

# THE LARGER MOTHS (LEPIDOPTERA: HETEROCERA) OF THE CROCKER RANGENATIONAL PARK, SABAH: A PRELIMINARY CHECKLIST

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## ABSTRACT

*The larger moth fauna of a hill mixed dipterocarp forest at the Crocker Range Park (CRP) was studied from light trap samples. A total of 859 individuals were collected comprising of 370 species from 15 families. A preliminary checklist of the larger moth species collected from the Park is presented. The CRP moth species diversity is found to be considerably high with an observed  $\alpha$  of  $249.75 \pm 28.09$ . This falls in the 200-400 range as the typical values for the larger moths of Borneo. Of the 15 families encountered, the Noctuidae and Geometridae represent the most diverse families while the three least diverse families are Brahmaeidae, Saturniidae and Bombycidae. None of the Nolidae, Callidulidae, Ratardidae and Zygaenidae were collected. As high as 62% of the total species collected are singletons, comprising of 27% of the total individuals collected. The reason for this is unclear, however, this could indicate that the larger moth fauna of the CRP is highly diverse. Some of these singleton species are recorded as rare in Borneo while the others are either uncommonly encountered or only reported from Borneo. The geometrid *Amblychia infoveata* Prout and *Godonela nora* Walker and the eupterotid *Eupterote multiarcuata* Holloway were among the most frequently encountered species.*

## INTRODUCTION

The Crocker Range, a tropical highland in Borneo, serves as the backbone dividing the interior regions from the west coast of Sabah. Within this range, two management entities were formed by the Sabah State Government to preserve its physical environment and biological diversity, the Kinabalu Park and the Crocker Range Park.

The Crocker Range Park (CRP) covers an area of 139,919 hectares and unlike the frequently visited Kinabalu Park, scientific documentation on the CRP is very much lacking. This includes basic scientific information such as local insect species checklist or inventory. The scarcity of scientific documentation on insects is partly due to the overwhelming species richness of the insects as a taxon which forms almost ninety percent of the biomass of the tropical rainforests. Another problem in assessing insect diversity lies in the deficiency in knowledge of the systematics of most of the insect fauna of this region. Only about 5% of the vast insect numbers could be scientifically identified in the tropics (Samways 1994). The scarcity in scientific documentation of the insects is also due to the low priority given to the invertebrate conservation effort as insect conservation in the tropics falls under the overall umbrella of biodiversity conservation (Samways 1994) which normally include the plants and the larger vertebrates.

Megadiverse groups like the insects form a major component of biodiversity of any particular area, thus, basic scientific documentation of this fauna is indispensable to any scientific, ecological and conservation studies. Data on species richness are undoubtedly important for biodiversity documentation and assessment, and conservation studies of a particular area.

Being a megadiverse taxon with an enormous species richness in the tropics, to evaluate total species richness of the insects is extremely laborious and time-consuming. Therefore, indicator groups such as the larger moths are frequently selected as the subject of study. Such taxon is selected because it is basically taxonomically well known and relatively rapid to identify (Holloway 1985). Furthermore, the vast majority of both the larger and smaller moths are nocturnal and their response to light provides a very convenient method of sampling by using the ultraviolet or mercury vapor in the light.

At present, the lepidopteran fauna of Kinabalu Park can be regarded as comparatively well-surveyed. Being one of the most visited localities in Borneo since the middle of the nineteenth century, basic scientific documentations of various insect groups are available compared to the lesser-known Crocker Range Park.

In line with the mission of the Crocker Range '99 Expedition, the primary aim of the present study was to survey the larger moth species of CRP, and in particular to prepare a preliminary checklist of the larger moth species of CRP.

## MATERIALS AND METHODS

Three modified Pennsylvanian light traps illuminated by Mercury vapor lamp of 160W each were operated at a hill mixed dipterocarp forest in the vicinity of the CRP Headquarters from 15-20 September 1999. All traps were set about 15m from the trails in the forests and left to function from 1800 hrs until 0600 hrs the following day. The larger moth specimens collected in the traps were extracted, pinned and labelled in the field while relaxing, spreading and sorting to family levels follows by identification to species were done in the lab after the expedition. As noted by most lepidopterists, relaxing, spreading and labelling of the moth specimens are both laborious and time-consuming. However, in this study, most of the collected specimens were prepared as voucher materials which will be deposited in the UNIMAS Insect Reference Collections and the Kinabalu Park Entomological Museum.

Species identification follows that of Holloway (1976; 1983; 1993 and 1996), and Barlow (1982). Cross reference was also made with the existing collections in the UNIMAS Insect Reference Collections. Within habitat diversity (William's  $\alpha$ ) is measured using the alpha statistic of Fisher, Corbet and Williams (1943).

## RESULTS AND DISCUSSION

Samples from the light traps proved extremely valuable for the production of an inventory of the macroheterocerous species found in the Crocker Range Park. Although the sampling period of six light trapping nights was relatively short, a reasonably high total number of the macroheterocerous moths was collected. This comprises of a total number of 849 specimens from 370 species and 15 families. Table 1 presents a preliminary checklist of these species.

An interesting observation made in this study points out to the large number of single individuals (singletons) collected (Table 1). All of the 15 families sampled were represented by singleton species with as high as 62% of the total species collected being singletons, comprising of 27% of the total individuals collected. The reason for the occurrence of the high number of singletons in this survey is unclear. However, most of these singleton species are recorded as rare in Borneo while some are uncommonly encountered. Other species, for instance, *Arctornis pellucidoides* and "*Euproctis*" *u-grisea* are only reported from Borneo. The presence of the large number of singletons over a short sampling period could indicate that the moth fauna of CRP is highly diverse and a number of its species are uncommonly encountered. The conservation of the CRP and its undisturbed forests could thus, act as a reservoir for the various moth species and other species of flora and fauna.

The three commonest species collected were the geometrid *Amblychia infoveata* Prout followed by *Godonela nora* Walker and *Eupterote multiarcuata* Holloway (Eupterotidae) with 23, 17 and 17 individuals collected respectively (Table 1). These species were frequently collected throughout the survey.

Table 2 highlights the family composition of the larger moths collected from the present study in comparison to those of a degraded peat swamp forests in Kota Samarahan (Abang and Karim 1999). Among the 15 families encountered, two major families of moths, the Noctuidae and Geometridae represent the most diverse families. As in moths encountered in a degraded peat swamp forest in Kota Samarahan (Abang and Karim 1999), it was observed that the family Geometridae was more abundant than the Noctuidae with 156 species collected compared to the 73 species of noctuids. However, if sampling was done over a much longer collecting period, the noctuids, being the largest family of the macroheterocerous moths could be found to be dominant.

Overall, the three least diverse families are Brahmaeidae, Saturniidae and Bombycidae with 1, 2, and 2 species encountered. None of the Nolidae, Callidulidae, Ratardidae and Zygaenidae was collected. The callidulids and some of the zygaenids are exclusively day-flying moths. The callidulids fly by day, generally in deep shade near stream beds while the nolidids are rarely found outside montane forests (Barlow 1982). Ratardidae is a small and rare family, represented by only 3 species in Borneo (Holloway 1986).

As expected, the undisturbed hill mixed dipterocarp forests of the CRP documents a high diversity in the larger moth fauna. The CRP larger moth species diversity index ( $\hat{a} = 249 \pm 28.09$ ) is found to be considerably high and falls in the 200-400 range as the typical values for the larger moths in Borneo (Holloway 1987). A much higher species number is to be expected over a longer sampling period.

Table 1: A preliminary checklist of the larger moths (Macroheterocera) of Crocker Range Park, Sabah.

Superfamily Family/Subfamily	Species	Individuals
<b>Noctuoidea</b>		
Arctiidae		
Aganainae		
	1. <i>Asota plana</i> Walker	4
	2. <i>Asota producta</i> Butler	1
Arctiinae		
	3. <i>Areas galactina</i> Hoeven	1
	4. <i>Asota heliconia</i> Linnaeus	2
	5. <i>Cyana malayensis</i> Hampson	2
	6. <i>Nyctemera adversata</i> Schaller	1
	7. <i>Nyctemera regularis</i> Snellen	2
	8. <i>Nyctemera sonticum</i> Swinhoe	2
	9. <i>Spilosoma ericsoni</i> Semper	4
	10. <i>Spilosoma hosei</i> Rothschild	2
	11. <i>Spilosoma strigatula</i> Walker	3
	12. <i>Utetheisa abraxoides</i> Walker	1
	13. <i>Cretonotos transiens</i> Walker	5
Lithosiinae		
	14. <i>Asura</i> cf. <i>bizonoides</i> Walker	6
	15. <i>Asura</i> sp.	2
	16. <i>Asura strigipennis</i> Herrich-Schafer	6
	17. <i>Chamaita trichopteroides</i> Walker	2
	18. <i>Cyana conclusa</i> Walker	1
	19. <i>Cyana pudens</i> Walker	1
	20. <i>Eilema</i> sp. 1	4
	21. <i>Eilema</i> sp.2	1
	22. <i>Eugoa bipunctata</i> Walker	1
	23. <i>Eugoa</i> sp.	1
	24. <i>Macotasa nubeculoides</i> Holloway	1
	25. <i>Mantala tineoides</i> Walker	3
	26. <i>Miltochrista cornicornutata</i> Holloway	1
	27. <i>Miltochrista svntypica</i> Swinhoe	2
	28. <i>Nishada sambara</i> Moore	6
	29. <i>Nishada</i> sp	1
	30. <i>Poliosia marginata</i> Hampson	1
	31. <i>Poliosia</i> sp	4
Syntominae		
	32. <i>Amata megista</i> Hampson	3
	33. <i>Auriculocervx pterodactyliformis</i> Holloway	3
Lymantriidae		
	1. " <i>Euproctis</i> " <i>citrinula</i> van Eecke	1
	2. " <i>Euproctis</i> " <i>pseudoarna</i> Holloway	1
	3. " <i>Euproctis</i> " <i>u-grisea</i> Holloway	1

4.	<i>Arctornis dorsalineatus</i> Holloway	1
5.	<i>Arctornis lumulosa</i> Mackey	1
6.	<i>Arctornis pellucidoides</i> Holloway	1
7.	<i>Arctornis rutila</i> Fabricius	3
8.	<i>Artaxa montiphaula</i> Holloway	1
9.	<i>Artaxa nubilosa</i> van Eecke	2
10.	<i>Artaxa tuhana</i> Holloway	2
11.	<i>Calliteara angulata</i> Hampson	2
12.	<i>Calliteara aphaesta</i> Collenette	2
13.	<i>Calliteara diplozona</i> Collenette	1
14.	<i>Calliteara horsfieldii</i> Saunders	1
15.	<i>Cozola subrana</i> Moore	4
16.	<i>Lymantria lepcha</i> Moore	1
17.	<i>Lymantria marginalis</i> Walker	1
18.	<i>Nygmia amplior</i> Collenette	3
19.	<i>Nygmia atereta</i> Collenette	1
20.	<i>Nygmia civitta</i> Swinhoe	1
21.	<i>Nygmia epirotica</i> Collenette	1
22.	<i>Nygmia exilela</i> Collenette	1
23.	<i>Nygmia peperites</i> Collenette	3
24.	<i>Nygmia postgrisea</i> Rothschild	1
25.	<i>Orgyia basinigra</i> Heylaerts	1
26.	<i>Orvasca bicolor</i> Heylaerts	1
27.	<i>Orvasca vespertilionis</i> Holloway	1
28.	<i>Rhyptoses ?brooksi</i> Collenette	1
29.	<i>Rhyptoses ruptata</i> Walker	1
30.	<i>Rhyptoses strigifimbria</i> Walker	1
31.	<i>Toxoproctis ?munda</i> Walker	2
32.	<i>Toxoproctis adrian</i> Schintlmeister	1
33.	<i>Toxoproctis alticosmia</i> Holloway	1
34.	<i>Toxoproctis cincta</i> Swinhoe	1
35.	<i>Toxoproctis dyssema</i> Collenette	2
36.	<i>Toxoproctis flavolimbata</i> Aurivillius	1
37.	<i>Toxoproctis helpsi</i> Holloway	1
38.	<i>Toxoproctis munda</i> Walker	1
<b>Noctuidae</b>		
Acontiinae		
1.	<i>Eugnathia diagonalis</i> Hampson	1
Acronictinae		
2.	<i>Acronicta rubiginosa</i> Walker	1
Agaristinae		
3.	<i>Sarbanissa catacoloides</i> Walker	1
Amphiphyrinae		
4.	<i>Athetis reclusa</i> Walker	2
5.	<i>Athetis thoracica</i> Moore	1
6.	<i>Callyna</i> sp.	1
7.	<i>Dipterygina major</i> Holloway	2
8.	<i>Dyrzela increnulata</i> Warren	1
9.	<i>Ischyja inferna</i> Swinhoe	1
10.	<i>Mudaria major</i> Warren	2

	11.	<i>Mudaria tayi</i> Holloway	1
	12.	<i>Spodoptera litura</i> Fabricius	2
Catocalinae	13.	<i>Didigua cineracea</i> Holloway	1
	14.	<i>Ercheia cyllaria</i> ? Cramer	2
	15.	<i>Erebus caprimulgus</i> Fabricius	2
	16.	<i>Erebus ephesperis ephesperis</i> Hubner	1
	17.	<i>Hypopyra ?lactipes</i> Hampson	3
	18.	<i>Hypopyra ?pudens</i> Walker	2
	19.	<i>Hypopyra</i> sp	2
	20.	<i>Mocis undata</i> Fabricius	1
	21.	<i>Parallelia fulvotaenia</i> Guenee	1
	22.	<i>Speiredonia</i> sp	1
	23.	<i>Sypna albilinea</i> Walker	1
Chloephorinae	24.	<i>Carea</i> sp.	1
Euteliinae	25.	<i>Targalla apicifascia</i> Hampson	1
Hadeninae	26.	<i>Mythimna calorai</i> Holloway	1
Herminiinae	27.	<i>Bocana ?nr. manifestalis</i> Walker	1
	28.	<i>Hydrillodes</i> sp	6
	29.	<i>Hypena</i> sp.	3
	30.	<i>Simplicia ?rnacrotheca</i> Prout	3
	31.	<i>Simplicia ?xanthoma</i> Prout	2
	32.	<i>Simplicia rufa occidentalis</i> Holloway	4
	33.	<i>Simplicia</i> sp	8
Ophiderinae	34.	<i>Othreis homaena</i> Hubner	1
	35.	<i>Saroba /Sarobides</i> sp	1
	36.	<i>Anomis scitipennis</i> Walker	2
	37.	<i>Anticarsia creberrima</i> Walker	3
	38.	<i>Arthisma rectilinea</i> Roepke	3
	39.	<i>Cryptastria fuscomarginata</i> Bethune-Baker	1
	40.	<i>Donda eurychlora</i> Walker	1
	41.	<i>Episparis costistriga</i> Walker	4
	42.	<i>Ericeia ?inangulata</i> Guenee	1
	43.	<i>Ericeia</i> sp	4
	44.	<i>Ericeia subcinerea</i> Snellen	1
	45.	<i>Gespanna pectoralis</i> Walker	1
	46.	<i>Lophoruza jugosa</i> Swinhoe	1
	47.	<i>Malagonia cf acypera</i> Hampson	6
	48.	<i>Mecodina</i> sp	1
	49.	<i>Othreis cajeta</i> Cramer	1
	50.	<i>Othreis homaena</i> Hubner	1
	51.	<i>Pangrapta holophaea</i> Hampson	1
	52.	<i>Pangrapta metagona</i> Walker	1
	53.	<i>Schistorhynx lobata</i> Prout	1

	54.	<i>Sympis rufibasis</i> Guenee	3
	55.	<i>Tamba cosmoloma</i> Prout	3
	56.	<i>Ugia decisa</i> Walker	1
	57.	<i>Ugia disjungens</i> Walker	4
	58.	<i>Ugia</i> sp	3
Pantheinae			
	59.	<i>Antitrisuloides catocalina</i> Moore	1
Plusiinae			
	60.	<i>Chrysodeixis diehli</i> Dufay	1
Sarrothripinae			
	61.	<i>Asinduma exscripta</i> Walker	1
	62.	<i>Blenina lichenosa</i> Moore	1
	63.	<i>Gadirtha inexacta</i> Walker	1
	64.	<i>Giaura lichenosa</i> Hampson	4
	65.	<i>Ptisciana seminivea</i> Walker	1
	66.	<i>Risoba</i> sp.	1
	67.	<i>Tathothripa continua</i>	1
Stictopterinae			
	68.	<i>Lophoptera acuda</i> Swinhoe	10
	69.	<i>Lophoptera huma</i> Swinhoe	1
	70.	<i>Lophoptera negretinoides</i> Holloway	1
	71.	<i>Lophoptera olivascens</i> Moore	1
	72.	<i>Lophoptera squammigera</i>	5
	73.	<i>Lophoptera submarginata</i> Holloway	1
<b>Notodontoidea</b>			
Notodontidae			
	1.	<i>Allata benderi</i> Dierl	1
	2.	<i>Benbowia virescens</i> Moore	1
	3.	<i>Cerura malaysiana</i> Holloway	1
	4.	<i>Eupydna testacea postrubra</i> Swinhoe	1
	5.	<i>Gangarides vardena</i> Swinhoe	1
	6.	<i>Ginshachia sumatrensis</i> Gaede	1
	7.	<i>Neocerura liturata</i> Walker	3
	8.	<i>Norraca sordida</i> Roepke	1
	9.	<i>Omichlis dimorpha</i> Kiriakoff	1
	10.	<i>Phalerajavana Moore albifrons</i> Walker	1
	11.	<i>Quadricalcarifera viridimaculata</i> Matsumura	1
	12.	<i>Tensha postobscura</i> Holloway	1
<b>Geometroidea</b>			
Drepanidae			
Drepaninae			
	1.	<i>Albara hollowayi</i> Watson	1
	2.	<i>Callidrepana micacea</i> Walker	1
	3.	<i>Callidrepana pulcherrima</i> Hampson	1
	4.	<i>Euphalacra discipuncta</i> Holloway	1
	5.	<i>Oreta singapura</i> Swinhoe	1
	6.	<i>Pseuderosia desmierdechenoni</i> Holloway	1
	7.	<i>Strepsigonia quadripunctata</i> Walker	1
	8.	<i>Strepsigonia robusta</i> Holloway	2

**Geometridae**

## Desmobathrinae

1.	<i>Eumelea feliciata</i> Guenee	3
2.	<i>Noreia anacardium</i> Holloway	1
3.	<i>Noreia unilineata</i> Walker	1
4.	<i>Ozola liwana</i> Sommerer	2

## Ennominae

5.	<i>Abaciscus shaneae</i> Holloway	5
6.	<i>Alcis periphraeta</i> Prout	6
7.	<i>Amblychia infoveata</i> Prout	23
8.	<i>Amblychia sommereri</i> Holloway	2
9.	<i>Astygisa circularia</i> Swinhoe	2
10.	<i>Astygisa vexillaria</i> Guenee	1
11.	<i>Astygisa waterstradti</i> Holloway	1
12.	<i>Biston insularis</i> Warren	4
13.	<i>Calletaera jotaria</i> Felder & Rogenhofer	1
14.	<i>Celenna festivaria</i> Fabricius	5
15.	<i>Chorodna complicataria</i> Walker	1
16.	<i>Chrysoblephara chrysoteucta</i> Prout	2
17.	<i>Cleora alienaria</i> Walker	1
18.	<i>Cleora cucullata</i> Fletcher	2
19.	<i>Cleora inoffensa</i> Swinhoe	1
20.	<i>Corymica arnearia</i> Walker	1
21.	<i>Dalima subflavata</i> Felder & Rogenhofer	1
22.	<i>Dasyboarmia subpilosa</i> Warren	1
23.	<i>Dilophodes elegans</i> Butler	1
24.	<i>Diplurodes inundata</i> Prout	2
25.	<i>Diplurodes kerangatis</i> Holloway	3
26.	<i>Diplurodes petras</i> Meyrick	1
27.	<i>Diplurodes semicircularis</i> Holloway	4
28.	<i>Diplurodes submontana</i> Holloway	2
29.	<i>Ectropidia illepidaria</i> Walker	1
30.	<i>Ectropis bhurmitra</i> Walker	13
31.	<i>Ectropis longiscapia</i> Prout	10
32.	<i>Eurytaphria chlorochroa</i> Meyrick	1
33.	<i>Fascellina meligerys</i> Prout	1
34.	<i>Gasterocome pannosaria</i> Moore	1
35.	<i>Godonela avitusaria</i> Walker	4
36.	<i>Godonela bornusaria</i> Holloway	2
37.	<i>Godonela mutabilis</i> Warren	1
38.	<i>Godonela nora</i> Walker	17
39.	<i>Godonela ozararia</i> Walker	1
40.	<i>Heterostegane contessellata</i> Prout	1
41.	<i>Heterostegane subfasciata</i> Warren	2
42.	<i>Heterostegane subtessellata</i> Walker	3
43.	<i>Hypephyra brunneiplaga</i> Swinhoe	1
44.	<i>Hypochrosis binexata</i> Walker	1
45.	<i>Hypochrosis cryptopyrrhata</i> Walker	1
46.	<i>Hypochrosis pyrrhophaeata</i> Walker	1
47.	<i>Hypochrosis sternaria</i> Guenee	1

48.	<i>Hypochrosis waterstradti</i> Holloway	1
49.	<i>Hypomecis cineracea</i> Moore	1
50.	<i>Hypomecis glochinophora</i> Prout	2
51.	<i>Hypomecis lioptilaria</i> Swinhoe	16
52.	<i>Hypomecis separata</i> Walker	15
53.	<i>Hyposidra apioleuca</i> Prout	16
54.	<i>Hyposidra infixaria</i> Walker	10
55.	<i>Hyposidra picaria</i> Walker	15
56.	<i>Hyposidra violescens</i> Hampson	2
57.	<i>Iridoplecta ferrifera</i> Moore	6
58.	<i>Iulotrichia decursaria</i> Walker	2
59.	<i>Krananda lucidaria</i> Leech	3
60.	<i>Krananda semihyalina</i> Moore	5
61.	<i>Lassaba acribomena</i> Prout	3
62.	<i>Lomographa luciferata</i> Walker	1
63.	<i>Loxotephria bornea</i> Holloway	5
64.	<i>Luxiaria acutaria</i> Snellen	2
65.	<i>Luxiaria emphatica</i> Prout	5
66.	<i>Luxiaria submonstrata</i> Walker	1
67.	<i>Maidania tetragonata</i> Walker	3
68.	<i>Mesaster albidiscata</i> Warren	1
69.	<i>Microplutodes hilaropa</i> Meyrick	1
70.	<i>Necyopa ioge</i> Prout	3
71.	<i>Omiza lycoraria</i> Guenee	15
72.	<i>Ophthalmitis basiscripta</i> Holloway	1
73.	<i>Ophthalmitis punctifascia</i> Holloway	1
74.	<i>Ourapteryx claretta</i> Holloway	1
75.	<i>Parasynegia sundastriaria</i> Holloway	2
76.	<i>Pareumelea eugeniata</i> Guenee	2
77.	<i>Peratophyga beta</i> Holloway	9
78.	<i>Peratophyga venetia</i> Swinhoe	3
79.	<i>Petelia delostigma</i> Prout	5
80.	<i>Petelia medardaria</i> Herrich-Schaffer	7
81.	<i>Petelia paroobathra</i> Prout	7
82.	<i>Petelia tuhana</i> Holloway	1
83.	<i>Plutodes argentalauta</i> Prout	1
84.	<i>Plutodes cyclaria</i> Guenee	4
85.	<i>Plutodes flavescens</i> Butler	1
86.	<i>Plutodes malaysiana</i> Holloway	1
87.	<i>Plutodes</i> sp.	1
88.	<i>Psilalcis bisinuata</i> Hampson	6
89.	<i>Psilalcis conceptaria</i> Holloway	5
90.	<i>Psilalcis subfasciata</i> Warren	2
91.	<i>Racotis boarmiaria</i> Guenee	1
92.	<i>Racotis inconclusa</i> Walker	1
93.	<i>Rhynchobapta eburnivena</i> Warren	1
94.	<i>Satablephara hollowayi</i> Sato	2
95.	<i>Tasta chalybeatoides</i> Holloway	5
96.	<i>Tasta disciscura</i> Holloway	1
97.	<i>Thinopteryx crocopterata</i> Kollar	2

	98.	<i>Zamarada baliata</i> Felder & Rogenhofer	2
	99.	<i>Zamarada eogenaria</i> Snellen	1
Geometrinae			
	100.	? <i>Pingasa lariaria</i> Walker	1
	101.	? <i>Rhombocentra semipurpurea</i> Warren	1
	102.	? <i>Spaniocentra megaspilaria</i> Guenee	1
	103.	<i>Agathia arcuata</i> Moore	1
	104.	<i>Agathia diplochorda</i> Prout	1
	105.	<i>Agathia gigantea</i> Butler	1
	106.	<i>Agathia laetata</i> Fabricius	1
	107.	<i>Agathia quinaria</i> Moore	1
	108.	<i>Agathia succedanea</i> Warren	5
	109.	<i>Anoplosceles nigripunctata</i> Warren	1
	110.	<i>Bracca georgiata</i> Guenee	1
	111.	<i>Chloristola setosa</i> Holloway	1
	112.	<i>Comostola dyakaria</i> Walker	2
	113.	<i>Comostola turgescens</i> Prout	1
	114.	<i>Dindica olivacea</i> Inoue	1
	115.	<i>Episothalma robustaria</i> Guenee	3
	116.	<i>Hemithea insularis</i> Guenee	1
	117.	<i>Herochroma orientalis</i> Holloway	1
	118.	<i>Herochroma urapteraria</i> Walker	3
	119.	<i>Jodis api</i> Holloway	1
	120.	<i>Lophophelma erionoma</i> Swinhoe	1
	121.	<i>Lophophelma funebrosa</i> Warren	1
	122.	<i>Lophophelma rubroviridata</i> Warren	1
	123.	<i>Macotasa</i> sp	1
	124.	<i>Maxates dysides</i> Prout	2
	125.	<i>Maxates inidescoides</i> Holloway	1
	126.	<i>Maxates magnipuncta</i> Prout	2
	127.	<i>Maxates waterstradti</i> Prout	1
	128.	<i>Mixochlora argentifusa</i> Walker	1
	129.	<i>Mixochlora vittata</i> Moore	1
	130.	<i>Oenospila altistrix</i> Holloway	1
	131.	<i>Ornithospila bipunctata</i> Prout	2
	132.	<i>Ornithospila submonstrans</i> Walker	2
	133.	<i>Ornithospila sundaensis</i> Holloway	1
	134.	<i>Orothalassodes floccosa</i> Prout	1
	135.	<i>Orothalassodes glabrosa</i>	3
	136.	<i>Paramaxates postenecta</i> Holloway	1
	137.	<i>Paramaxates yazakii</i> Holloway	1
	138.	<i>Pelagodes cochlearis</i> Holloway	2
	139.	<i>Pingasa lariaria</i> Walker	2
	140.	<i>Pingasa nubicunda</i> Warren	2
	141.	<i>Tanaorhinus rafflesii</i> Moore	3
	142.	<i>Thalassodes apalinoides</i> Holloway	1
Larentiinae			
	143.	<i>Pomasia galastis</i> Meyriek	
	144.	<i>Pomasia reticulata</i> Hampson	
Sterrhinae			

	145.	<i>Idaea mundaria</i> Walker	2
	146.	<i>Ignobilia urnaria</i> Guenee	1
	147.	<i>Organopoda ?acmaea</i> Prout	1
	148.	<i>Perixera niveopuncta</i> Warren	1
	149.	<i>Perixera sabulosa</i> Warren	1
	150.	<i>Problepsis achlyobathra</i> Prout	1
	151.	<i>Problepsis plenorbis</i> Prout	1
	152.	<i>Scopula deflavarioides</i> Holloway	3
	153.	<i>Scopula parodites</i> Prout	2
	154.	<i>Scopula pauperata</i> Prout	1
	155.	<i>Scopula</i> sp	1
	156.	<i>Zythos turbata</i> Walker	1
Uraniidae			
Epipleminae			
	1.	<i>Dysaethria nigrifrons</i> Hampson	1
	2.	<i>Dysaethria quadricaudata</i> Walker	1
	3.	<i>Monobolodes</i> sp.?	2
	4.	<i>Oroplema parvipallida</i> Holloway	1
	5.	<i>Phazaca leucocera</i> Hampson	1
	6.	<i>Pseudodirades transgrisea</i> Holloway	1
	7.	<i>Pterotosoma castanea</i> Warren	1
Uraniidae			
	8.	<i>Urapteroides astheniata</i> Guenee	1
<b>Bombycoidea</b>			
Bombycidae			
	1.	<i>Mustilia dierli</i> Holloway	1
	2.	<i>Penicillifera apicalis</i> Walker	1
<i>Brahmaeidae</i>			
	1.	<i>Brahmaea hearseyi</i> White	2
Eupterotidae			
	1.	<i>Eupterote asclepiades</i> Felder	13
	2.	<i>Eupterote harmani</i> Holloway	3
	3.	<i>Eupterote multiarcuata</i> Holloway	17
	4.	<i>Eupterote muluana</i> Holloway	8
	5.	<i>Eupterote naessigi</i> Holloway	10
Lasiocampidae			
	1.	<i>Bhima borneana</i> Holloway	1
	2.	<i>Kunugia rectifascia</i> Holloway	1
	3.	<i>Lajonquiereia jermeyi</i> Holloway	1
	4.	<i>Radhica elisabethae</i> Lajonquiere	1
	5.	<i>Trabala krishna</i> Roepke	1
Saturniidae			
	1.	<i>Cricula bornea</i> Watson	1
	2.	<i>Loepa megacore</i> Jordan	1
Sphingidae			
	1.	<i>Acosmeryx shervilli</i> Boisduval	1
	2.	<i>Ambulyx obliterateda</i> Rothschild	1
	3.	<i>Ambulyx pryeri</i> Distant	1
	4.	<i>Cechenena lineosa</i> Walker	3
	5.	<i>Daphnusa ocellaris</i> Walker	3

	6.	<i>Hippotion.velox</i> Fabricius	2
	7.	<i>Marumba juvenicus</i> Rothschild	1
	8.	<i>Meganoton analis</i> Felder	4
	9.	<i>Theretra latreillei</i> MacLeay	1
	10.	<i>Theretra nessus</i> Drury	1
	11.	<i>Theretra rhesus</i> Drury	1
<b>Cossoidea</b>			
Cossidae			
	1.	<i>Cossus kinabaluensis</i> Gaede	1
	2.	<i>Xyleutes mineus</i> Cramer	2
	3.	<i>Xyleutes persona le</i> Guillou	1
	4.	<i>Xyleutes strix</i> Linnaeus	2
<b>Zygaenoidea</b>			
Limacodidae			
	1.	<i>Birithama congrua</i> Walker	2
	2.	<i>Flavinarosa holoxanthia</i> Hampson	1
	3.	<i>Griseothosea cruda</i> Walker	2
	4.	<i>Heringarosa trifurca</i> Holloway	1
	5.	<i>Marsuplectra parasina</i> Hering	1
	6.	<i>Narosa velutina</i> Walker	1
	7.	<i>Scopelodes albipalpis</i> Hering	3
	8.	<i>Setothosea asigna</i> van Eecke	1
	9.	<i>Susica everetti</i> Holloway	1
	10.	<i>Thosea borneensis</i> Hering	1
	11.	<i>Thosea griseafurca</i> Holloway	2
	12.	<i>Thosea vetusta</i> Walker	2
<b>Total</b>		<b>370 species</b>	<b>849</b>

Another interesting observation to note is the occurrence of the family Brahmaeidae in the samples from the CRP forest which is not found in the peat swamp forest (Table 2). This family is represented by a single species, *Brahmaea hearseyi* White and in this survey, two individuals were collected. In Borneo, *B. hearseyi*, has been uncommonly encountered in lowland rainforest and up to 1200m at Mt. Kinabalu (Holloway 1987). Saturniidae was not well represented with only two singleton species collected, *Cricula bornea* Watson and *Loepa megacore* Jordan. Another least represented family was Bombycidae. Like Saturniidae, only two singleton species were collected. These are *Mustilla dierli* Holloway and *Penicillifera apicalis* Walker.

Table 2: The position of the larger moth fauna of CRP compared to those of Kota Samarahan (KS) (Abang and Karim 1999).

Family	Species	
	CRP (Sampling over 6 consecutive nights)	KS (Sampling of 12 nights over 3 months)
Lymantriidae	38	37
Arctiidae	33	60
Nolidae	0	1
Noctuidae	73	119
Notodontidae	12	30

<b>Sphingidae</b>	11	18
<b>Saturniidae</b>	2	0
<b>Brahmaeidae</b>	1	0
<b>Bombycidae</b>	2	7
<b>Eupterotidae</b>	5	1
<b>Lasiocampidae</b>	5	11
<b>Uraniidae</b>	8	4
<b>Geometridae</b>	156	124
<b>Drepanidae</b>	8	13
<b>Callidulidae</b>	0	0
<b>Limacodidae</b>	12	28
<b>Zygaenidae</b>	0	1
<b>Cossidae /Metarbelldae</b>	4	3
<b>Ratardidae</b>	0	0
<b>Total</b>	<b>370</b>	<b>457</b>

Overall, our samples suggest that the larger moth fauna of CRP is largely typical of that of an undisturbed Bornean rain forest. From this survey, it could also be said that the hill dipterocarp forest of CRP is characterised by the presence of a large proportion of the Geometridae and Noctuidae which are among the most diverse families of moths in Borneo. Apart from that, it is also characterised by the occurrence of the relatively rare family, Brahmaeidae.

## CONCLUSIONS

The larger moths of the CRP hill dipterocarp forest is considerably high in diversity ( $\lambda = 249.75 \pm 28.09$ ). Results from this survey also indicate that the hill dipterocarp forest of CRP is characterised by the large proportion of Geometridae and Noctuidae which are among the most diverse families of moths in Borneo and the occurrence of the relatively rare family, Brahmaeidae.

As high as 62% of the total species collected are singletons, comprising of 27% of the total individuals collected. Most of these singleton species are recorded as rare in Borneo while some are uncommonly encountered. Others, for instance, *Arctornis pellucidoides* and "*Euproctis*" *u-grisea* are only reported from Borneo. The presence of the large number of singletons over a short sampling period could indicate that the moth fauna of CRP is highly diverse and a number of its species are uncommonly encountered. Thus the conservation of the CRP is timely and the conservation of its undisturbed forests could act as a reservoir for the various moth species and other species of flora and fauna.

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