Morphometric Variance of South Sulawesi's Freshwater Prawn Macrobrachium rosenbergii and Macrobrachium idae

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***Abstract*-** Indonesia has two species of indigenous freshwater prawn *Macrobrachium rosenbergii* and *Macrobrachium idae* which are distributed in different environments/habitats. Adaptation to different environments leads to dissimilar characters, causing morphological variance which could be evaluated using morphometric character measurements. This study was aimed to discover the morphometric variation of the population of freshwater prawn *Macrobrachium rosenbergii* and *Macrobrachium idae* in South Sulawesi. The samples were taken from Waelawi River in North Luwu, Kariango River in Pinrang and Tempe Lake in Wajo. The freshwater prawn's morphology was analyzed descriptively based on the coefficient of variance. The *Macrobrachium rosenbergii*'s coefficient of variance was relatively high, ranging between 9.33% and 71.20% and the coefficient of variance for *Macrobrachium idae* was between 8.69% and 67.49%. The analysis of 25 morphological characters demonstrated that the population was heterogeneous, which was probably caused by difference in habitat.

***Index Terms*-** freshwater prawn, *Macrobrachium rosenbergii, Macrobrachium idae* morphometric, South Sulawesi

I. INTRODUCTION

reshwater prawn from the Macrobrachium genus (Bate, 1868) (Crustacea: Palaemonidae) is a highly diverse decapod-crustacean group (Jalihal *et al.*, 1993; Liu *et al.*, 2007), having approximately 210 species (Short, 2004), and there are indications that Indonesia has widely dispersed freshwater prawn *Macrobrachium rosenbergii* and *Macrobrachium idae* species.

The freshwater prawn's natural habitat in Indonesia is divided into two, the Western group and the Eastern group. The Western group was identified as sub-species of *M. rosenbergii schenkeli* Johnson (1973) or *M. rosenbergii dacqueti* Sunier (1925) *in* Binur, et al. (2013) which are distributed all over Sumatra, Java, and Borneo, whereas the Eastern population was identified as sub-species of *M. rosenbergii rosenbergii* de Man, 1879 which are distributed all over Sulawesi and Papua (Holthuis and Ng 2010 *in* Binur et al., 2013). In addition, there are also populations of *Macrobrachium idae.*

Some areas in South Sulawesi, such as North Luwu and Pinrang, are the habitats of *Macrobrachium rosenbergii*, while Wajo is the habitat of *Macrobrachium idae*. New (2002) described the habitat of this prawn as freshwater bodies (ponds, lakes, rivers, and irrigation canals) and estuaries.

Dissimilar habitats/environments affect a species' morphology. Adaptation to different environments cause character differences and thus causes morphological variation. These variations could be evaluated, among others by morphometric character measurement. Morphometric measurements are geometrical and biological empiric functions (Bookstein, 1997). Murta (2000), Silva (2003) and Turan (2004) explained further that morphmetrical measurement is the morphological character most often employed in describing stock/population.

This study was aimed to discover the morphometric variance of the freshwater prawn *Macrobrachium rosenbergii* and *Macrobrachium idae* populations in South Sulawesi.

II. MATERIALS AND METHODS

The samples were taken from Kariango River in Pinrang (A), Waelawi River in North Luwu (B) and Tempe Lake in Wajo (C) (Figure 1). Samples of the freshwater prawn were caught using nets. The number of samples taken from the populations of Kariango River was 35 samples each (25 male and 10 female) and Waelawi River 35 samples each (10 male and 25 female), whereas the number of samples taken from Tempe Lake was 33 samples (22 male and 11 female).

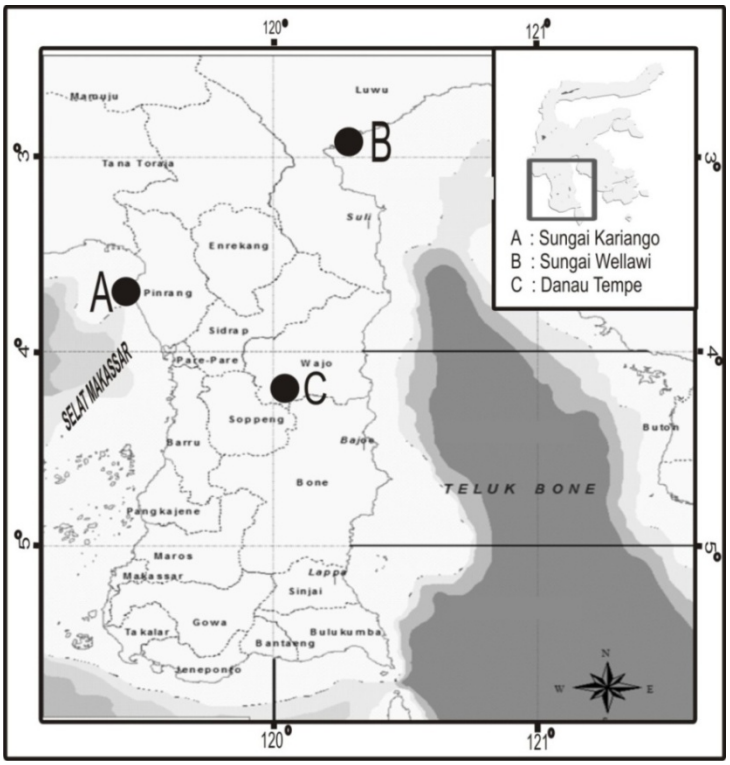

Figure 1: Sampling locations

The equipment used was digital calipers (0.01 mm accuracy). The summary and definition of morphometric characters measured can be seen in Table 1.

Table 1. Symbols, characters and the definitions of freshwater prawn morphometric characters

Symbol	Character	Definition of Character
TB	Total body length	The distance between the tip of the rostrum and the tip of the telson, body straightened
SL	Standard length	The distance between the base of eye and the base of the uropode
HL	Head length	The distance between the tip of the rostrum and the base of the carapace
RL	Rostrum length	The distance between the tip of the rostrum and the posterior border (the eye)
CL	Carapace length	The distance between the eye and the base of the carapace
CW	Carapace width	The widest part of the last rostral spine
CH	Carapace height	The highest point between the top and the bottom of the carapace
TA	Total abdominal length	The distance between the first segment and the tip of the telson
SA	Standard abdominal length	The distance between the first segment and the tip of the sixth segment
WS1	Width of the first segment	The widest point of the first segment
WS2	Width of the second segment	The widest point of the second segment
WS3	Width of the third segment	The widest point of the third segment
WS4	Width of the fourth segment	The widest point of the fourth segment
WS5	Width of the fifth segment	The widest point of the fifth segment
WS6	Width of the sixth segment	The widest point of the sixth segment
LS1	The length of the first segment	The distance between the carapace and the boundary between the first and second segments

LS2	The length of the second segment	The distance between the boundary of the first and second segment and the boundary of the second and third segments
LS3	The length of the third segment	The distance between the boundary of the second and third segment and the boundary of the third and fourth segments
LS4	The length of the fourth segment	The distance between the boundary of the third and fourth segment and the boundary of the fourth and fifth segments
LS5	The length of the fifth segment	The distance between the boundary of the fourth and fifth segment and the boundary of the fifth and sixth segments
LS6	The length of the sixth segment	The distance between the boundary of the fifth and sixth segment and the telson
CAA	The circumference of the anterior abdomen	The distance (circumference of the boundary of the fifth and sixth segments)
CPA	The circumference of the posterior abdomen	The distance (circumference of the boundary of the second and third segments)
LT	The length of the telson	The distance between the base and the tip of the telson
WT	The width of the telson	The widest point of the telson

The morphometric measurements were analyzed descriptively by calculating the coefficient of variance (cv) using the Excel 2007 program. In order to avoid the effect of dissimilar measurements, the values of the characters were standardized using the comparison between Carapace Length (PK) and Standard Body Length (PBT).

III. RESULTS AND DISCUSSION

The analysis results of the coefficient of variance (cv) of the morphometric characters were divided into two groups, male (Table 2) and female (Table 3).

Table 2. Mean, standard deviation (sd), coefficient of variance (cv) and morphometric characters of the male freshwater prawn population of North Luwu, Pinrang and Wajo

Character	North Luwu			Pinrang			Wajo		
	Mean (mm)	sd	cv (%)	Mean (mm)	sd	cv (%)	Mean (mm)	sd	cv (%)
TB	77.62	13.67	17.61	47.09	27.44	58.27	36.87	3.20	8.69
SL	49.80	8.40	16.87	33.14	17.16	51.79	27.70	3.65	13.19
HL	38.49	5.94	15.44	22.75	14.55	63.94	15.35	1.67	10.87
RL	26.29	5.46	20.78	14.65	10.43	71.20	11.15	1.80	16.16
CL	18.34	6.46	35.23	13.08	7.90	60.44	10.17	1.53	15.00
CW	13.15	2.35	17.85	8.11	4.73	58.35	5.94	0.79	13.34
CH	14.03	2.36	16.84	8.30	4.62	55.64	6.98	0.85	12.15
TA	36.88	5.91	16.01	24.67	12.92	52.38	21.51	1.97	9.17
SA	27.77	4.30	15.49	18.47	9.68	52.37	16.05	1.48	9.22
WS1	10.23	1.67	16.32	6.44	4.07	63.15	4.77	0.52	10.93
WS2	9.69	1.62	16.69	6.61	3.95	59.78	5.06	1.67	32.89
WS3	8.71	1.68	19.25	5.47	3.27	59.77	4.68	1.31	28.08
WS4	7.47	1.21	16.24	4.49	2.80	62.37	3.63	0.53	14.58
WS5	6.03	1.15	19.03	3.71	2.21	59.45	3.36	1.05	31.10
WS6	5.46	0.99	18.15	3.38	2.06	60.84	2.82	0.55	19.58
LS1	3.50	0.96	27.45	2.63	1.59	60.65	2.51	0.71	28.09
LS2	5.83	0.85	14.55	3.76	1.99	52.78	3.83	0.90	23.62
LS3	6.17	1.00	16.24	4.48	2.15	48.03	3.89	0.60	15.45
LS4	4.07	0.83	20.39	3.10	1.34	43.29	3.04	0.50	16.58
LS5	3.08	0.67	21.69	2.25	1.18	52.36	2.35	0.42	17.89
LS6	5.45	0.80	14.75	3.84	1.91	49.63	3.77	0.41	10.78
CAA	25.99	4.03	15.52	15.65	10.54	67.34	10.99	2.02	18.40
CPA	14.06	2.39	17.01	8.97	5.92	66.00	6.22	0.86	13.75
LT	8.67	1.36	15.73	6.22	3.36	54.09	5.30	0.82	15.51
WT	3.33	0.75	22.67	2.15	1.28	59.27	1.78	0.38	21.13

Table 3. Mean, standard deviation (sd), coefficient of variance (cv) and morphometric characters of the female freshwater prawn population of North Luwu, Pinrang and Wajo

Character	North Luwu			Pinrang			Wajo		
	Mean (mm)	sd	cv (%)	Mean (mm)	sd	cv (%)	Mean (mm)	sd	cv (%)
TB	70.45	8.46	12.01	50.49	19.06	37.74	40.67	8.43	20.72
SL	46.80	4.37	9.33	33.64	11.96	35.55	32.27	6.92	21.43
HL	34.45	4.55	13.22	24.20	9.85	40.70	19.96	4.43	22.19
RL	24.97	4.38	17.54	17.60	7.92	44.97	12.49	5.04	40.31
CL	18.27	3.20	17.53	13.16	6.55	49.72	10.13	2.44	24.07
CW	10.84	1.52	13.98	8.20	2.99	36.42	6.36	1.46	22.99
CH	11.52	1.64	14.25	8.43	3.08	36.47	6.57	1.69	25.69
TA	35.58	4.52	12.70	26.33	9.15	34.74	20.35	3.90	19.18
SA	27.11	3.76	13.87	20.06	7.03	35.04	15.29	2.84	18.57
WS1	9.72	1.24	12.78	6.98	2.47	35.40	5.47	1.37	25.13
WS2	9.43	1.45	15.43	6.91	2.29	33.16	5.08	1.12	22.04
WS3	8.16	1.29	15.82	6.44	2.71	42.06	4.83	1.32	27.24
WS4	6.84	1.06	15.51	5.43	1.95	35.95	4.10	1.05	25.59
WS5	5.61	0.84	15.03	4.22	1.51	35.86	3.53	0.76	21.47
WS6	4.87	0.88	18.04	3.51	1.07	30.46	2.77	0.87	31.43
LS1	3.64	0.98	27.00	2.55	1.20	47.08	1.70	0.32	18.97
LS2	6.01	1.23	20.40	4.37	1.40	31.92	2.88	0.82	28.50
LS3	5.98	0.93	15.52	4.44	1.45	32.76	3.45	0.82	23.68
LS4	4.64	0.77	16.68	3.42	1.13	33.09	2.42	0.48	19.86
LS5	3.19	0.65	20.36	2.39	0.84	35.03	1.82	0.40	21.91
LS6	5.24	0.90	17.15	3.92	1.34	34.28	3.03	0.64	21.18
CAA	23.95	5.29	22.07	19.49	8.19	42.02	8.85	5.97	67.49
CPA	12.33	2.79	22.62	10.16	3.83	37.71	5.84	3.49	59.67
LT	8.64	1.35	15.60	6.13	2.25	36.68	5.03	1.00	19.83
WT	3.51	1.37	39.01	2.41	1.06	44.05	1.96	1.05	53.55

The coefficient of variance describes the variation of morphometric characters of the population evaluated. The coefficient of variance for the male *Macrobrachium rosenbergii* population in North Luwu was between 14.55% and 35.23%, in Pinrang between 43.29% and 71.20% and for the *Macrobrachium idae* population in Wajo between 8.69% and 32.89%, whereas for the female *Macrobrachium rosenbergii* population in North Luwu it was between 9.33% and 39.01%, in Pinrang between 30.46% and 49.72% and for the *Macrobrachium idae* population in Wajo it was between 18.57% and 67.49%. The range of the coefficient of variance in male *Macrobrachium rosenbergii* was wider than that of the females, while the coefficient of variance for the female *Macrobrachium idae* was higher than that of the males. This condition demonstrates that the morphology of male *Macrobrachium rosenbergii* is more heterogeneous than that of the females. On the other hand, for *Macrobrachium idae*, the female population's morphology was more heterogeneous than that of the male population.

The lowest coefficient of variance was found in the TB character (the distance between the tip of the rostrum and the tip of the telson, body straightened) of the male *Macrobrachium idae* population in Wajo male and the RL character (the distance between the tip of the rostrum and the posterior border (the eye)) of the male *Macrobrachium rosenbergii* population in Pinrang.
The phenotypic characters in the freshwater prawn *Macrobrachium rosenbergii* and *Macrobrachium idae* based on their coefficient of variance demonstrated a higher and wider ranging value than that of *Macrobrachium vollenhovenii* Herklots at a range of 1.93% to 19.83% (Konan, *et al*., 2010) and *Macrobranchium lar* (Fabricus, 1798) which has a range of 9.46% to 20.48% (Sethi *et al.*, 2013). It is postulated that the high variance is because that the freshwater prawn evaluated were in their natural habitats, or in other words they were not cultivated populations (domesticated populations). The cultivation process could decrease genetic variation in the subsequent generations because the individuals are under strict selection, reducing the number of breeders included in the reproducing population.

The high range of coefficient of variance in the three populations indicated the yang morphometric characters tended to be heterogeneous; therefore the values also explained that the freshwater prawn populations evaluated had high heritability. Heritability is the ratio between additive and phenotypic variance. The importance of heritability is that it is predictive in the subsequent generations, thus it could be used as breeding value.

IV. CONCLUSION

It could be concluded based on the results of this study that the three populations of freshwater prawn in South Sulawesi have a high coefficient of variance due to the differences in their natural habitats and that this could increase the breeding value.

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