

**ABSTRACT:** An expedition by Academy of Science Malaysia to the inaccessible Lanjak Entimau, Sarawak on Borneo Island was conducted in June 2008. Using 20 light traps, 15 Malaise traps and 250 pitfall traps set up at 5 sites, a total of 1,307 beetle from 41 family and 227 species were sampled. The most abundant family was Scarabaeidae followed by Chrysomelidae and Curculionidae. The most abundant beetle was sampled at Begua and Kawi river both assembling 89 species. The most species collected (N=380) was an unidentified species from family Lycidae followed by *Stephanodes coffea* (N=82) (family Scolytidae) and the water beetle *Hydrovatus bohvoulouiri* (family Dystiscidae) (N=82). The best trapping method was light trapping (margalef index, 15.515) compared to pitfall trap (margalef index, 4.242). There was a high diversity (Simpson diversity index, 0.90; Shannon weiner index, 3.67) of beetles at Lanjak Entimau indicating that Lanjak Entimau is still intact. 189 species were identified from this expedition.

**Keywords:** beetle, diversity, Lanjak Entimau, *Dioryche torta*, *Orphnebius bakerianus*, *Megapenthus epirotus*, Sarawak, tropical rainforest

**INTRODUCTION**

Sarawak is located on the north west of Borneo island. It is one of the two states in East Malaysia, the other being Sabah. Sarawak is home to hornbills, orang utans, elephants, exotic plants and the biggest flower Rafflesia, pitcher plants and in the old days of the Iban head hunters who is still 35% of the population. Sultan Brunei made Brooke the Rajah in 1841, Brooke Dynasty ruled for a hundred year and established the first Museum in Borneo in 1888. Presently due to marked logging and conversion to plantation forest including oil palm the dense rainforests is reduced and Bornean Orang Utan and Bornean elephant are critically endangered.

From 1854 to 1856 Alfred Russel Wallace collected 2000 beetle specimens in southwestern Sarawak and 800 were new species (Wallace, 1869). 300 species was described by Baly and Pascoe between 1859 and 1874. Two decades after Wallace's travel, a list of 1000 species described from Sarawak was documented.

At Lambir Hills National Park, Sarawak, Sakai et. al. (1999) studied beetles which pollinated *Shorea Parvifolia* (Dipterocarpaceae Mutica). Sakai and Inoue (1999) reported on dung beetle pollinated *Orchidantha inouei* (Lowiaceae, Zingiberales) in lowland dipterocarp forest. Yamada et al (2009) reported on the population fluctuations of light-attracted chrysomelid beetles in relation to supra-annual environmental changes at Lambir Hills national Park, Sarawak.

Abdullah and Sina (2009) reported high assemblage of Staphylinid beetle (Coleoptera: Staphylinidae) using pitfall set near fresh river margins at Lanjak Entimau (LEWS). However Abdullah and Shamsulaman (2010) found low abundance of carabid beetles at LEWS due to ground disturbance by ethnic group who rely on small mammals in the forest for food and subsistence. Account on the click beetle (Abdullah and Mat Isa, in press) and on water beetles (Abdullah and Fauzee, in press) of LEWS were given recently.

Lanjak Entimau Wildlife sanctuary was gazetted as a protected area 21 years ago in 1989. This study was conducted to investigate the abundance and diversity of beetle fauna at Lanjak Entimau in determining the status of disturbance.

**MATERIALS & METHOD**

**STUDY VENUE:** University Malaya team flew from Kuala Lumpur, Malaysia to Kuching on Borneo island then the following day flew to Sibul and proceeded for 3 hours by ferry to a small Iban town at Song. Then by longboat manned by Iban people took 8 hours to reach the base camp at Batang Ai river at Lanjak Entimau.

**SAMPLING:** Sampling methods followed those of Abdullah (2005, 2006; 2007,2008), Abdullah et al (2008) Abdullah and Sina (2009). Sampling was conducted for 15 days consecutively from 15<sup>th</sup> June 2008 to 29<sup>th</sup> June 2008 at five sites using 20 Malaise traps, 250 pitfall traps for 24 hours. Twenty light traps were set for from 19:00 hr to 23:00 hr. The traps were set up on hill slopes, at river bank and in the middle of the forests.

**SORTING, PRESERVATION AND IDENTIFICATION :** Specimens were sorted to family with Borror and DeLong (1971) and Triplehorn and Johnson (2004) then crossed reference with Department of Agriculture of Peninsular Malaysia and History Museum of Sarawak

**RESULTS**

Lanjak Entimau has high diversity of beetle fauna (Simpson index, 0.9; Shannon weaver index;3.67). A total of 1,307 specimens comprising of 41 families from 227 species were collected. Beetles were caught mostly at Satap River (N = 462). Species sampled at Bergua and Kawi River were most specious (Table 1). Most individuals caught were from family Lycidae (N=381), family Scolytidae (N=188) and family Staphylinidae (N=75) (Fig 2). Most no of species collected were from family Chrysomelid and family Scarabaeidae, each with 23 species assembled followed by 17 species of Staphylinidae (Fig 3).

Table 1. A summary of beetle sampled at different location. at LEWS

Study sites	Specimen No.	Family No.	Species No.	Margalef Index	Simpson Diversity Index	Shannon Weaver index
Kawi River	342	31	89	15.10	0.92	3.37
Joh River	137	12	34	6.74	0.83	2.48
Satap river	462	23	51	8.16	0.32	1.11
Transek Menyaring II	119	24	70	14.82	0.97	3.87
Begua	247	28	89	16.02	0.96	3.81
<b>OVERALL Lanjak entimau</b>	<b>1,307</b>	<b>41</b>	<b>227</b>	<b>31.36</b>	<b>0.90</b>	<b>3.67</b>

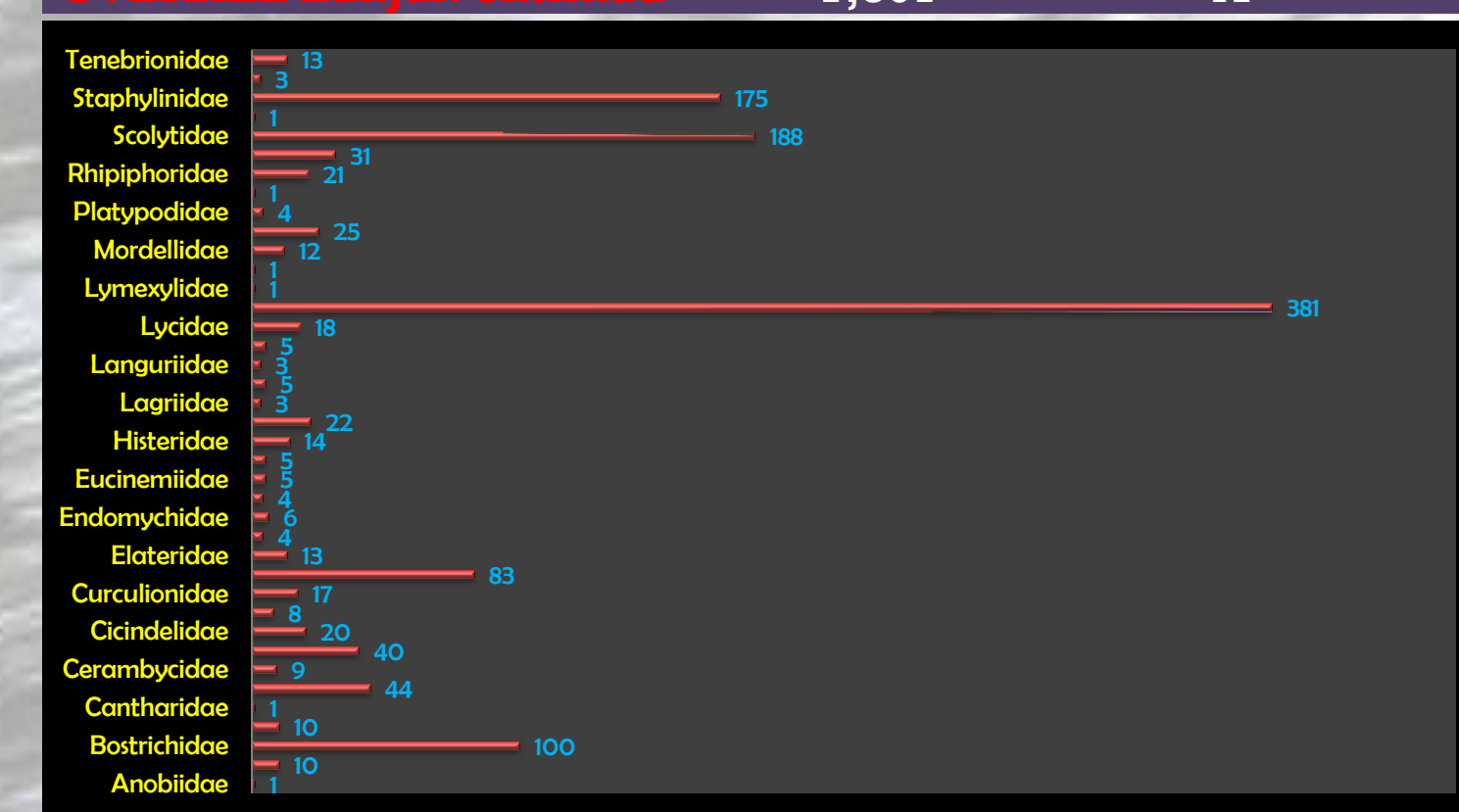


Figure 2. Number of beetle from each family sampled at Lanjak Entimau, Sarawak.

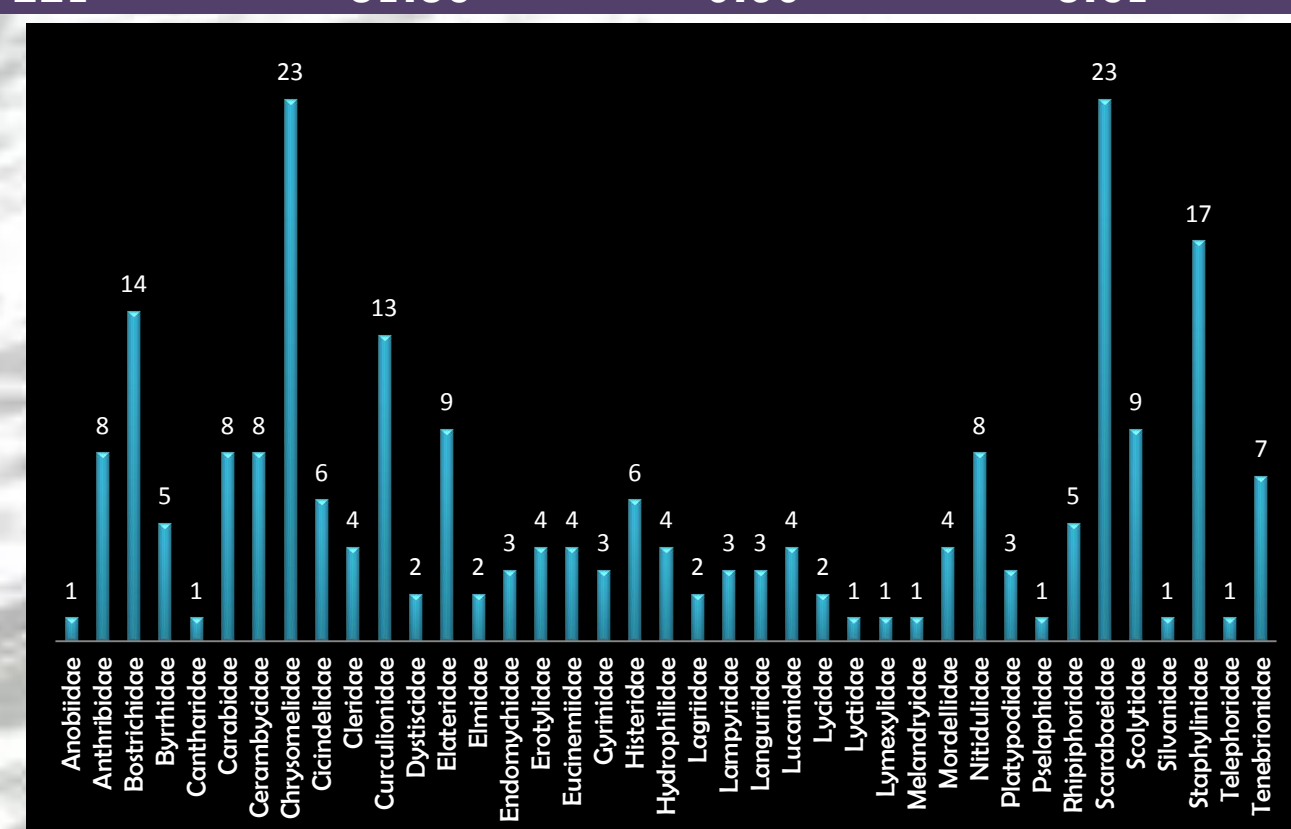


Figure 3. Number of beetle species sampled at Lanjak Entimau, Sarawak.

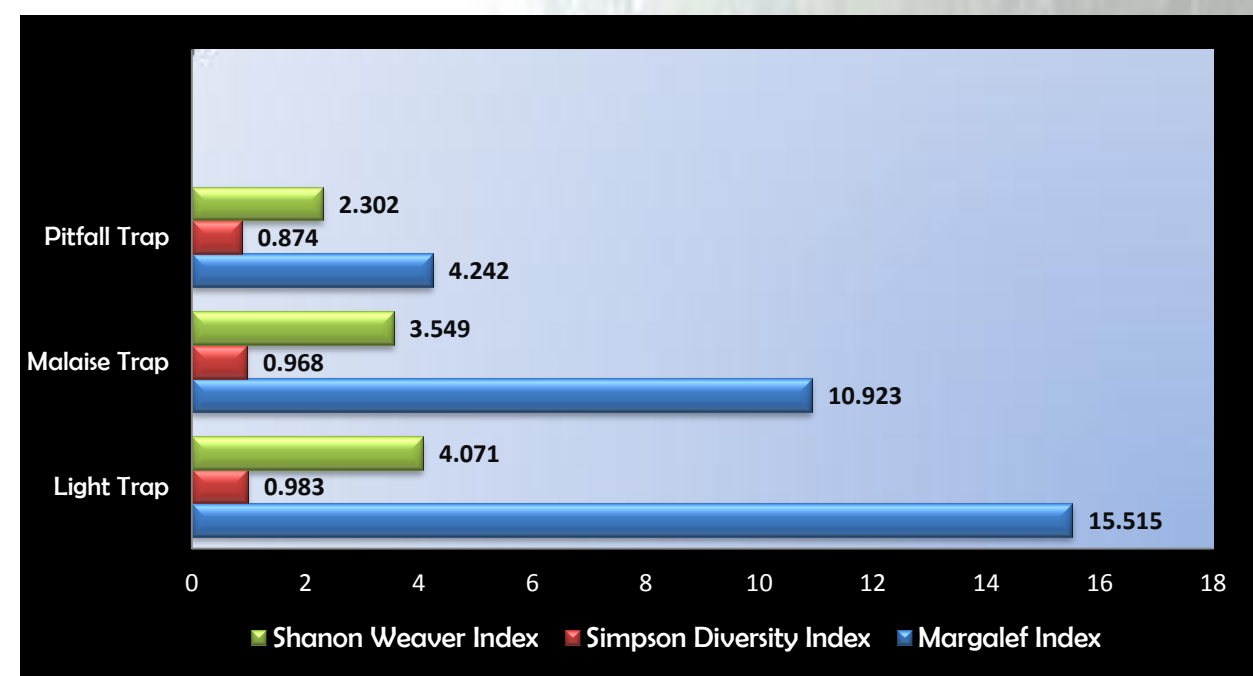
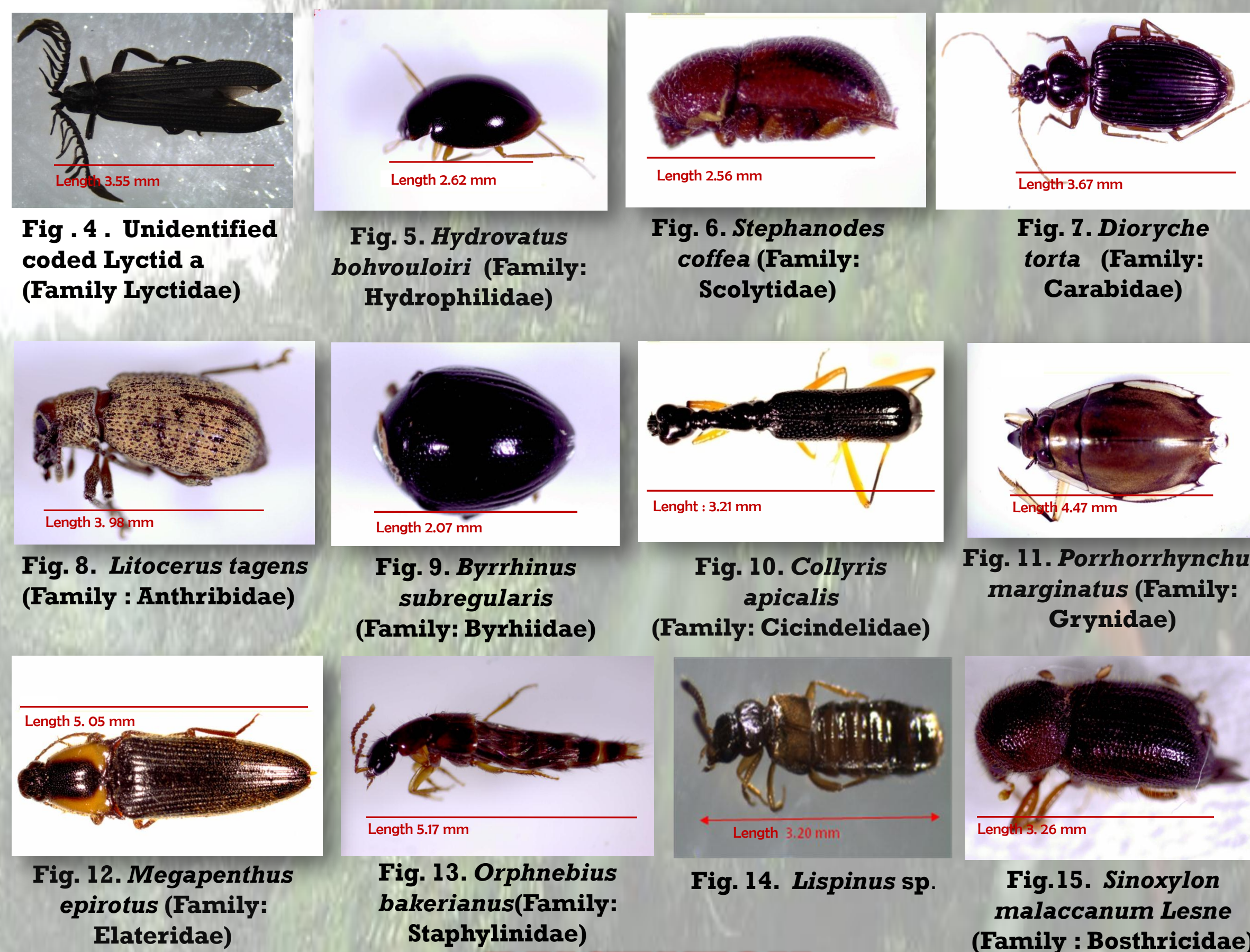


Figure 3. The abundance and diversity of beetles caught from different traps.

Fig 3 shows light trap caught the most abundant (Margalef index: 15.52) and diverse beetles (Simpson diversity index, 0.98; Shannon-Weaver index, 4.07) followed by malaise trap (Margalef index, 10.92; Simpson diversity index, 0.97; Shannon-Weaver index, 3.55). Pitfall collected the least abundant and the least specious (Margalef index, 4.24; Simpson diversity index, 0.87; Shannon-Weaver index: 2.30).

Uniqely the most beetle species collected in this expedition was 380 specimens of the unidentified beetle family Lyctidae coded as Lyctid a (fig 4) followed by Dystiscid water beetle *Hydrovatus bohvoulouiri* (N=82) (fig 5) and scolytid beetle *Stephanodes coffea*. (N=82) (fig 6). The largest no of staphylinid species collected was 60 specimens of *Lispinus* sp. (fig 14). The most number of Carabid collected was *Dioryche torta* (N=22) (fig 7) Some examples of only one individual collected were *Byrrhinus subregularis* (fig 9) (Byrrhidae), *Collyris apicalis* (fig 10) and Grynida water beetle *Porrhorrhynchus marginatus* (fig 11). An example of elaterid beetle caught was *Megapenthus epirotus*. (fig 12) For family Bosthricidae, 16 specimens *Sinoxylon malaccanum* was also sampled (fig 15). Below is some pictures with measurement of the actual specimens from LEWS.



**DISCUSSION**

From a 15 days' study a yield of 1307 specimens comprising of 227 beetle species from 42 families shows high diversity of beetle fauna at Lanjak Entimau (Simpson index, 0.9; Shannon weaver index: 3.67) indicating that Lanjak Entimau is still intact and good habitat for different families of beetles. 189 species were identified from this study and 88 species remains unidentified and probably new to science. With the help of taxonomic experts from America these new species can be described and named.

LEWS is inaccessible to visitors. Only the ethnic people Iban is allowed to enter since they lived along the river leading to Lanjak Entimau. Being a protected area there is no activities of poaching from unwanted visitors but the ethnic inhabitants the Iban people from closeby longhouse do hunt wild boars for food.

Beetle species richness not only increases from temperate to tropical latitudes, but also according to the level of resource availability (Hanski and Cambefort 1997; Janzen 1983; Lumaret et al. 1992). Areas that are rich in mammals, and in particular that have a significant biomass of large herbivores, contain more species of beetle than those that have comparatively poor mammalian faunas (Hanski and Cambefort 1997).

The high species richness recorded at Lanjak Entimau is the result of various factors, including the combination of three different trapping methods, temporal and spatial aspects of the sampling regime and movement of vertebrate from surrounding fragments of remaining forests.

Beetles being adaptable and live in various habitat and has many niche, fulfill all the criteria for an effective focal taxon for biodiversity assessment and monitoring as well as for ecological and biogeographic study. Efforts to include patterns of beetle biodiversity in ecosystem management and single species conservation efforts are proving effective in several countries, and the broader use of beetles as a biodiversity focal taxon is clearly justified (Vulinec . 2000; Davis 2002; Davis et al. 2004).

Results of this study have shown that Lanjak Entimau is still good environmental health and should continue to be protected providing a sanctuary for fauna including beetle with the increasingly reduction of rainforest areas in Sarawak and Borneo island.

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