



## EVALUATION OF GROWTH RATE OF GI Macro II STRAIN IN DIFFERENT LOCATIONS

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### INTRODUCTION

Indonesia is one of the countries with high levels of biological diversity in terms of freshwater fish. About 30 endemic species of freshwater fish are found in Sumatera, 149 species in Kalimantan, 12 species in Java, and 52 species in Sulawesi (Anon, 1994; Kottelat et.al., 1993). The country's total freshwater area is 55 million ha consisting of lakes, dams, swamps and other water bodies. The potential area for freshwater pond fish culture is estimated at 233,124 ha with a production of 334,085 mt/year (DGF Indonesia, 2001) of which about 5140 mt comprises the giant freshwater prawn.

The giant freshwater prawn has been considered an important commodity that is successfully cultured in Indonesia. Freshwater prawn culture has been developed in several areas of West Java, i.e., in Ciamis (Tambaksari, Pamarican and Kalipucang) and Tasikmalaya. Commercial hatcheries are mostly found in Jogjakarta area with the Indonesian Government operating one hatchery while the private sector operates at least seven hatcheries. In East Java, freshwater prawn culture is conducted in brackishwater ponds. The development of the freshwater prawn culture has also spread to Bali Island, e.g., in Gianyar, Klungkung, Buleleng and Tabanan.

Freshwater prawn population in Indonesia is unique and its geographical distribution is in almost all islands. Indonesia is recognized as the center of origin of the freshwater prawn because of about 19 species are still existing (Holthuis, 1980). However, the potential genetic resource is not yet utilized in freshwater prawn culture. Further, despite the advanced development of freshwater prawn culture in Indonesia, some problems have been found, e.g., declining growth rate, diseases and the edible portion getting smaller. In recent years, the Government of Indonesia stressed its focus on the increased production of the freshwater prawn. One of the ways being promoted to achieve increased production is through a genetic improvement program.

Selective breeding program has been conducted to improve the freshwater prawn using synthetic population gathered from numerous breeders collected from the waters of Tanjung Air (Bekasi), Kalipucang (Ciamis) and Musi (Palembang). Subpopulation from Tanjung Air was collected in February 1995 with an average body weight of 70 g/pc. Individual selection is applied to this subpopulation to improve the edible portion trait.

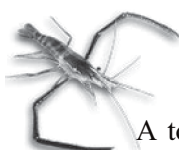
The subpopulation from Kalipucang was collected in June 1996 with an average weight of 72 g. Index selection was used in this population to improve the growth rate and edible portion trait. After two steps selection, the synthetic population was constructed from these two subpopulations and added to the subpopulation from Musi (ave body weight of 75 g collected in May 1997). Family selection was then applied to the synthetic population.

Thus, in 2001, a certain race of freshwater prawn has been developed and released to the farmers. This strain was the GI Macro or the Genetically Improved *Macrobrachium rosenbergii* (Emmawati et.al., 2001). Based on the feedback from farmers, and in order to evaluate the capability of GI Macro in different locations, this study intended to know the GI Macro growth rate in three different locations i.e. low (<10m), moderate (150-250m) and high (>250) of sea surface level.

### MATERIALS AND METHODS

#### Spawning activity

About 1800 breeders with total length size of up to 22 cm have been selected from 18 families of GI-macro II stock population. Twenty five percent of the best size in terms of length of each family was used as the selected line while the 25% residual to average size was used as the control line (50 male and 50 female per family). Each family is differentiated by means of a plastic tagging and contributed to about 50 breeders selected in the mass spawning.



A total of 900 breeders from each line (selected and control line) with 1:1 male and female ratio were mass spawned separately in 200 m<sup>2</sup> concrete pond for 1 month. Seventy female breeders with mature eggs (chocolate color) from the selected line and 60 female breeders with the same condition from the control line have been collected for the spawning and hatching.

Table 1. Characteristics of GI Macro after fourth generation

No	Character	Value
1	Heritability of edible portion ( $h^2_{ep}$ )	0.56 (SE: 0.07)
2	Heritability of body weight ( $h^2_{bw}$ )	0.84 (0.02)
3	Inbreeding rate (F)	0.0091
4	Total length of male (cm) Total length of female (cm)	21.53 (5.45) 15.02 (3.19)
5	Percentage of carapace (male) Percentage of carapace (female)	30.45 (5.86) 32.68 (8.05)
6	Hatching rate (%)	65.27 – 80.0
7	Survival rate (% per 4 months)	46.3 – 53.1

Breeders were treated by dipping them in 1.5 mg/l malachite green for 20 min before placing them into hatching fiberglass tank. The water temperature was kept at 29-30°C using thermostat heaters. Squid was given as food at 5% of body weight and feeding frequency was three (3) times daily.

### Larval Rearing

Larvae were collected using net tray daily and kept into rearing tank at 100-150 fry/liter. Larvae collected in 10 days were pooled into one batch. Clean water system with 10-12 ppt salinity was used in this process. *Artemia* naupli was given to the 1-7 days old larvae followed by egg custard containing 55% protein and 8% fat 7 times daily. Water was changed every three days when larvae was 1-7 days old, every two days for larvae 7-15 days old and then daily up to post larvae (PL).

### Post Larval Rearing

About 24 thousand larvae of the selected and control line were collected and reared in different concrete tanks provided with bamboo shelters. PL-10 of *M. rosenbergii* was reared up to 3-5 cm in a concrete tank in the hatchery at 400 PL/m<sup>2</sup>. Feed used was natural food (i.e. *Moina* and *Daphnia*), and pellet containing 38% protein at 20% of body weight. The natural food was given once while pellet was given 4 times daily.

### Grow-out culture

*M. rosenbergii* juveniles, ave size 0.3 g, was reared in a hapa nets placed in the pond at 85 juveniles/m<sup>2</sup>. The juveniles were cultured in three different locations: Sukamandi (low level, <10 m), Cibalagung (moderate level, 200-250 m) and Cijeruk (high level, >250 m).

Pellet containing 30-33% protein was used for 1-3 weeks at 20% of body weight 4 times daily (07.00; 10.00; 13.00 and 17.00). At 4-8 weeks, feeding rate was 15% of body weight given 4 times daily after which feeding rate was 10 of body weight given three times (07.00; 12.00 and 16.00). Sampling was done twice in a month while cleaning of the hapa was conducted every week.

## RESULTS AND DISCUSSION

Total length, standard length, body weight and survival rate of *M. rosenbergii* batches are listed in Table 1.



Table 1. Average total length (TL), standard length (SL), body weight (BW) and survival rate (SR) of *M. rosenbergii* batches

Batch	Selected				Control			
	TL (mm)	SL (mm)	BW (gram)	SR (%)	TL (mm)	SL (mm)	BW (gram)	SR (%)
1	2.833	1.753	0.19	93.3	2.807	1.650	0.19	93.0
2	2.987	1.800	0.19	79.0	2.467	1.467	0.19	48.0

The results showed that over a month culture, the average total length and survival rate of the selected line was higher than the control line. The average total length and survival rate of GI Macro varied between groups 1 and 2. This phenomenon indicated that population of GI Macro has wide variance in terms of growth and survival. The average total length and weight of juveniles during rearing for three months in a net placed at an earthen pond is listed in Table 2.

Table 2. Average total length (cm) and weight (g) of GI Macro fry during rearing for 3 months in three different locations (standard deviation in bracket)

Location	Collection	Initiated	2 week	4 week	6week	8 week	12 week
Sukamandi	Selected	TL=2.910 (0.527) W=0.189 (0.089)	3.880 (0.695) 0.432 (0.259)	4.568 (1.416) 0.773 (0.569)	5.858 (1.459) 1.544 (1.365)	6.858 (1.459) 2.774 (1.889)	7.789 (1.775) 4.698 (3.287)
	Control	TL=2.628 (0.742) W=0.189 (0.089)	4.328 (0.701) 0.568 (0.267)	4.916 (1.142) 1.001 (0.864)	5.628 (1.285) 1.648 (1.287)	5.992 (1.299) 1.821 (1.272)	7.606 (1.768) 4.320 (3.927)
Cijeruk	Selected	TL=2.910 (0.527) W=0.189 (0.089)	3.976 (0.788) 0.514 (0.331)	5.194 (0.999) 1.166 (0.779)	5.944 (1.034) 1.782 (0.951)	6.760 (1.239) 2.846 (2.653)	7.990 (1.043) 4.692 (2.011)
	Control	TL=2.628 (0.742) W=0.189 (0.089)	3.724 (0.609) 0.394 (0.910)	4.718 (0.663) 0.776 (0.347)	5.162 (1.150) 1.134 (0.851)	5.944 (1.171) 1.641 (0.940)	7.224 (1.193) 3.579 (2.052)
Cibalagung	Selected	TL=2.910 (0.527) W=0.189 (0.089)	4.486 (0.870) 0.691 (0.357)	5.642 (0.838) 1.218 (0.499)	6.964 (0.961) 3.234 (1.333)	8.138 (1.245) 4.880 (2.268)	8.858 (1.859) 7.982 (5.891)
	Control	TL=2.628 (0.742) W=0.189 (0.089)	4.196 (0.65) 0.545 (0.378)	5.820 (1.263) 1.528 (1.040)	6.600 (1.237) 2.384 (1.329)	7.506 (1.404) 3.784 (2.275)	8.556 (1.727) 6.648 (4.591)

Generally, the average total length and weight of the GI Macro selected line was better than the control line in the three different locations. The selected line of GI Macro in Sukamandi grew slower than the control line during the six weeks culture period. In Cibalagung and Cijeruk, the selected line of GI Macro grew faster than the control line during the 12 weeks rearing period. It is recognized that the best harvest weight is GI Macro reared in Cibalagung ( $7.982 \pm 5.991$  g), followed by Sukamandi ( $4.698 \pm 3.287$ g) and Cijeruk ( $4.692 \pm 2.011$  g).

This phenomenon showed that GI Macro is more suitable reared in low to moderate level than in high sea level area. Water temperature was 30-32°C, 28-30°C and 24-28°C in Sukamandi, Cibalagung and Cijeruk, respectively. The water sources of three different locations are: natural water source for Cijeruk, and channel water from paddy field for Cibalagung and Sukamandi. The water sources may have also influenced the growth of the GI Macro.

### Length and Weight Gain

Generally, the length gain of GI Macro reared in three different locations for three months was positive (Fig. 1). However, GI Macro reared in Cijeruk only showed positive tendency during the research period, while the negative value of the length gain was observed in GI Macro reared in Sukamandi and Cibalagung. A similar result was also obtained in the weight gain of the GI Macro (Fig. 2). The positive value was observed in GI Macro reared in Cijeruk, while negative value in weight gain was observed in Sukamandi and Cibalagung.

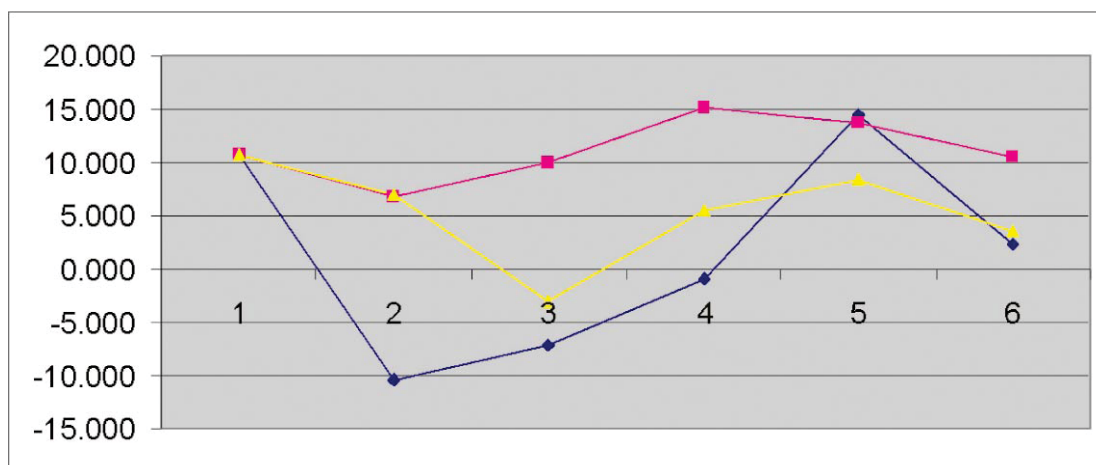


Fig. 1 Length gain of juvenile GI Macro reared in three different locations (Blue = Sukamandi, Pink = Cijeruk, Yellow = Cibalagung)

This shows that the selection activity has more affect on weight gain than in length gain. The harvest weight gain of the GI Macro reared in Cijeruk, Cibalagung and Sukamandi were 31.09%, 20.06% and 8.750%, respectively. While the harvest length gain of the GI Macro was 10.6%, 3.53% and 2.4% in Cijeruk, Cibalagung and Sukamandi, respectively. The highest weight and length gain of GI Macro in each location was 52% and 14% (Sukamandi) in 8 week period, 73% and 15% (Cijeruk) in 8 weeks and 6 weeks, and 35% and 8% (Cibalagung) in 6 week and 8 week period. Nugroho et.al (2005) had indicated that a wide variation of the GI macro was also observed genetically using DNA Markers, suggesting that another selection activity should be conducted to improve their variability as a pure line.

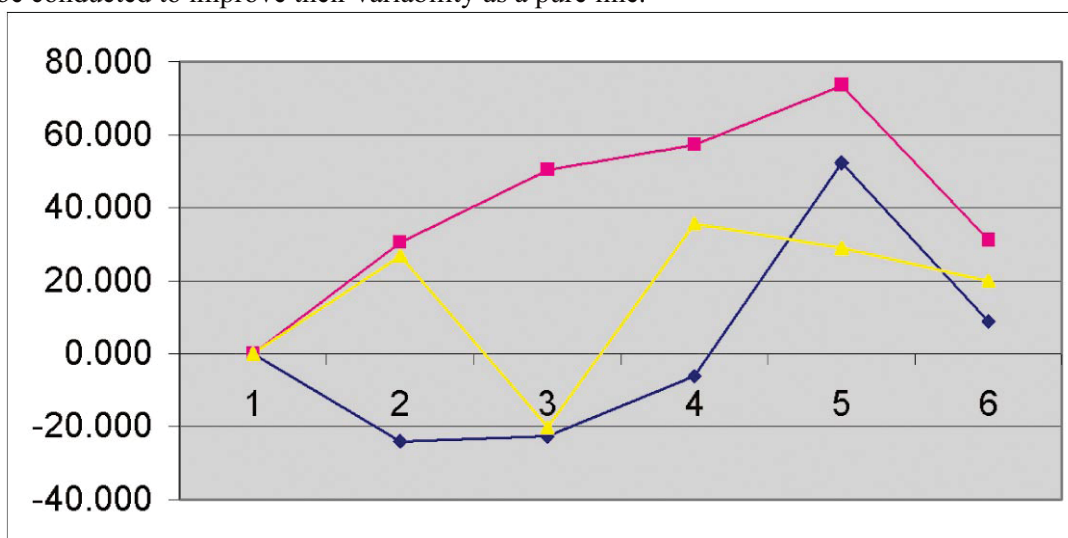


Fig. 2 Weight gain of juvenile GI Macro reared in three different locations (Blue = Sukamandi, Pink = Cijeruk, Yellow = Cibalagung)

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