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Morphometric Characteristic of White Shrimp *Fenneropenaeus merguiensis* de Man 1888 in South Sulawesi Indonesia

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Abstract

Morphometric studies are not only essential to understand the taxonomy but also characteristic of the population. The morphometric character was examine to detect variation of *Fenneropenaeus merguiensis* population in Pinrang, Siwa and Takalar South Sulawesi of Indonesia. The number of samples used were 50 shrimps for each location that consisted of 25 males and females, respectively. A total of 23 length character were evaluated by using electric digital calliper 0.01 mm and two characters by using analytic balance 0.001 mg. Measurement data were standardise with an allometric method to avoid the effect of size and age on morphometric traits and then analyse by discriminant analysis. The results showed the significance different of 25 morphometric characters between Pinrang, Siwa, and Takalar both of male and female. Based on difference on morphometric character further forming two population grup that is group I consist of Siwa and Takalar male and female, and male and female Pinrang formed group II. The highest morphometric diversity obtained in Pinrang both males and females.

Keywords: morphometric; F. merguiensis; South sulawesi; diversity.

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1. Introduction

Fenneropenaeus merguiensis de Man 1888 are shrimps from Family Penaeideae which widely distribute almost among Indonesia waters. *F. merguiensis* known as udang putih or udang jerbung in Indonesia, udang kaki merah or udang putih in Malaysia, and in Australia as banana prawn [1].

These shrimps are the important species in West Indo Pacific, live in shallow waters between 10 to 45 meters with a sandy bottom either on estuarine or sea environment. Juvenile lives in estuaries and can grow up to a maximum standard length 24 cm [2].

F.merguiensis had several advantages as an aquaculture species including more tolerant to temperature and salinity, faster grow, and low in size variability [3].

Therefore, in order to develop the cultivation, of genetic variation information is very necessary because it will describe the condition or status of a population that is closely related to long-term survival of a species and the fitness of a population to adapt to environmental changes [4]. Also, natural population are perhaps the best gene bank, a critical resource for genetic variation for current and future application in genetic improvement for farmed species and specialised sports fish application [5].

Genetic diversity can be determined by phenotypes differences between individual which regulated by one or more genes [6]. Morphometric studies are not only essential to understand the taxonomy but also character of population [7], for stock identification [8,9,10,13], identify the difference between population [11,12], revealed the inter relation between the various bodily parameters like length, weight, fecundity and supporting breeding program for shrimp aquaculture species [14].

Studies morphometric on penaeid shrimp have been conducted on *Penaeus monodon* [15,16,17], *F. merguiensis* [14,18] *Farfantepenaeus notialis* [19], *P. indicus* [20], *P. semisulcatus* [21]. In Indonesia, information about genetic diversity of *F. merguiensis* is still limited in Sumatra, West Java, West Kalimantan and West Nusa Tenggara [18], whereas in South Sulawesi has not been done by him it was necessary to study genetic diversity based on morphometric characters.

2. Material and methods

2.1. Morphometrics Data collection

F. merguiensis samples collected from three location in the South Sulawesi of Indonesia (Figure 1) that is Pinrang (Makasar Strait), Siwa (Bone Bay), and Takalar (Flores Sea) since November 2014 to April 2015. A total number of 150 fresh samples were collected consist of 25 males and females, respectively. Before measurement, sample **s**eparated by se**x**uality and then measured for morphometric characters. The 23 length morphometric character measurement by using electrical digital calliper 0.01 mm and two weight character measurement by using an analytical balance 0.001 mg. Measurement morphometric character refers to [22,23] (Figure 2).

Figure 1: Sampling site

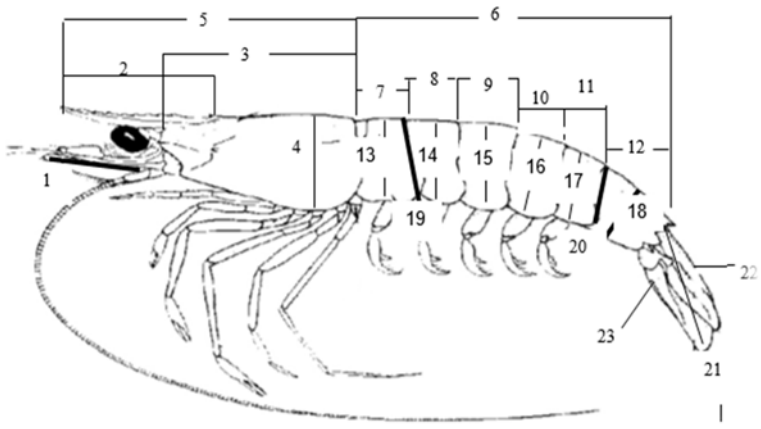

Figure 2: Schematic representation morphometric characteristic of *F.merguiensis*

2.2. Statistical Analysis

Morphometric characteristic data obtained from 23 lengths and two weight morphometric characters. To remove the effect of size from the shape measures, all morphometric characters measurement were standardised according to the formula [24] ,

$$\mathrm{Ms} = \mathrm{Mo}\ (\mathrm{Ls}/\mathrm{Lo})^{\mathrm{b}} \ldots\ldots\ldots (1)$$

Where *Ms*= standardized measurement, *Mo*=measured character length, *Ls*=overall mean standard length for all samples in each analysis, *Lo*=Standart length of specimen, and *b*=estimated for each character from the observed data by allometric growth equation $\mathrm{M} = aL^{\mathrm{b}}$ and then continued with normality test. Statistical analyzed was perform further with SPSS version 22.0 and program XL-stat 2014 to differentiate the character of the populations, respectively.

Table 1: Morphometric characters of *F. merguiensis*

No.	Morphometric character	Description
1.	Prosertemal length (PL)	The length from the origin to the tip of prosertema
2.	Rostral length (RL)	The length from the origin to the tip of the rostrum
3.	Partial carapace length (PCL)	The length from tip of the orbital the to the posterior of the carapace
4.	Carapace depth (CD)	Maximum depth between the top and the bottom of the carapace
5.	Carapace length (CL)	The length from tip of rostrum to the end of carapace
6.	Standard length (SL)	The length from the origin of the first carapace until the end of the sixth carapace
7.	First segment length (FSL)	The length between the origin of the first segment to the origin of the second segment.
8.	Second segment length (SSL)	The length between the origin of the second segment to the origin of the third segment
9.	Third segment length (TSL)	The length between the origin of the third segment to the origin of the fourth segment
10.	Fourth segment length (FoSL)	The length between the origin of the fourth segment to the origin of the fifth segment.
11.	Fifth segment length (FiSL)	The length between the origin of the fifth segment to the origin of the sixth segment.
12.	Sixth segment length (SiSL)	The length between origin of the six segment to the origin of telson
13.	First segment depth (FSD)	Depth at the midpoint of the first segment
14.	Second segment depth (SSD)	Depth at the midpoint of the second segment
15.	Third segment depth (TSD)	Depth at the midpoint of the third segment
16.	Fourth segment depth (FoSD)	Depth at the midpoint of the fourth segment
17.	Fifth segment depth (FiSD)	Depth at the midpoint of the fifth segment
18.	Sixth segment depth (SiSD)	Depth at the midpoint of the sixth segment
19.	Anterior abdominal circumference	The circumference of the boundary between the second and third
20.	(AAC)	segments
21.	Posterior abdominal circumference	The circumference of the boundary between the fifth and sixth
22.	(PAC)	segments
23.	Telson (Ts)	The length the origin to the tip of telson
24.	Exopod (Ex)	The length from the base to the tip exopod
25.	Endopod (En)	The length from the base to the tip endopod
	Total weight (TW)	The total weight of the entire body
	Tail weight (TaW)	The weight of the body without the head

3. Results

3.1. Morphometric characters

Morphometric characters both of females and males from Pinrang, Siwa, and Takalar population analysed by the significance test and the result given to Table 2.

In this study, we investigated genetic diversity based on morphometric characteristic both of male and female between three population of *F.merguiensis* in South Sulawesi. Result from the significant test (Tabel 2) reveals that all of the morphometric characters were evaluated (25 character) have different (sig. <0.05) one each other for each locations Pinrang, Siwa, and Takalar population both in males and females population, at once that *F.merguiensis* have diversity of phenotypes level both of males and females. It was a reflection as the adaptability of *F.merguiensis* in response to different environment.

Tabel 2: Results of Significance Tests of Morphometrics Character Females and Males From Pinrang, Siwa, and Takalar South Sulawesi

No. Morphometric characters	Wilks' Lambda	F	df1	df2	Sig.
1. Prosertemal length (PL)	.395	44.195	5	144	.000
2. Rostral length (RL)	.548	23.712	5	144	.000
3. Parsial carapace lenght (PCL)	.378	47.362	5	144	.000
4. Carapace depth (CD)	.325	59.801	5	144	.000
5. Carapace length (CL)	.260	82.175	5	144	.000
6. Standard length (SL)	.424	39.144	5	144	.000
7. The first segment lenght (FSL)	.470	32.442	5	144	.000
8. The second segment length (SSL)	.550	23.599	5	144	.000
9. The third segment length (TSL)	.514	27.240	5	144	.000
10.The fourth segment length(FoSL)	.604	18.872	5	144	.000
11.The fifth segment length (FiSL)	.728	10.759	5	144	.000
12 The sixth segment length (SiSL)	.430	38.238	5	144	.000
13. First segment depth (FSD)	.432	37.895	5	144	.000
14. Second segment depth (SSD)	.350	53.602	5	144	.000
15. Third segment depth (TSD)	.367	49.739	5	144	.000
16. Fourth segment depth (FoSD)	.374	48.267	5	144	.000
17. Fifth segment depth (FiSD)	.349	53.610	5	144	.000
18. Sixth segment depth (SiSD)	.339	56.086	5	144	.000
19. Anterior abdominal circumference (AAC)	.243	89.696	5	144	.000
20.Posterior abdominal circumfence (PAC)	.279	74.468	5	144	.000
21. Telson(Ts)	.072	373.481	5	144	.000
22. Exopod(Ex)	.745	9.840	5	144	.000
23. Endopod(En)	.734	10.448	5	144	.000
24. Total weight (TW)	.395	44.028	5	144	.000
25. Tail weight (TaW)	.369	49.344	5	144	.000

Performance or phenotype (appearance or characteristics) including morphometric character within a species are genetic effects, environmental, interaction between genetics and environment, and selection [5,25,26] suspect if the location is changed then the stock population will be different based on the morphometric variation, so is thought to be due to differences in the pattern of evolution of differences in environmental conditions such as depth, flow, and availability of food [10]. Morphological differences between populations are often quite

difficult to explain [25,26], but it has been known that the morphometric characters can describe the level of plasticity in response to environmental [27].

3.2. Distribution of Population based on Morphometric Character

The results of canonical analysis of morphometric characters describe the distribution pattern *F. merguiensis* in South Sulawesi given to Figure 3.

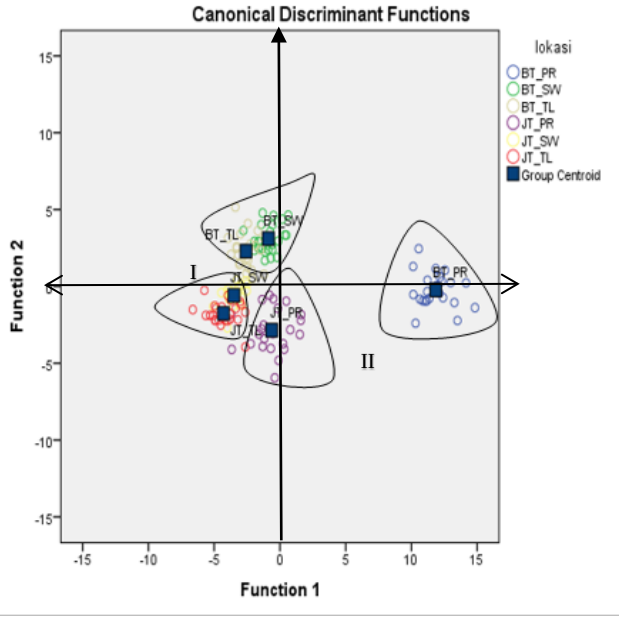

Figure 3: Distribution of Morphometric Characteristic of *F.merguiensis* in South Sulawesi

(BT_SW: Siwa Female Population, BT_TL:Takalar Female Population, JT_SW: Siwa Male Population, JT_TL:Takalar Male Population, BT_PR: Pinrang Female Population, and JT_PR: Pinrang Male Population)

Canonical discrimination function (Figure 3) reveals that distribution pattern of morphometric characters of *F.meguiensis* formed two group population. Group I consist of Takalar and Siwa population both of female and male, and group II consist of Pinrang population. Siwa and Takalar male population most closely related subsequently form that characterise by some characters overlapped with each other as well as female population between Siwa and Takalar. Their intersection in a few characters in the same group describes the possibility of engaging the population phenotype both intra and interpopulation [28]. Pinrang female population is different from Pinrang male population marked by no overlap in all evaluated characters. We suspect due to the similarity of environmental conditions between Siwa and Takalar population where influenced by the presence of some short river that empties into the sea and then affects the salinity. In contrast, Pinrang waters precisely influenced by the great river which empties into the sea will cause different salinity from Takalar and Siwa. These results simultaneously describe the character differences between male and female populations in all populations. Fish body shape is a phenotypic trait influenced by a number of factors including inherited genes, fitness obtained through selection and environmental conditions, particularly those experienced during early life stages. The

relative influence of each of these factors on morphometric characters is unknown [26] as if differences in sexuality for endemic shrimp in the river in Taiwan [29], also *Macrobrachium roserbergii* in South Sulawesi such as female has morphometric character different in different locations [30] . [31] considers that the variation in the size of the population is largely dependent on environmental parameters while the shape variation may reflect a genetic condition.

4. Conclusion

The results of this study reveals that morphometric character of *Fenneropenaeus merguiensis* in South Sulawesi different between male and female population in Pinrang, Siwa, and Takalar. Based on difference of morphometric character further forming two population grup that is group I consist of Siwa and Takalar male population and Siwa and Takalar female population and group II consist of Pinrang female and male population. The difference is due to the ability of adaptation to environmental changes.

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