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CATATAN PENELITIAN

Moth Diversity at Sebangau Peat Swamp and Busang River Secondary Rain Forest, Central Kalimantan

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A study on the diversity of moths was conducted from July to Augustus 2004 at the peat swamp forest Setya Alam research station, Sebangau, Central Kalimantan. The result showed that diversity of moths at this area was lower (100 species of 12 families; *H'* = 6.643, *E* = 0.794) than that in secondary rain forest Busang River (278 species of 19 families; *H'* = 8.139, *E* = 0.831). The result also showed that the similarity index (*Cj*) of the two areas was very low (0.05). Geometridae, Noctuidae, and Pyralidae were dominant in both areas. There might be more species that have not been found during eight night sampling as indicated by the species numbers in both areas has not reach a plateau.

It is well known that Lepidoptera, moths and butterflies, is the most divers group among insect groups after beetles and Hymenoptera (Gullan & Cranston 1995; Kristensen 1999). It has been estimated that the world fauna of Lepidoptera numbers more than 160,000 species and more than 90% of them is moths. The adults have an important role in the forest ecosystem as pollinators. Their larvae are mainly plant defoliator, but there are also leaf miners (several microlepidoptera families such as Nepticulidae and Gracillaridae), stem borers (for instances in Noctuidae and Pyralidae), flower feeders (Noctuidae and Geometridae), and timber borers (Cossidae and Hepialidae). The larvae indeed often show great specificity to host plants (Robinson 1975; Holloway 1976, 1979, 1984, 1987; Hebert 1980; Inoue *et al*. 1982; Common 1990; Robinson *et al*. 1994).

Compared with butterflies, however, our knowledge on moth fauna in Indonesia are still very limited and poorly documented. Researches on moths have mostly focused on biological aspects of certain groups of economic value: i.e. agricultural pests (Prabaningrum & Sastrosiswojo 1994; Schellhorn 1995). This is partly because there are relatively few researchers who are able to study our moth fauna, and also because the Indonesian moth fauna has a high proportion of very small species (microlepidopteran). Although, there have been some efforts to inventory our moth faunas, such as study on diversity of lepidopteran in the Gunung Halimun National Park (Atmowidi *et al*. 2001), however, because of lack of adequate capacity to identify to species, they failed to achieve the objective of research. Studies conducted by Sutrisno (2003) also failed to show the diversity of moth in the Gunung Gede Pangrango National Park because only recorded about 100 species which, however, might be far from the actual number of species in that area. Other studies mostly focused on certain groups such as which has been carried out by Germany researchers (Nässig *et al*. 1996; Kobes 2000) which conducted studies on several groups of moths in North Sumatra and published in a series book of Heterocera Sumatrana. Holloway (1987) conducted studies in Sulawesi and Seram Islands with focused on macrolepidoptera. Therefore, all these efforts are still needed to be continued to cover all diversity of Indonesian moths.

In order to acquire information of Indonesian moth diversity and to assess the composition of moth species in peat swamp forest, I conducted a study at the peat swamp forest Setya Alama research station, Sebangau, Central Kalimantan. For comparison, I also used data from secondary rain forest Busang River, Jujang Parit Village, Sumber Barito, Murung Raya District (230 m above sea level) central Kalimantan. This secondary forest is characterized by mix vegetation between young indigenous trees and some agricultural plants such as coconut palm, mango, and rambutan. All the methods used in moth diversity study at the Busang River are similar as described in this present paper.

Setya Alam research station is one of timber logging company areas where operation was commenced in 1995. Currently, the area is a peat swamp forest research station under the management of Palangka Raya University. This research station is located at Kereng Bengkirai Village, about 20 km west of Palangka Raya City (2°45'45, 8"S 111°56'42, 4"; 10 m above sea level) and covers nearly 15,000 ha. The most dominant vegetation at this forest is *Combretocarpus rotundus* (Tumih) (Mirmanto *et al*. 2005).

This research was conducted from July to Augustus 2004 during eight nights using light traps equipped with a 160 watt mercury vapor light and a 2 x 2 m white screen. The light trap was set up on eight sites along the main track of railway in the forest with the interval 500 m. Moths attracted to the light trap and lie at the white screen were collected into an ethyl acetate-killing bottle and brought to the laboratory for identification. Preservation of the specimens was following Ubaidillah's procedures (1999). All moth specimens were deposited at Museum Zoologicum Bogorienses, Bogor.

The data were analyzed by using Shannon's diversity index (*H'*), Shannon's evenness (*E*) and Jaccard's index (*Cj*) (Magurran 1987).

The results showed that the diversity of moth at peat swam forest was lower (100 species in 12 families; $H' = 6.643$, $E = 0.794$) than those found in the secondary rain forest Busang River (278 species in 19 families; $H' = 8.139$, $E = 0.831$). The results also showed that Geometridae, Noctuidae and Pyralidae were dominant in both areas. The list of the species at both areas is presented in Table 1.

There might be more species that has not been collected at both areas judging from the observation that the number of species did not reach a plateau but increased more or less regularly during eight night collection. At the Sebangau, the increasing of species number was slower than those found at Busang forest as shown in Figure 1. The similarity index (*Cj*) of the two areas was very low (0.05).

Table 1. The number of indiviuals, diversity index and evenness indexes for moths collected from the peat swamp forest Sebangau and the secondary forest Busang river

Family	Species	No of individuals	
		Sebangau (A)	Busang (B)
Geometridae	*Achrosis fulvifusa*	2	0
	Agathia laetata	1	0
	Alex palparia	1	0
	Amblychia angeronaria	0	2
	Antitrygodes divisaria	0	7
	Bracca subfumosa	0	13
	Cassyma quadrinata	0	1
	Cassyma undifasciata	1	0
	Celenna centaria	0	8
	Chlorissa amphitritaria	1	0
	Chlorocoma sp.	0	18
	Cleora contiguata	0	3
	Cleora determinata	0	10
	Comibaena biplaga	0	1
	Comibaena cassidara	0	5
	Comibaena quadrinotata quadrinotata	1	0
	Comostola cedilla	0	1
	Comostola meritaria	0	2
	Comostola pyrrhogana	0	1
	Cusiala boarmoides acutijuxta	0	2
	Diplurodes vestitus fusco vestitus	4	0
	Diplurodes vestitus sinecoremata	0	1
	Dysphania malayanus	1	0
	Ectropidia fimbripedata	0	6
	Ectropidia quasilepidaria	0	2
	Eois obliviosa	0	1
	Eucyclodes rufimargo	1	0
	Eucyclodes semialba	0	2
	Eumelea sp.	0	2
	Fascellina clausaria	1	1
	Godonela avitusaria	0	10
	Godonela translineata	0	1
	Hemithea neptunaria	1	0
	Hemithea tritonania	1	0
	Hemithea undifera	1	0
	Herochroma flavibasalis	1	0
	Herochroma orientalis	0	2
	Heteralex rectilineata	1	0
	Heterarmia charon charon	0	8
	Heterolocha sp.	0	2

Table 1 (continued)

Family	Species	No of individuals	
		Sebangau (A)	Busang (B)
	Horisme sp.	0	1
	Hypena indicatalis	0	1
	Hypochrosis cryptopyrrhata	0	4
	Hypochrosis pyrrhophaeta	0	167
	Hypochrosis sternaria	0	1
	Hypomecis costaria	5	9
	Hypomecis definiza	0	2
	Hypomecis glochinophora	0	7
	Hypomecis subdetractaria	0	1
	Hyposidra infixaria	3	5
	Hyposidra talaca	1	2
	Iulotricia decursaria	0	0
	Lophophelma vigens	1	0
	Luxiaria acutaria	0	1
	Luxiaria amasa amasa	0	25
	Luxiaria mitorrhaples	0	10
	Luxiaria prouti	0	1
	Maxates indescoides	1	0
	Metallolophia cineraceae	1	0
	Metallolophia viticosta	0	1
	Microcalicha fumosaria fumosaria	1	0
	Microplutodes hilaropa	0	3
	Monocerotesa proximesta	0	3
	Noreia achloraria	2	0
	Nothomiza aureolaria	1	0
	Oenospila flavifusata	0	3
	Omiza lycoraria	9	16
	Ophthalmitis irrorataria	1	0
	Ornithospila submonstrans	0	5
	Ourapteryx padaliriata	0	1
	Ozola turlini	0	25
	Paramaxates posterecta	1	0
	Peratophyga trigonata	8	0
	Pingasa rubimontana	0	1
	Pingasa ruginaria	0	20
	Plutodes argentilauta	0	15
	Pomasia lamunin	0	5
	Protuliocnemis biplagiata	1	0
	Racotis quadripunctata	0	1
	Rhomboista megaspilaria lyra	1	2
	Ruttellerona pallicostaria	0	1
	Scopula personata	6	0
	Tanaorhinus rafflesii	1	11
	Tasta discisaura	0	7
	Tasta reflexoides	1	5
	Thalassodes sundissepta	1	0
	Triaena tridens	0	2
	Yezognophos sp.	0	2
	Zola terranea terranea	1	0
	Zythos obliterata	0	5
	Zythos turbata	5	1
Noctuidae	*Achaea serva*	1	0
	Aletia sp.	1	0
	Ancara replicans	6	0
	Anisoneura sp.	0	7
	Bematha extensa	0	1
	Bocana manifestalis	1	0
	Bomolocha sp.	0	1
	Boriana polyspila	0	5
	Callopistria duplicans	1	0
	Callopistria rivularis	0	3
	Claterna cydonia	0	1
	Cyclodes spectans	0	1
	Diehlea tumida	1	0
	Dipterygira dorsipallens	0	4
	Episparis costisriga	0	1

Table 1 (continued)

Family	Species	No of individuals	
		Sebangau (A)	Busang (B)
	Episparis sejunctata	0	11
	Ercheia cyllaria	1	1
	Erebus ephesperis	0	1
	Felinia precedens	0	3
	Flammona quadrifasciata	0	1
	Hademia obliqua	1	0
	Hulodes caranea	0	4
	Hypena subcyanea	0	1
	Hypopyra lactipex	2	0
	Iambia tessellata	0	7
	Ischyja manlia	14	1
	Mudaria luteileprosa	0	1
	Mudaria minoroides	0	9
	Mudaria tayi	0	3
	Ophisma pallescens	1	0
	Ophiusa coronata	2	0
	Ophiusa trapezium	1	0
	Otheis fullonia	0	1
	Parallelia fulvotaenia	0	2
	Pseudothyrma complens	1	0
	Pseudothyrma tepescens	0	8
	Sarbanissa albifascia	0	1
	Sarbanissa transiens	0	2
	Siglophiora haemoxantha	3	0
	Simplicia sp.	0	1
	Strophidia caudata	0	4
	Sympis rufibasis	0	7
	Tinolius sp.	0	1
	Westermannia sp.	0	1
	Xenochroa costiplaga	1	0
Pyralidae	*Aetholix flavibasalis*	0	1
	Agrotera scisalis	23	1
	Ambia tigridalis	2	0
	Arthrochista hilaralis	4	4
	Aulocodes sp.	0	9
	Botyodes asialis	1	4
	Chabula telphusalis	0	9
	Cirrhoa cristabrizoalis	0	3
	Cnaphalocrocis patnalis	3	2
	Conogethes punctiferalis	0	6
	Cydalima laticostalis	0	3
	Dausara amethysta	0	137
	Dichocrocis plutosalis	0	1
	Endotricha sp.	0	1
	Eublemma sp.	0	7
	Filodes fulvidorsalis	0	8
	Gadessa nilusalis	3	0
	Gaurena pallescens	0	2
	Gaurena sp.	0	1
	Gliphodes militaris	0	1
	Glyphodes actorionalis	0	4
	Glyphodes bivitralis	0	5
	Glyphodes caesalis	1	6
	Glyphodes canthusalis	0	2
	Glyphodes onychinalis	0	8
	Glyphodes stolalis	1	0
	Hapalia castoralis	0	23
	Haritalodes derogata	0	1
	Herculia marthalis	2	2
	Herpetogramma fuscescens	0	3
	Herpetogramma luctuosalis zelleri	0	18
	Heterocnephes lymphatalis	0	8
	Isocentris phoenicozona	0	3
	Lista haraedusalis	1	0
	Margaronia amphitritalis	0	15
	Maruca testulalis	7	39

Table 1 (continued)

Family	Species	No of individuals	
		Sebangau (A)	Busang (B)
	Nacoleia diemenalis	0	1
	Nausinoe pucritia	0	6
	Nothomiza aureolaria	1	0
	Nymphula sp.	0	1
	Omiodes camphorae	0	1
	Omphisa anastomosalis	0	5
	Omphisa fuscidentalis	0	1
	Orthaga divacea	0	4
	Orthaga euadrusalis	0	13
	Orthaga onerata	0	1
	Pachynoa grossalis	0	6
	Pachynoa purpuralis	0	5
	Pachynoa thoosalis	0	0
	Pagida quadrilineata	0	3
	Palpita annulata	0	2
	Palpita inusitata	0	3
	Palpita sp.	7	1
	Paracymoriza vagalis	0	2
	Paranacoleia lophophoralis	0	10
	Parotis laceritalis	0	3
	Pitama hermasalis	0	1
	Pleuroptya deficiens	0	2
	Pleuroptya iopasalis	0	4
	Pleuroptya scinisalis	0	4
	Polythlipta macralis	0	9
	Prooedema incisalis	0	2
	Pseudonoorda nigropunctalis	0	14
	Rhimphalea ochalis	0	2
	Sameodes cancellalis	1	0
	Scircophaga incertulas	1	0
	Spoladea recurvalis	1	0
	Stenarorrhages amphitritalis	0	6
	Sylepta selallis	0	1
	Syllepte fabiusalis	1	17
	Syllepte fuscoinvalidalis	0	2
	Synclera sp.	0	9
	Termioptycha sp.	0	1
	Tetridia caletoralis	0	11
	Uresiphita dissipatalis	0	12
	Xanthomelaena schematias	0	3
Thyrididae	*Banisia fenestrifera*	1	0
	Calindoea argentalis	1	0
	Calindoea atripunctalis	0	1
	Calindoea hypargyra	0	4
	Epaena candidatalis	3	0
	Epaena complicatalis	1	0
	Hedonia pulchella	0	2
	Rhodoneura erubrescens	1	0
	Rhodoneura ritteri	1	0
	Salma philiasalis	0	4
Sphingidae	*Ambulyx carescens*	1	0
	Ascomeryx shervillii	0	1
	Callambulyx rubricosa	0	1
	Cechenena aegrota	0	3
	Cechenena lineosa	0	6
	Cechenena sp.	0	3
	Daphnis hypothous hypothous	1	0
	Daphnusa ocellaris	0	6
	Eilema sp.	1	0
	Enpinanga borneensis	0	3
	Megacorma obliqua	0	1
	Panacra dohertyi	1	6
	Theretra boisduvali	2	0
	Theretra boisduvali	0	1
	Theretra clotho	0	1
	Theretra suffusa	24	0

Table 1 (continued)

Family	Species	No of individuals	
		Sebangau (A)	Busang (B)
Arctiidae	*Amata dilata*	1	0
	Amata egenaria	0	7
	Asota egens	2	0
	Asota heliconia	0	1
	Asura intermerdia	0	2
	Asura sp. 1	0	1
	Asura sp. 2	0	1
	Auriculoceryx transtiva	2	0
	Bizone unipunctata	0	5
	Chrysaeglia sp.	0	5
	Cyana peronata	0	3
	Cyana sp.	0	13
	Eilema nankingica	0	2
	Eilema sp.	0	2
	Eugoa sp.	0	3
	Eugoa grisea	0	3
	Garudinia sp.	0	5
	Macotasa sp.	0	2
	Miltochrista aberans	1	2
	Miltochrista cuprepioides	0	1
	Miltochrista palida	0	2
	Miltochrista sp. 1	0	2
	Miltochrista sp. 2	0	1
	Padania duplicana	0	8
	Spilosoma hosei	1	0
	Spilosoma seriatopunctata	0	1
	Spilosoma seriatopunctata seriatopunctata	0	1
Lasiocampidae	*Arguda* sp.	0	2
	Gastropacha leopoldi	0	5
	Kunugia basimacula	0	2
	Kunugia basnigra	0	2
	Kunugia ferox	1	0
	Kunugia gynandra	3	0
	Lebeda cognata	0	9
	Odonensis erectilinea	1	1
	Paralebeda lucifuga	0	4
	Suana concolor	0	1
	Suana sundana	0	1
	Trabala ganesha	0	8
Uraniidae	*Lyssa tampa*	0	1
	Nyctalemon sp.	1	0
Limacodidae	*Birthama rubicunda*	0	1
	Birthamoides junctura	0	1
	Cania guichardi	1	0
	Cania styx	0	1
	Phocoderma velutina	0	1
	Praesetora kinibalua	0	1
	Scoelodes pallivittata	0	2
	Setora cupreistriga	47	2
	Setothosea asigna	0	1
	Trichogyia semifascia	11	0
Lymantridae	*Arctornis calcariphallus*	0	5
	Arctornis kumatai	7	0
	Arctornis semihyalina	0	2
	Arna bipunctapex	0	4
	Arna erema	0	2
	Artaxa gentia	0	3
	Callima vaneeckei	0	2
	Carriola ecnomoda	0	1
	Euproctis protea	0	1
	Lymantria hollowayi	0	3
	Lymantria sp.	0	1
	Micromorphe hemibathoides	0	3
	Nygma baueri	0	1
	Nygmia aterata	0	10

Table 1 (continued)

Family	Species	No of individuals	
		Sebangau (A)	Busang (B)
	Nygmia guttulata	0	2
	Nygmia peperites	0	1
	Nygmia sp.	0	1
	Orvasca sp.	0	1
	Pantana melantara	0	1
	Praesetora albitermina	0	7
	Psilochira venusta	0	2
	Rhypotoses stigifimbria	0	1
	Susica heringi	0	1
	Toxoproctis flavolimbata	0	1
	Toxoproctis layi	0	3
Drepanidae	*Callidrepana argenteola*	0	1
	Camptopsestis malayana	3	0
	Tridrepana microcrocea	0	1
	Tridrepana subtusmaculata	0	1
Notodontidae	*Ambadra similis*	0	3
	Ambadra suniga	0	1
	Besida xylinata	0	0
	Cerasana anceps	0	2
	Dudula synopla	0	1
	Forfofentonia orbifer	0	1
	Meostauropus alternus	1	0
	Tarsolepis sommeri	0	11
	Torigea plumose	1	0
Cossidae	*Cossus verbeeki*	0	1
	Xleutes stenoptera	0	1
	Xyleutes adusta	0	1
	Xyleutes adusta	0	5
	Xyleutes ceramica	0	5
	Xyleutes malayica	0	2
	Xyleutes mineus	0	1
	Xyleutes pardicolor	0	1
	Xyleutes sp.	0	1
	Xyleutes strix	0	13
	Zeuzera borneana	0	1
	Zeuzera lineata	0	1
Brahmaeidae	*Mustilia dierti*	0	1
Eupterotidae	*Pseudojana perspicuifascia*	0	1
Nolidae	*Aiteta trighonophora*	0	1
	Asinduma exscripta	0	11
	Miaromina columbinea	0	2
	Pterogonia cardinalis	0	1
	Westermannia triangularis	0	1
	Xenochroa balteata	0	2
	Xenochroa consimilis	0	1
	Xenochroa costiplaga	0	2
	Xenochroa mathilda	0	1
	Xenochroa verticata	0	6
Bombycoidae	*Hemistola dipunctata*	0	6
	Ocinora albiceps	0	1
Yponomeutidae	*Mosymna stipella*	0	1
Psychidae	*Eumeta* sp.	0	16
	Oiketicus gigantea	0	53
Total individuals		291	1467
Diversity index		6.64385619	8.139551352
Evennes index		0.794227479	0.831771925

It has been reported that diversity in lowland rainforest is lower than those found at the lower montane forest in tropical areas. An explanation specific to lowland forest in the SE Asia may lie in the dominance of the tree family Dipterocarpaceae which have high proportion of green foliage biomass. Thus, this vegetation tends to have a relatively low

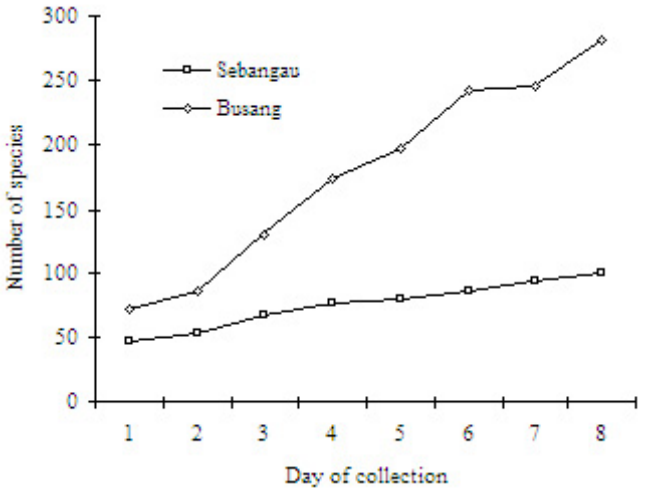

Figure 1. Accumulation of species numbers versus day of collection.

incidence of Lepidoptera defoliators, most species recorded from them tending to be highly polyphagus (Holloway 1987; Wolda 1987).

The results of this study almost have a similar phenomenon. This is possibly due to a low of floral diversity at the peat swamp forest (Holloway 1989). Only the trees which have ability to adapt the peat environment (low nutrition and acidity) can survive at the peat swamp forest i.e., *Combretocarpus rotundus*, *Platea excelsa*, *Blumeodendron elateriospermum*, *Palaquium leiocarpum*, *Ploiarium alternifolium*, *Eugenia densinervium*, *Eugenia castaneum* and *Xylopia fusca*. Those species grow very vast and well-adapted to the peat environment. Thus, this peat swamp forest has a high proportion of green foliage biomass but very low on floral fauna (Mirmanto *et al*. 2005). As a result, not only is the diversity of moths was very low, but also there are no specific moth which are solely distributed at the peat swamp forest Sebangau since they are mostly polyphagus. For example: *Maxates indescoides*, *Metallophia cineraceae*, *Thalassodes sundissepta* (Geometridae), *Theretra suffusa* (Sphingidae), *Setora cupreistriga* (Limacodidae), *Miltochristra aberans* (Arctiidae), *Agrotera scisalis* (Pyralidae), *Kunugia ferox*, *Kunugia gynandra* (Lymantridae), *Camptopsestis malayana* (Drepanidae) were found at the peat swamp forest, but they have also been reported to distribute from the low land to high montane (Robinson 1994; Holloway 1997).

Only one species is subject to be specific to the peat swamp forest, *Eucyclodes rufimargo* (Geomteridae). It might be the host plant of this species is a typical low land tree as has been reported that this species also occurs at lowland forest up to 50 m. above sea level in Serawak. However, there is no available information of their host plant (Holloway 1997).

Due to time constraints, the results of this study should not be taken as a final conclusion. Further studies are still needed to be conducted not only by increasing number of sampling points and duration of sampling time to get the actual number species occurred in this forest but the most important is to investigate the relationships between each species moth with its host plant to know more detailed their biological aspects.

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