Beetles (Coleoptera) sampled at the Ginseng Camp, Maliau Basin, Sabah, Malaysia with the Winkler's method and light trap

Arthur Y. C. Chung, Momin Binti and John L. Yukang

Forest Research Centre, Forestry Department, P. O. Box 1407, 90715 Sandakan, Sabah.

ABSTRACT. Beetle diversity was assessed at the Ginseng Camp, using the Winkler's method and light trap during the Maliau Basin Scientific Expedition. A total of 27 families from 582 specimens were sampled from the soil and leaf litter. The most prominent family was Staphylinidae, followed by Pselaphidae and Scydmaenidae. Macro beetles from eight families were recorded through light-trapping. The common families were Scarabaeidae and Cerambycidae. The most common species encountered was *Oxyropterus audoniwi*, a giant click beetle from the family Elateridae. A list of the families sampled through the Winkler's method is provided while macro beetle species from light-trapping are also listed.

Keywords: Beetles, Winkler's method, light trap, Maliau Basin.

INTRODUCTION

Insects are very diverse and abundant in the tropics, and beetles are among the prominent orders in the class Insecta. Even at the family level, there are 166 families worldwide and more than half are recorded in Malaysia (Chung, 2005). Diversity of beetles is not only observed in numbers. Size, shape, colour and occurrence in various habitat types are also diverse in beetles. Beetles can be the smallest, biggest and bulkiest insects. Many small beetles are found in leaf litter and soil, and these are relatively difficult to extract and study. Different methods have to be used to get a comprehensive survey of beetles because of their occurrence in various types of habitats. Because of their high diversity and abundance, beetles are ecologically important in the functioning of the tropical ecosystem. Some are economically essential as pollinators, while others cause considerable damage to agricultural crops and forest trees.

Maliau Basin is a 588.4 km^2 conservation area under the management of Yayasan Sabah (Sabah Foundation), centred at about 4^{0}50' North and 116^{0}65' East, in the central interior of Sabah. Originally, it was designated as a conservation area within the Yayasan Sabah timber concession. However, recognising the uniqueness of the area, the Sabah State Government upgraded the Maliau Basin Conservation Area to a Class 1 Protection Forest Reserve, providing legal status as a protected area. Popularly known as the 'Lost World' (Sinun & Tengku Adlin, 1997), the almost circular Basin encompasses 390 km^2 of pristine forest, a virtually self-contained ecosystem, never permanently inhabited and has large areas yet to be explored and documented. The whole Basin is a single huge water catchment area, drained by the Maliau River, which flows into the Kinabatangan River, Sabah's largest and most important river (Anon., 2003).

It is timely to carry out biodiversity surveys, including on beetle diversity, as little is known about many areas in the Basin. Expeditions in the past focused on different areas and on certain insect groups, but this beetle survey was conducted at the Ginseng Camp. For example, Davis (1998) studied the dung beetle diversity and abundance at a different part of the Basin. Information procured from this survey is important in enhancing conservation efforts in protecting Maliau Basin.

MATERIALS AND METHODS

This survey was conducted from 6-12 March, 2005 during the Maliau Basin Scientific Expedition organised by Universiti Malaysia Sabah, Yayasan Sabah and the Japan International Cooperation Agency (JICA), through the Bornean Biodiversity and Ecosystems Conservation Programme.

Two methods were used to sample beetles, namely Winkler's method for soil and leaf-litter beetles, and light trap for the nocturnal beetles. Sampling was carried out within the Ginseng Camp area at 670 m a.s.l.

Winkler's method

The Winkler apparatus consists of an enclosable cloth bag (Winkler bag), cloth mesh bags that fit inside the Winkler bag, and a sieve of 1 cm^2 mesh fixed inside its own collecting bag. Twenty 1-m^2 samples of leaf litter and soil were taken at random along the Seraya Trail and Agathis Trail near the Ginseng Camp. The litter and surface soil were scraped using gloved hands. Each sample was sifted through a wire sieve to exclude larger elements (e.g. twigs, stones). After sifting, each sample was transferred to a debris bag. Upon arrival at the camp, the sifted material was transferred to mesh bags and suspended in Winkler bags. Each sample was put into one Winkler bag. When loading the samples into mesh bags, a tray was placed below to catch falling debris. Arthropods that attempted to escape from the desiccating litter inside the Winkler bag would fall into a collecting bottle containing 75% ethanol solution at the bottom. The Winkler bags were left suspended under the shade over a three-day period.

Light trap

The trap consists of a vertical white sheet (1.5 X 1.5 m) illuminated by a 250W mercury-lithium bulb, powered by a portable generator. Sampling was carried out between 7 pm to 9 pm. The light trap was set up at the helipad facing the forest at the Ginseng Camp. Only macro beetles (> 5 mm) were sampled.

All specimens were dry-mounted and were identified using various reference materials. They are deposited at the insect collection of the Entomology Section at the Forest Research Centre, Sepilok.

RESULTS AND DISCUSSION

Soil and leaf-litter beetles, as assessed with the Winkler's method

A total of 27 families from 582 specimens were sampled from the soil and leaf-litter at the forest adjacent to Ginseng Camp (Table 1). The most prominent family was Staphylinidae, followed by Pselaphidae and Scydmaenidae. These three families recorded more than 100 specimens from the 20 Winkler's samples. On average, each one metre-square sample recorded 15.6±0.9 morphospecies and 26.6±2.4 individuals. These figures are comparable with those of lowland dipterocarp forests of Danum Valley, Sepilok and Deramakot, which were also sampled with the same Winkler procedure (Chung, unpublished data; Chung, 2004).

Nocturnal macro beetles, as assessed with light-trapping

Macro beetles from eight families were sampled (Table 2). The common families were Scarabaeidae and Cerambycidae. The most common species encountered was *Oxyropterus audoniwi*, a click beetle from the family Elateridae. This is the biggest click beetle in Sabah, measuring 60-70 mm. It is chocolate brown in colour. The pronotum of this giant click beetle is loosely joined to the body, and has no difficulty in righting itself with a somersault when on its back. This is a typical defense mechanism to frighten and also to escape from intruders. The head is small,

Table 1. Soil and leaf-litter beetle families sampled using the Winkler's method at the Ginseng Camp, Maliau Basin, Sabah.

No.	Beetle family	Total specimens sampled
1.	Carabidae	2
2.	Paussidae	3
3.	Hydrophilidae	1
4.	Histeridae	5
5.	Ptiliidae	26
6.	Leiodidae	18
7.	Scydmaenidae	112
8.	Staphylinidae	143
9.	Pselaphidae	138
10.	Scaphidiidae	18
11.	Eucinetidae	1
12.	Scarabaeidae	3
13.	Dryopidae	1
14.	Limnichidae	1
15.	Elateridae	2
16.	Dermestidae	1
17.	Nitidulidae	2
18.	Phalacridae	1
19.	Silvanidae	1
20.	Cerylonidae	7
21.	Corylophidae	4
22.	Anthicidae	4
23.	Lagriidae	2
24.	Tenebrionidae	1
25.	Chrysomelidae (Alticinae)	37
26.	Curculionidae	10
27.	Scolytidae	37
28.	Unidentified	1
	Total	582

with the pronotum almost entirely covering it from above. The male has comb-like antennae, presumably for better detection of pheromone released by the female. The female antennae are simple, almost thread-like.

The three-horned beetle, *Chalcosoma moellenkampi* (Scarabaeidae) was among the large and common beetles sampled here. The male can measure up to 100 mm from the tip of the abdomen to the end of the projection, making it among the biggest beetle in Sabah. Only the male has three prominent projections, hence the name three-horned beetle. It looks ferocious but is harmless. The female is smaller, unimpressive and looks very much like a dung beetle. The elytra are glossy greenish-black with the head and pronotum fully black. This species is common throughout Sabah. It is often confused with *C. atlas* because they look very much alike. Generally, *C. atlas* in Sabah is smaller than *C. moellenkampi*. The projections of the former species forms a 'U' shape at the base of the pronotum whereas the latter species develops a 'V' shape. Some of the projections, however, are reduced in size. Fewer specimens of *C. atlas* were sampled in this survey.

Eight species of long-horned beetles (Cerambycidae) were recorded. The most impressive species was *Aeolesthes aurifaber,* measuring about 70 mm. It is dark brown in colour, with a layer of golden velvety surface. The pronotum is rounded with 'wrinkles' over it.

Eulichadidae is a lesser-known beetle family that looks similar to Elateridae in appearance. However, it does not have the mechanism to click-jump at the posterior part of the pronotum. It has fine teeth at the base of the pronotum, and a distinctive scutellum with fine white hairs forming a circle. Not much is known about this family, but seven specimens were collected from this survey.

CONCLUSION

The beetle diversity from the Ginseng Camp is considered diverse and interesting, even from this preliminary and short survey. Many macro beetles are not commonly encountered, such as *Trichogomphus* sp., *Batocera parryi* and *Zegriades magister*. It is also interesting to note the high abundance of the giant click beetle *Oxyropterus audoniwi*, which was not a common sight in previous light-trapping work at other parts of Sabah. Such interesting diversity of beetles is due to the pristine and mostly undisturbed environment at the Ginseng Camp, Maliau Basin.

Table 2. List of macro beetles sampled through light-trapping from the Ginseng Camp during the Maliau Basin Expedition (6-12 March, 2005).

No.	Family	Species	No. of specimens	Plate no.
1.	Lucanidae	*Cyclommatus canaliculatus* Ritsema	1	1
		Prosopocoilus zebra (Olivier)	1	2
2.	Scarabaeidae	*Chalcosoma atlas* Linnaeus	2	5
		Chalcosoma moellenkampi Kolbe	7	4(♂) & 6(♀)
		Oryctes sp.	1	
		Trichogomphus sp.	1	3
		Lepidiota sp.	2	8
		Mimela sp.	2	7
		Anomala sp. 1	1	
		Anomala sp. 2	1	
		Ectinohoplia sp.	2	
		Unidentified	1	
3.	Eulichadidae	Unidentified	7	12
4.	Elateridae	*Alaus maculorus* Cand.	2	
		Alaus sp. 1	1	
		Alaus sp. 2	1	
		Alaus sp. 3	1	
		Oxyropterus audoniwi Cand.	9	9
5.	Lycidae	Unidentified	1	
6.	Erotylidae	*Encaustes* sp.	1	10
7.	Tenebrionidae	*Setenis* cf. *striatipennis* Lewis	2	11
		Unidentified	1	
8.	Cerambycidae	*Zegriades magister* (Pascoe)	1	16
		Batocera rubus Linnaeus	1	13
		Batocera parryi Hope	1	14
		Macrotoma sp.	1	
		Aeolesthes aurifaber White	2	15
		Aeolesthes sp.	1	
		Trachylophus sp.	1	
		Peribasis princeps Pascoe	2*	17
9.	Brenthidae	*Eupeithes* sp.	1	18

* Collected from Agathis Camp (N $4^0$41'52.7" E $116^0$54'13.4", 511 m a.s.l.)

ACKNOWLEDGEMENTS

We would like to thank the Institute for Tropical Biology and Conservation, UMS (Prof. Datin Dr. Maryati Mohamed and Dr. Homathevi Rahman), Yayasan Sabah (Dr. Waidi Sinun) and the Japan International Cooperation Agency (JICA) for the invitation to participate in this expedition.

REFERENCES

Anon. 2003. *Maliau Basin Conservation Area. Strategic Management Plan, 2003-2012*. Yayasan Sabah & DANIDA, Kota Kinabalu, Sabah. 188 pp.

Chung, A.Y.C. 2005. An overview of beetle diversity and taxonomy research in Malaysia. Paper presented at the Seminar on the Status of Biological Diversity in Malaysia, at FRIM, Kepong. 28-30 June, 2005.

Chung, A.Y.C. 2004. Effect of Reduced Impact Logging (RIL) on soil beetles in Deramakot Forest Reserve. Paper presented at the Workshop on Synergy between Carbon Management & Biodiversity Conservation in Tropical Rain Forests. Sandakan, Sabah, 24 November, 2004.

Davis, A.J. 1998. Dung beetle abundance and diversity in the Maliau Basin, Sabah, Malaysian Borneo. *Malayan Nature Journal*. 52 (3 & 4): 181-191.

Sinun, W. & Tengku Z. Adlin. 1997. The Maliau Basin Conservation Area – Sabah's lost world. *Sabah Society Journal* 14: 21-30.

Plate 1–18: Macro-beetles sampled through light-trapping during the expedition.