



**KEANEKARAGAMAN FENOTIPIK NGENGAT (Subordo *Heterocera*)
BERDASARKAN KARAKTER MORFOLOGI DI KAWASAN
UNIVERSITAS RIAU DAN DESA SIABU, PROVINSI RIAU
*PHENOTYPIC DIVERSITY OF MOTH (Suborder Heterocera) BASED ON MORPHOLOGICAL
CHARACTERS IN THE AREA OF RIAU UNIVERSITY AND SIABU VILLAGE, RIAU PROVINCE***

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Abstrak

Penelitian tentang ngengat masih sangat sedikit dilakukan di Indonesia terutama di kawasan Universitas Riau dan Desa Siabu Kampar belum ada datanya. Penelitian ini bertujuan untuk menganalisis keanekaragaman fenotip ngengat berdasarkan karakter morfologi untuk mengetahui jarak genetik ngengat di kawasan Universitas Riau dan Desa Siabu. Penelitian dilakukan pada bulan Desember 2016 - Mei 2017. Lokasi pengambilan sampel terdapat di dua kawasan dengan enam lokasi yang berbeda yaitu Universitas Riau (Arboretum, Kebun FMIPA, Rusunawa) dan Desa Siabu (perumahan warga, Bukit Tentado dan hutan sekunder). Metode sampling menggunakan perangkap layar (*light trap*) sebagai sumber cahaya digunakan lampu merkuri merk Philips 160 watt. Bagian tubuh ngengat yang diamati adalah kepala, *torak*, abdomen dan sayap, jumlah karakter morfologi yang diamati adalah 24 karakter. Setiap karakter morfologi diberi skor kemudian dianalisis menggunakan program NTSYS ps versi 2.02i. Hasil yang didapat yaitu 61 spesies dengan 414 individu dari 10 famili ngengat. Keanekaragaman fenotipik ngengat di Universitas Riau dan Desa Siabu berturut turut adalah 87% dan 78%. Ngengat dari kedua kawasan menunjukkan perbedaan pada karakter ukuran, namun tidak pada karakter morfologi dan warna. Terdapat adanya kemiripan sebesar 66% antara ngengat yang dikoleksi dari Universitas Riau (kebun FMIPA, rusunawa) dengan Desa Siabu (Bukit Tentado dan hutan sekunder).

Kata kunci: Desa Siabu; Karakter morfologi; Keanekaragaman fenotipik; Ngengat; Universitas Riau

Abstract

Research on moths is still very few in Indonesia. Especially in the area of Riau University and Siabu Kampar Village. There is no datum about moths. The objective of this research is to analyze the genetic diversity of moths in Riau University and Siabu Vilage, Riau Province based on morphological characters. The study was conducted from December 2016 to May 2017. The moths were collected from two areas with six different locations such as Riau University (arboretum of mathematics and science faculty) and Siabu Village (village residence, Tentado Hill, and secondary forest). The sampling method that used was the light trap, with 160 watts of mercury, was used as a light source. The parts of the body observed were head, thorax, abdomen, and wings with the number of morphological characters observed by 24 characters. Morphological characters were observed and scored and then analyzed using the NTSYS p c version 2.02i software. The results showed that there were 61 species with 414 individuals from 10 families of moths. The genetic diversity of moth in the Riau University and Siabu Village was 87% and 78%. Moths on both locations indicated no difference in the shape and color, but they were different in size. Moths from FMIPA garden and rusunawa had 66% genetic similarity to one from Tentado Hill and secondary forest.

Keywords: *Phenotypic diversity; Morphological characters; Moths; Riau University; Siabu Village*

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INTRODUCTION

Moths are insects belonging to the order *Lepidoptera* and Suborder *Heterocera*. Moth (Suborder *Heterocera*) morphologically has a body and leg covered by scales, a pair of wings with a dull color, the type of antenna generally is *plumose*, the type of mouthpiece when the larvae is bite and chew while when adults are suckers. On resting time the wings are stretched and the abdomen closes so that what appears is only the surface of the wing. Moths have an active time at night (*nocturnal*) so that they have thick scales that is used as a protection from cold air at night (Borror *et al.*, 1992; Gillott, 2005; Darmawan *et al.*, 2013).

Each individual of moth has a different morphological character even though it is in one species or the same habitat. Individual diversity can give rise to variation, and the individual nature itself is determined by genes. Genetic variation is a variation that is produced from a permanent hereditary (gene) factor that is inherited from one generation to another. *Genotype* factors that interact with environmental factors will emerge properties that appear or are called phenotypic.

Phenotypic kinship is a kinship based on the similarities and differences in the characteristics seen in taxon (Clifford & Stephenson, 1976). Phenotypic study examines the similarities and differences of visible characters, one of them is the morphological characters (Syamsuri, 2004). Morphological characters are basic characters in a classification, because by these characters can distinguish individuals from one individual to another easily and objective manner (Kaplan, 2001). General morphological characters of moths that were observed, namely the head, thorax, abdomen, and wing color. The higher character difference morphologically indicated the bigger diversity size of moth species in a region.

The diversity of moths can be found in various vegetation, such as in the Riau University garden and Siabu Village, Kampar Regency. Riau University garden has a variety of plant species. Variation of those plants are food sources for moths so that the survival of moths is maintained. Siabu Village, Kampar Riau is a rural area. Based on its natural use, Siabu Village has three types of vegetation,

namely secondary forests, rubber fields and grasslands. According to the people of Siabu there are still many moths found in various colors, but there is no datum and research on moths before in these two regions.

Research on moth in Indonesia is still very few, especially in Riau Province. Previous research that has been done in Indonesia, namely the diversity of moth in Halimun Mountain Salak national park, West Java (Sutrisno, 2008), the diversity of moth in Sebangau Peat Swamp and Busang Secondary Forest Central Kalimantan (Sutrisno, 2005), the diversity of moth in the protection forest Patuha Mountain (Sutrisno, 2009), an inventory of moths in Meru Betiri National Park, Banyuwangi (Azizah, 2009), identification of moth genus *Lymantria* (*Lepidoptera: Erebidae*) in Indonesia based on morphology characters and genitalia (Damayanthi *et al.*, 2013), and identification of some male species of moths genus *Arctornis* (*Lepidoptera: Noctuoidea*) in Indonesia based on morphological characters an energy (Darmawan *et al.*, 2013). But research on the diversity of phenotypic moths based on morphological characters has never been done yet, especially at the Riau University and Siabu Village, Kampar Riau. This research is an early study, that is why it is important and interesting to do some research on these two regions. The aim of this study is to analyze the diversity phenotypic of moths in the area Riau University and Siabu Village based on morphological characters.

MATERIAL DAN METODE

Collection and Specimen

The study was conducted for five months from December 2016 to May 2017. Collection time was done at night starting at 18.00–22.00 pm. The method that was used follows the procedure of Sutrisno (2005), namely using a screen capture or *light trap*. Light trap used the white screen size 2 x 2 m stretched facing the wind direction and placed in an open area like the edge of a forest. The light source is a 160 watt Philips mercury lamp that is placed right in front of the white screen. Moths that are attracted to light will be stuck on the white screen. Moths were collected by hand, then put in a killer bottle that has been filled with 70%

alcohol. Large-size moth (wings size >5 cm) trapped by using insect nets, to kill them 70% alcohol was injected on the thorax *head*. Having collected moths do preservation or creation of insectarium based on Ubaidillah (1999).

Making Insectarium and Observing Morphological Characters

The wings of specimen moth was stretched well and carefully on a stretcher board so that all the characters, namely legs, wings and other parts could be seen or observed using a microscope for easy identification. Furthermore, specimens that have been stretched out, were put in the oven for 2–3 days (length of wing <5 cm) and 5–7 days (length of wing >5 cm) at a temperature of 45 °C. After drying, then labeled and transferred in a storage box and kept at a temperature of 22 °C and 50% of humidity. Then doing specimen identification base on morphological characters. Morphology characters that observed were part of head, thorax,

abdomen and wings with 24 characters as on Table 1 (Randle, 2009; Sutrisno & Darmawan, 2012; Gurule & Nikam, 2013; Kirichenko *et al.*, 2015).

Data Analysis

Morphological data obtained are presented on tables and figures, then *scoring* was carried out. Scoring data were analyzed using the Numerical Taxonomy and Multivariate Analysis System (NTSYS) program PC version 2.02i to obtain matrix similarity and dendrograms.

RESULTS

The Number of Species and Individual Moths at Riau University and Siabu Village

The total samples obtained at Riau University area and Siabu Village is 10 families, 53 genus, 61 species and 414 individuals. The number of genus and species of the two regions can be seen on Table 2. Total individual of each species in every habitat can be seen on Table 3.

Table 1. The morphological characters of the moth that were observed

Parts of body	Morphological characters	Character code
Head	Head length	HL
	Head width	HW
	Eye distance	ED
	Head color	HC
	Head scales	HS
	Prososcis color	PRC
	Length of antenna	LAN
	Type antenna	TAN
Thorax	Torax length	TL
	Torax width	TW
	Torax color	TC
	Front leg length	FLL
	Middle leg length	MLL
Abdomen	Rear leg length	RLL
	Abdominal length	AL
	Abdominal width	ABW
	Abdominal color	ABC
	Abdomen tergite thorn	ATT
	Number of abdominal segments	NAS
Wing	Total body length	TBL
	Front wing length	FWL
	Rear wing length	RWL
	Front wing width	FWW
	Rear wing width	RWW

Table 2. The number of genus and species from each moth family at Riau University and Siabu Village

Families	TS	Location											
		Riau University						Siabu Village					
		AR		FG		RN		CH		TH		SF	
G	S	G	S	G	S	G	S	G	S	G	S		
<i>Bombycidae</i>	1	-	-	-	-	-	-	1	1	-	-	-	-
<i>Crambidae</i>	14	10	11	3	4	5	5	4	4	1	1	1	1
<i>Erebidae</i>	26	11	14	4	4	5	5	13	14	5	6	3	3
<i>Geometridae</i>	4	3	3	2	2	2	2	1	1	-	-	-	-
<i>Noctuidae</i>	10	4	4	1	1	1	1	6	7	3	4	4	5
<i>Pyalidae</i>	1	-	-	1	1	1	1	-	-	1	1	1	1
<i>Sphingidae</i>	2	2	2	-	-	-	-	-	-	-	-	-	-
<i>Tineidae</i>	1	-	-	1	1	-	-	-	-	1	1	-	-
<i>Lasiocampidae</i>	1	-	-	-	-	-	-	1	1	-	-	-	-
<i>Tortricidae</i>	1	-	-	-	-	-	-	-	-	-	-	1	1
Total	61	30	34	12	13	15	15	26	28	11	13	10	11

Details: Riau University (AR= Arboretum; FG= Faculty Garden; RN= Rusunawa), Siabu (CH= Citizen Housing; TH= Tentado Hill; SF= Secondary Forest), G= Genus; S= Species; TS= Total Species

Table 3. The number of individuals from each species of moths in the Riau University area and Siabu Village

Families	Species	Location						TS					
		UNRI			SIABU								
		AR	FG	RN	CH	TH	SF						
<i>Bombycidae</i>	1	<i>Ocinara</i> sp. A					1					1	
<i>Crambidae</i>	2	<i>Agrotera basinotata</i>	1	-	-	-	-	-	-	-	-	-	1
	3	<i>Antigastra catalaunalis</i>	-	-	1	-	-	-	-	-	-	-	1
	4	<i>Autocharis fessalis</i>	1	-	-	-	-	-	-	-	-	-	1
	5	<i>Chiasmia nora</i>	1	-	-	1	-	-	-	-	-	-	2
	6	<i>Conogethes punctiferalis</i>	2	-	3	-	-	-	-	-	-	-	5
	7	<i>Omiodes diamenalis</i>	5	5	6	-	-	-	-	-	-	-	16
	8	<i>Omiodes indicata</i>	4	2	-	2	-	-	-	-	-	-	8
	9	<i>Pleuroptya runalis</i>	1	-	-	-	-	-	-	-	-	-	1
	10	<i>Salma</i> sp. 2	-	-	-	-	2	2	-	-	-	-	4
	11	<i>Samoedes cancellalis</i>	4	2	2	3	-	-	-	-	-	-	11
	12	<i>Scircophaga incertulas</i>	7	-	-	-	-	-	-	-	-	-	7
	13	<i>Syllepte fabius</i>	6	7	5	-	-	-	-	-	-	-	18
	14	<i>Terastia egialealis</i>	1	-	-	-	-	-	-	-	-	-	1
	15	<i>Tyspanodes linealis</i>	-	-	-	1	-	-	-	-	-	-	1
	<i>Erebidae</i>	16	<i>Amata huebneri</i>	2	-	-	1	-	-	-	-	-	-
17		<i>Amata</i> sp.	1	-	-	-	-	-	-	-	-	-	1
18		<i>Bastilla arctotaenia</i>	-	-	-	1	-	-	-	-	-	-	1
19		<i>B. fulvotaenia</i>	-	-	-	1	-	-	-	-	-	-	1
20		<i>B. joviana</i>	-	-	-	3	-	-	-	-	-	-	3
21		<i>Chalciope mygdon</i>	-	-	3	-	-	-	-	-	-	-	3
22		<i>Chilkasa falcata</i>	35	10	-	-	-	-	-	-	-	-	55
23		<i>Cnaphalocrocis medinalis</i>	2	-	-	3	6	9	-	-	-	-	20
24		<i>Cosmophila lyona</i>	50	10	10	-	-	-	-	-	-	-	70
25		<i>Cretonotos gangis</i>	1	-	-	-	-	-	-	-	-	-	1
26		<i>C. transiens</i>	1	-	-	-	-	-	-	-	-	-	1

Families	Species	Location						TS
		UNRI			SIABU			
		AR	FG	RN	CH	TH	SF	
	27 <i>Erebus ephesperis</i>	-	-	-	1	-	-	1
	28 <i>Ericcia inangulata</i>	-	-	-	6	20	30	56
	29 <i>Grammodes stolidia</i>	-	-	-	1	-	-	1
	30 <i>Homodes propitia</i>	-	-	-	1	-	-	1
	31 <i>Hypena laceratalis</i>	-	-	-	-	1	-	1
	32 <i>Hypena</i> sp. A	2	-	-	-	1	-	3
	33 <i>Hypena</i> sp. B	1	-	-	-	1	-	2
	34 <i>Hyospila bolinoides</i>	-	-	1	1	-	-	2
	35 <i>Mocis frugalis</i>	2	1	2	3	-	-	8
	36 <i>Nygmiini</i> sp.	4	-	-	-	-	-	4
	37 <i>Psimada quadripennis</i>	1	-	-	3	-	-	4
	38 <i>Serodes campana</i>	-	-	-	-	1	3	4
	39 <i>Spirama identa</i>	-	1	-	1	-	-	2
	40 <i>Thyas honeste</i>	1	-	-	-	-	-	1
	41 <i>Trigonodes disjuncta</i>	1	-	-	2	-	-	3
Geometridae	42 <i>Cleora cornaria</i>	1	1	1	-	-	-	3
	43 <i>Eupithecia centaureata</i>	5	3	1	-	-	-	9
	44 <i>Instrugia disputaria</i>	3	-	-	2	-	-	5
	45 <i>Scopala decorata</i>	2	-	-	-	-	-	2
Lasiocampidae	46 <i>Kunugia ampla</i>	-	-	-	1	-	-	1
Noctuidae	47 <i>Asota ficus</i>	1	-	-	-	-	-	1
	48 <i>Agrotis segetum</i>	-	-	-	3	-	-	3
	49 <i>Arctornis</i> sp.	2	2	3	3	-	-	10
	50 <i>Condica dolorosa</i>	-	-	-	-	2	2	4
	51 <i>Mythimna separata</i>	-	-	-	5	3	5	13
	52 <i>M. designata</i>	-	-	-	2	2	2	6
	53 <i>Ozarba punctigera</i>	-	-	-	1	-	-	1
	54 <i>Sasunaga tenebrasa</i>	-	-	-	1	-	-	1
	55 <i>Spodotera ditura</i>	-	-	-	-	-	3	3
	56 <i>Zanclognatha griselda</i>	2	-	-	2	-	-	4
Pyralidae	57 <i>Pyrausta rurralis</i>	-	2	2	-	2	3	9
Sphingidae	58 <i>Agrius convolvuli</i>	1	-	-	-	-	-	1
	59 <i>Theretra oldenlandie</i>	2	-	-	-	-	-	2
Tineidae	60 <i>Cimitra seclusella</i>	-	4	-	-	1	-	5
Tortricidae	61 <i>Loboschiza koenigiana</i>	-	-	-	-	-	1	1
Total		156	50	50	56	42	60	414

Details: Riau University (AR= Arboretum; FG= Faculty Garden; RN= Rusunawa) UNRI (Riau University) Siabu (CH= Citizen Housing; TH= Tentado Hill; SF= Secondary Forest)

Based on Table 2, the most families, genus, and the most species in the AR location are 5 families, 30 genera, and 34 species. In SF locations there were 5 families, 10 genus and 11 species. Moths that were collected consist of 61 species from 10 different families. The number of moths obtained at Riau University is 256 individuals and Siabu Village amounts to 158 individuals. The highest number of

individuals is in *Erebidae* family namely *C. lyona* (70 individuals), *Chilasa falcate* (55 individuals), and *E. inangulata* (56 individuals).

The existence of moth species at the Riau University and Siabu Village is different. it is known from the existing some species found in the area of Riau University but were not found in the Siabu Village. The similarity coefficient

value between species in the Riau University garden and Siabu Village is around 0.32–0.90. The lowest similarity value is 0.32 that was found between moths in the arboretum and

secondary forest while the highest coefficient value is 0.90 that was found between moths in Tentado Hill and secondary forests, faculty gardens and rusunawa as presented in Table 4.

Table 4. The moth resemblance matrix at the Riau University area and Siabu Village

	AR	FG	RN	CH	TH	SF
AR	1.00					
FG	0.57	1.00				
FL	0.52	0.90	1.00			
CH	0.36	0.47	0.44	1.00		
TH	0.36	0.67	0.63	0.44	1.00	
SF	0.32	0.67	0.67	0.47	0.90	1.00

Description: AR= Arboretum; FG= Faculty Gardens; RN= Rusunawa; CH= Citizen Housing; TH= Tentado Hill; SF= Secondary forest

The existence of a species is strongly influenced by food sources and the environment where they live. The following grouping of dendograms is based on the

presence or absence of moths in a location. Dendrogram of moth species existence in each research location can be seen in Figure 1.

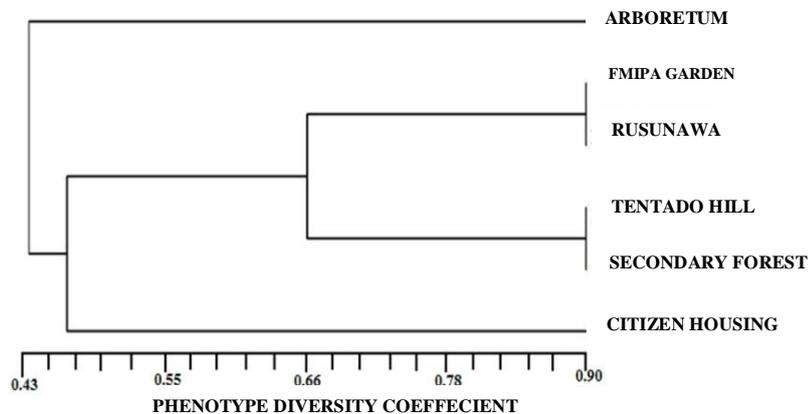


Figure 1. Dendrogram of moth population at Riau University and Siabu Village based on the existence of species

Morphology of Moth at Riau University and Siabu Village

The morphologies of moths in this study are quite diverse on part the head, toract, abdomen, and wings. The followings are the morphological characters of moths that are found.

Head

The head consists of several morphological characters namely the head length, the head width, the eye distance, the head color, the head scales the *prosboscis* color, the antenna length, and the antenna type. The the head length, the head width and the eye distance will be different for each individual of moth, depending on the size of the moth. The color of moth's head in this

study varied, namely light brown 5 YR 5/6; dark brown 5 YR 3/6; white 2.5 YG 8/0; black 5 R 1.7/1; gray 7.5 YR 6/1; and yellow 5 Y 8/8. Moth head scales are rough and smooth (Darmawan *et al.*, 2013). The color of the *Prosboscis* moth that was found was light brown 7.5 YR 5/4; dark brown 7.5 YR 3/4; white 2.5 YG 8/0; black 5 YR 1.7/1; yellow 5 Y 8/8; red 10 R 5/8. The moth which has the longest anna is *E. ephesperis* (23 mm) while the shortest one is *Arctornis sp.* and *Amata huebnri* (4 mm). Type of a moth's antenna are varied, namely type of *flagellum*, *bipectinate*, *clubbed*, *unipectinate*, and *fasciculate* (Scoble, 1992). The type of a moth's antenna that were found in this study were four namely *fasciculate*, *clubbed*, *bipectinate*, and *flagellum* (Figure 2).

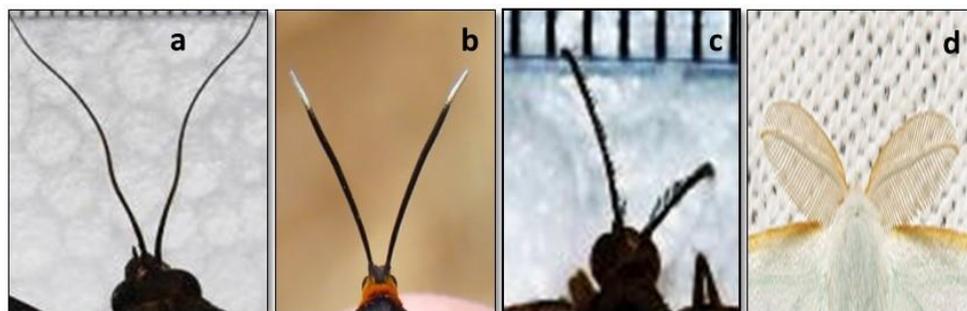


Figure 2. Type of moth's antenna found is *flagellum* (a), *clubbed* (b), *bipectinate* (c), and *fasciculate* (d)

Thorax

Thorax consists of several characters, namely the length of the thorax, the width of the thorax, the thorax color, the length of the front legs, length of the middle legs and the length behind legs. Moth which has the longest thorax is *A. convolvuli* (13 mm) while the shortest is *S. cancellalis* (2.1 mm). Moth that has a wide torax is *A. convolvuli* (13 mm), while the shortest is *S. cancellalis* (2.0 mm).

The torax colors of the moth that were found are light brown 5 YR 5/4; dark brown 5 YR 2/4; black 5 R 2/1; white 2.5 YG 8/0; gray 7.5 YR 5 Y 6/1; and yellow 5 Y 8/8. Moths that have the longest size of front legs, the length of middle leg and the length of the behind legs are *E. ephesperis* (21 mm, 23 mm, and 21 mm), while the shortest size is *S. identa* (6 mm, 8 mm, and 6 mm).

Abdomen

The abdomen consists of several characters, namely the length of the abdomen, the width of the abdomen, the color of the abdomen, the thorns of the abdomen and the number of abdominal segments and total body length. Moths that have the longest abdominal size, namely *A. convolvuli* (32 mm) while the shortest is *Z. griselda* (4.0 mm). Moths that have the widest size of abdomen, namely *A. convolvuli* (14 mm) while the shortest is *A. huebneri* (2.0 mm).

Moth abdominal colors found varied, namely light brown 5 YR 5/4; dark brown 5 YR 2/4; white 2.5 YG 8/0; black orange 7.5 YR 2/1 7/8; black 5 R 2/1; red gray 10 R 5/8 6/1; gray 10 R 6/1, red black (10 R 5/8 1.7/1; yellow 5 Y 8/8; and red 10 R 5/8. The spines on the abdomen are divided into two, which are grouped and paired with a pair of abdomen

(Holloway, 1997). Moths that were found in this study generally have long spin abdomen. The largest number of moth segments is 8 segments and the smallest is 5 segments. Moth that has the longest total body length is *A. convolvuli* (48 mm).

Wing

The wings consist of several characters namely front wing length, rear wing length, front wing width and rear wing width. Moth that has the longest of front wing and rear wing length is *E. ephesperis* (30 mm and 25 mm). Moths have the widest front wing and rear wing is *A. convolvuli* (103 mm and 53 mm).

Moths Phenotypic Diversity Analysis Base on Morphology Character

Moth Phenotypic Diversity at Riau University

The number of species of moths that obtained in the Riau University is as many as 40 species while in the area of Siabu Village as many as 38 species. Because there are similar species found in the two study areas (17 species), so the combined species of the two regions are 61 species. Moth phenotypic diversity at the Riau University and Siabu Village are displayed in the form of dendrogram base on 24 morphology character. Diversity phenotypic value is obtained by 1 minus the similarity coefficient value.

The value of moth coefficient phenotype similarity that obtained in Riau University ranges between 0.04–00 (Appendix 1), so that the distance of phenotypic obtained by 0–0.96. The highest value of phenotypic similarity coefficient is 1.00 in couple of *C. medinalis* and *A. catalaunalis*, *C. nora* and *Pleuroptya runalis*, *Conogethes punctigera* and *Sylepte*

fabius. The value of 1.00 indicate that between these pairs do not have different characters from the total 24 characters that exist, this can occur because these moths have a range of character sizes that are still close together so they can be categorized as the same.

The lowest similarity coefficient value is 0.04 in pair of *A. convolvuli* and *S. identa*, *A. convolvuli* and *S. cancellalis*, *A. concolvuli* and *Arctornis* sp.. A value of 0.04 indicated that the couple had a common character a bit, this was due to *A. convolvuli* classified as macro moth (wingspan >5 cm), while others belong micro moth (wingspan <5 cm), the character that greatly distinguishes one moth from the other is the size of morphological characters

which causes the similarity value in this pair to be low.

The grouping of moths at the Riau University is presented in Figure 3. The dendrogram shows that the grouping of moths at the Riau University produces similarities between 13–100% Dendrogram is divided into two main groups at a coefficient value of 13%. Phenotypic distance obtained by 1 minus the value of the similarity coefficient, so the distance of the phenotypic obtained is 87%. Group I consists of 38 species and group II consisted of two species. Species obtained are grouped based on similarities in the size of the characters that have been analyzed.

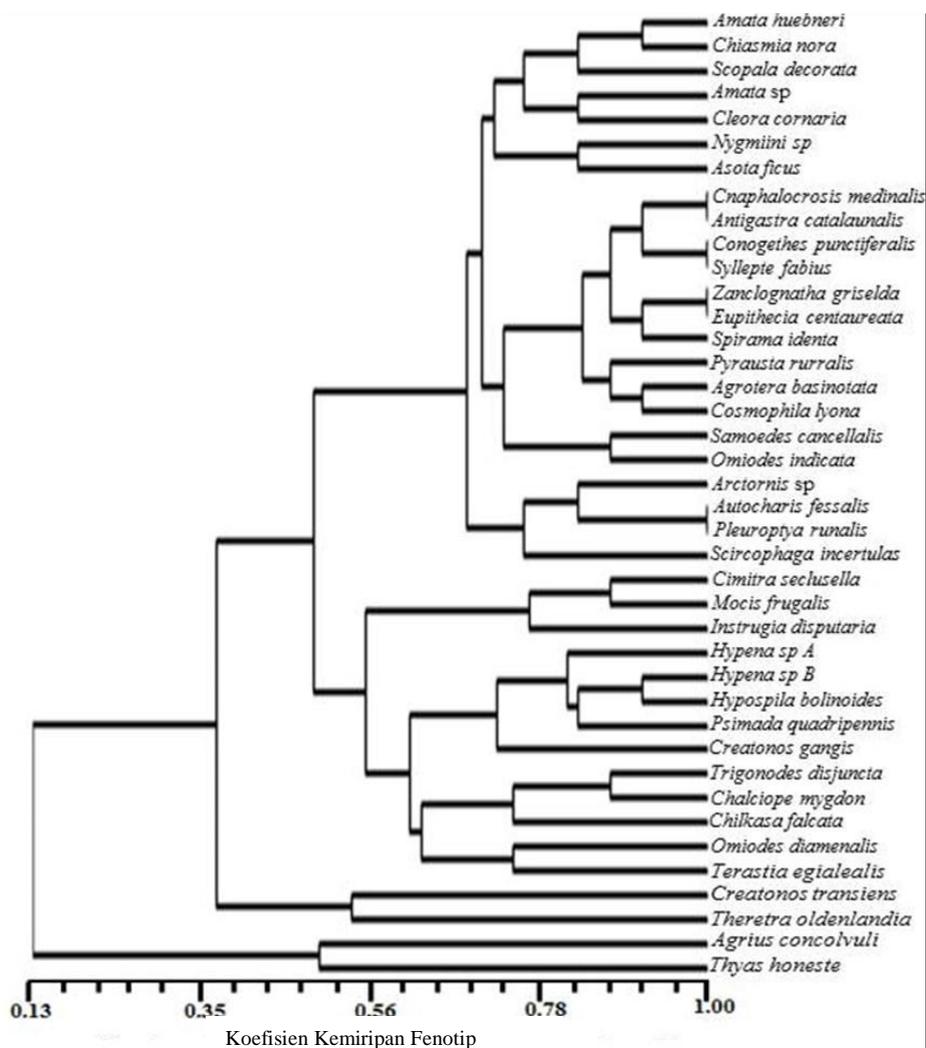


Figure 3. Moth dendrogram at Riau University

Subgroup Ib consists of only 2 species, namely the *Creatonos transiens* and *Theretra oldenlandia* which separate far from the

species in the 1a subgroup, this due to the size of the character is much different. Ib subgroup species belongs to in macro moth because it

has a wingspan of 50–70 mm, whereas in the subgroup it belongs to micro moth, because it has a wingspan of 10–20 mm. *C. transiens* and *T. oldenlandia*, among these species, 12 different characters were found such as head length, head width and head color. Group II consists of only 2 species they are *A. convolvuli* and *T. honeste*. These species clumped away from other species because of the similarity in the size of wingspan is very big about 90–110 mm, between species *A. convolvuli* and *T. honeste* it was found 12 different characters, some of them are head color, head scales, and proboscis color.

Moth Phenotypic Diversity in Siabu Village

Moth similarity coefficient values obtained in Siabu village range 0.12–0.95, so that the distance of its phenotypic is 0.05–0.88. The highest similarity coefficient value is 0.95 in couple of *B. arctotaenia* and *B. fulvotataenia* it was found 1 different character that is in the length of the front wing. On *B. arctotaenia* and *B. joviana* it was found 1 different character that is on the width of the front wing. The lowest coefficient of similarity value is 0.12 in the couple of *Arctornis* sp. dan *Bastilla arctotaenia*, *Arctornis* sp. and *Bastilla fulvotataenia*, *Arctornis* sp. and *B. joviana*, *Arctornis* sp. and *G. stolidia*, *Z. griselda* and *B. arctotaenia*, *Z. griselda* and *B. fulvotataenia*, *Z. griselda* and *B. joviana*, *I. disputaria* and *Erebus espheris*, *Z. griselda* and *G. stolidia*, *S. tenebrasa* and *B. arctotaenia*, *S. tenebrasa* and *B. fulvotataenia*, *S. tenebrasa* and *B. joviana*, *S. campana* and *B. arctotaenia*, *S. campana* and *B. fulvotataenia*, *S. campana* and *B. joviana*, *T. linealis* and *B. arctotaenia*, *T. linealis* and *B. fulvotataenia*, *T. linealis* dan *B. joviana*. Ngenget *B. arctotaenia*, *B. fulvotataenia*, *B. arctotaenia*, *G. stolidia* and *E. espheris*. Those moths are classified into makromoth because it has a large body size and wingspan around 70–100 mm, while the other moths are classified as micromoth so that the similarity value in this couple is low.

The group of moths in the Siabu village region is presented in Figure 4. Dendrogram indicated that the diversity coefficient group of moths in the siabu village ranges 22–100%. Dendrogram is divided into two main groups at

22% coefficient value. Diversity of phenotypic is obtained by 1 minus the similarity coefficient value, so the value obtained is 78%. Group I consists of 33 species and group II consists of 5 species. Species are grouped based on similarities in the size of morphological characters that have been analyzed.

Group I was divided into two subgroups at a coefficient of 45% to 1a and 1b subgroup. The subgroup consists of 18 species, namely *A. segetum*, *L. koenigiana*, *K. ampla*, *T. disjuncta*, *Hypena* sp. A, *H. bolinoides*, *P. quadripennis*, *Hypena* sp. B, *Mytimna separata*, *Mytimna designata*, *Spodoptera litura*, *C. nora*, *Instrugia disputaria*, *C. seclusella*, *E. inangulata*, *M. frugalis*, *Tysponodes linealis*, and *S. tenebrasa* who have 12 different characters some of them are the head color, head scales and proboscis color.

1b Subgroup consists of 15 species, namely *A. huebneri*, *O. punctigera*, *Z. griselda*, *Ocinara* sp. A, *Cnaphalocrosis medinalis*, *Propomod homodes*, *S. campana*, *Salma* sp. 2, *S. identa*, *P. rurralis*, *C. dolorosa*, *H. laceratalis*, and *O. indicata* which have 12 different characters some of them are the head color, head scales, and proboscis color.

Group II consists of five species they are *Bastilla arctotaenia*, *B. fulcota*, *B. joviana*, *G. stolidia* and *Erebus espheris* which belongs to macro moths and are grouped based on the similarity of the morphological character at the time of scoring. Group II was divided into two subgroups at a coefficient of 59% become subgroup IIa (4 species) and IIb (1 species). IIa subgroup on *B. arctotaenia* and *B. fulcota* it was found similarity value of up to 96%, because there was only one different character found that is the length front wing. *B. joviana* moths and *G. stolidia* also have similarity character with the *B. arctotaenia* and *B. fulcota*, and isolated because it has a different character that really stands out that is the size of the wingspan it was found about 60–70 mm. Subgroup IIb consists of only 1 species it is *E. espheris*, which makes this species isolated from species in the subgroup IIb which has a larger body size that is about 30–40 mm and a wingspan about 90–100 mm.

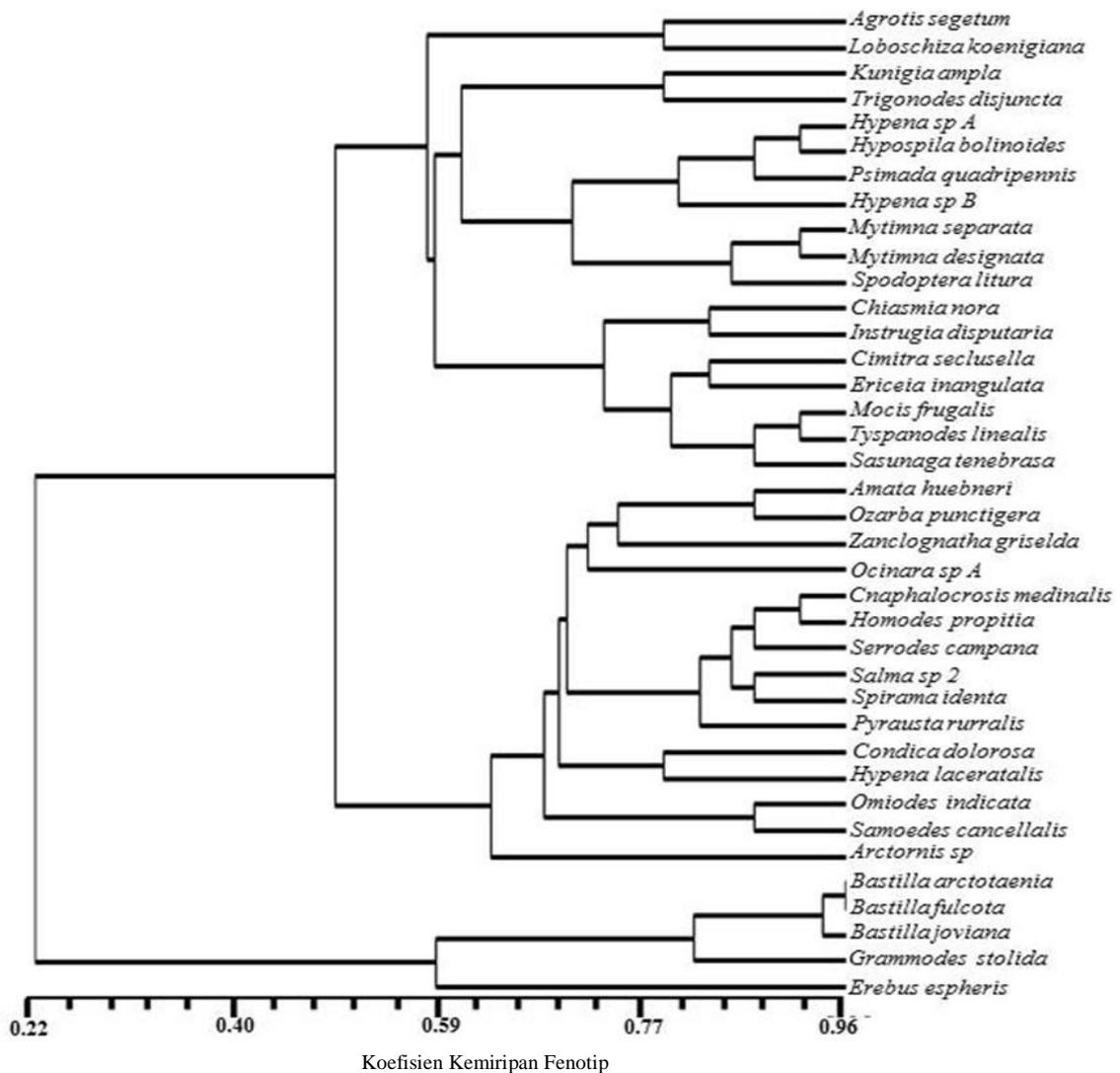


Figure 4. Dendrogram of moths in Siabu Village

Moth Phenotypic Diversity at Riau University and Siabu Village

The grouping of moths at the Riau University area and Siabu village is presented in Figure 5. Dendrogram shows that the combined grouping of moths in both region resulted diversity coefficient ranges between 22–100%. Dendrogram is divided into two main groups at a coefficient value of 22%, that is group I (53 species, 17 species are same) and group II (8 species). Phenotypic diversity is obtained by 1 minus the similarity coefficient value, so the value obtained is 78%.

The moth species were grouped based on similarities in the size of the character that have been analyzed. The morphological

characterization that has been analyzed shows that the most distinguishing between one moth and the other is the size of the body length and size of the wings, because moths are divided into two, namely macro moth (wingspan more than 5 cm) and micromoth (wingspan less than 5 cm). The moths that were most commonly found during this study, which were classified as micromoth, were moth which were in group I, while those that were classified as macro moths were only few, namely moths in group II such as *A. convolvuli*, *T. honeste*, *Bastilla joviana*, *B. arctotaenia*, *B. fulvotaenia*, *Theretra oldenlandia*, *G. stolidia*, and *Erebus espheris*.

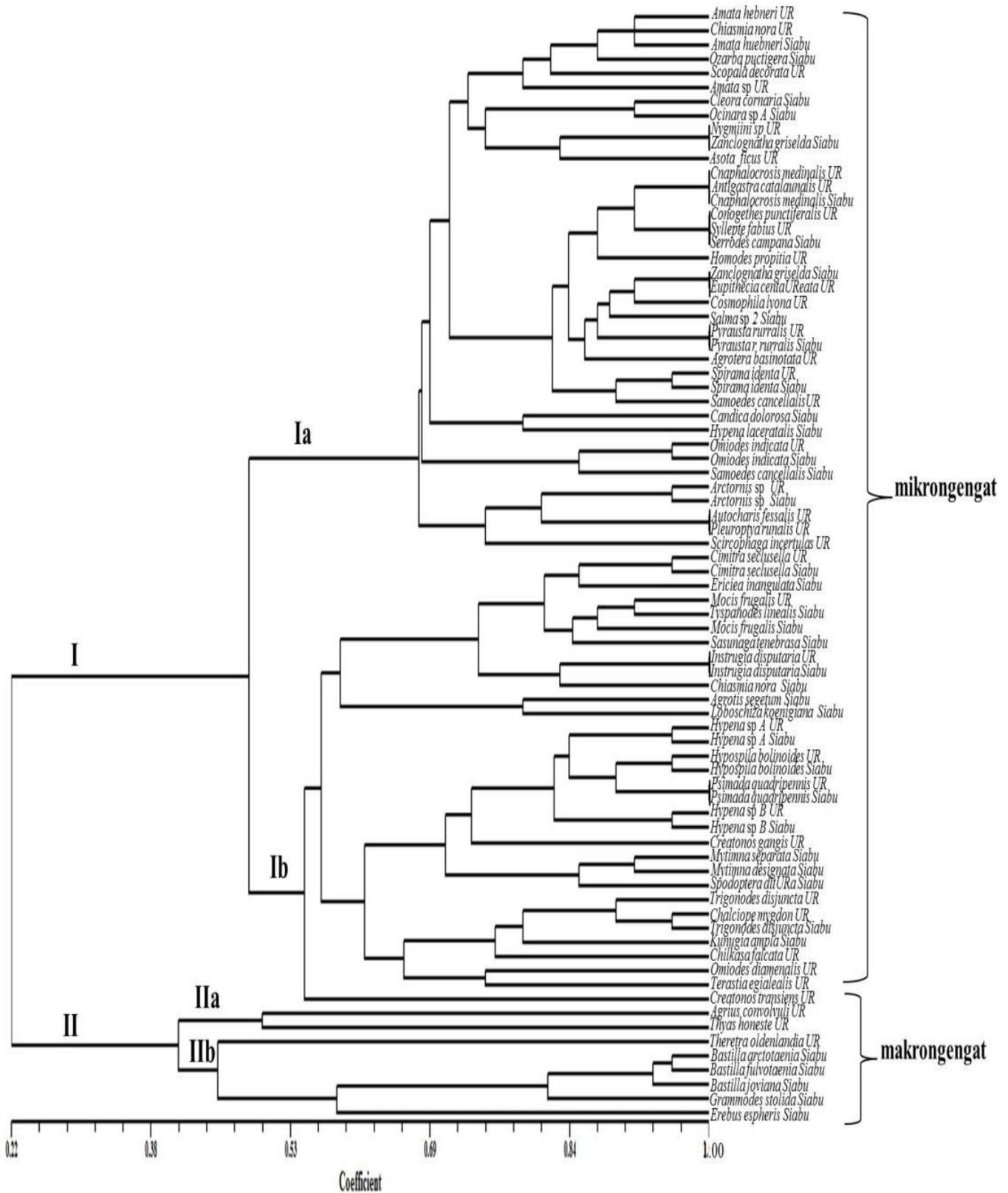


Figure 5. Dendrogram of moth at Riau University and Siabu Village

DISCUSSION

Differences in the number of species of moths found likely to be caused by the diversity of plants that contribute as food resources available at each location. Especially for the species and individuals that most found

in the *Erebidae* family, their presence is influenced by the availability of food (Damayanthi *et al.*, 2013; Gurule & Nikam, 2013; Kirichenko *et al.*, 2015). Some of the food that were found at the Arboretum location are the *Leguminosae*, *Burseraceae*, *Malvaceae*,

Rubiaceae, *Ebenaceae*, *sapotaceae* and *Rubiaceae* (Furqan *et al.*, 2016). In addition there are other plants such as *Casea alata*, *Peporomia pellucida*, *Cassia obtusifolia*, *Loranthus* sp., *Impirata cylindrica*, and *Mimosa pudica*. Meanwhile, there were fewer plants found in Siabu Village, namely *Hevea braziliensis*, *Bougenville* sp., *Canna indica*, *Arthocarpus heterophyllus*, *Ficus benjamina*, *Imperata cylindrica*, and *Mimosa pudica*.

The presence of species from all research locations based on the results of the dendrogram showed that moths clustered adjacent to the location of secondary forests with Tentado Hill and Rusunawa with the Faculty of Science and Mathematics (FMIPA) gardens having a similarity percentage of 90%. This grouping is likely caused by the presence of plants in the secondary forest also found in Tentado Hill, as well as in the location of the Rusunawa can be found in the FMIPA gardens so that the presence of the same type of moth can be found in that location. In citizen housing and arboretum separate groupings are formed with each other, this is also likely because plants that are very diverse as a food source and an environment suitable for moths can survive.

CONCLUSION

Diversity phenotypic of moth at Riau University at 87% is not much different from that diversity phenotypic of moths in Siabu Village it is 78%. Phenotypic combined moth diversity at Riau University and Siabu Village area is a 78%. So that it can be concluded that the moth collection results from both area do not show different morphology and color, but there's difference on the character of its size.

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