>	2
<i>A. (A.) kinabalensis</i>	0
<i>A. (A.) kobayashii</i>	0
<i>A. (A.) lucidus</i>	0
<i>A. (A.) nayani</i>	0
<i>A. (A.) noboyukii</i>	0
<i>A. (A.) oxygenus</i>	0
<i>A. (A.) parallelus</i>	0
<i>A. (A.) planicollis</i>	0
<i>A. (A.) punctatissimus</i>	0
<i>A. (A.) punctipennis</i>	1
<i>A. (A.) rigouti</i>	1
<i>A. (A.) subniger</i>	0
<i>A. (A.) tetsuoi</i>	0
<i>A. (A.) variegatus</i>	0

**Aegus (Micraegus)**

<i>A. (M.) adelphus</i>	0
<i>A. (M.) amictus</i>	0
<i>A. (M.) arcuatus</i>	0
<i>A. (M.) brevimandibularis</i>	0
<i>A. (M.) consimilis</i>	0
<i>A. (M.) eximius</i>	0
<i>A. (M.) falcicornis</i>	0
<i>A. (M.) formosulus</i>	0
<i>A. (M.) gestroi</i>	0
<i>A. (M.) hamatus</i>	0
<i>A. (M.) hopei</i>	0
<i>A. (M.) ipseni</i>	0
<i>A. (M.) krikkeni</i>	0

(continued)

<i>A. (M.) lunatus</i>	0
<i>A. (M.) miyashita</i>	0
<i>A. (M.) mizukamii</i>	0
<i>A. (M.) myrmidon</i>	0
<i>A. (M.) parryi</i>	0
<i>A. (M.) porrectus</i>	0
<i>A. (M.) sexlineatus</i>	0
<i>A. (M.) westwoodi</i>	0
<b>Aegus (Torynognathus)</b>	
<i>A. (T.) marginatus</i>	0
<b>Aegus (Tumidaegus)</b>	
<i>A. (T.) dusunorum</i>	1
<i>A. (T.) rungusinorum</i>	1
<b>Foraminis</b>	
<i>F. perforates</i>	0
<b>Total</b>	<b>658</b>

## Appendix 3

First webpage of the Beetle Morphology which was referred in this thesis writing.



First webpage of the WWF website which was referred in this thesis writing.

