Recent Updates on the Selective Breeding Program for the Genetic Improvement of *Macrobrachium rosenbergii* in Thailand[7]

**Supattra Uraiwan, Panom K. Sodsuk, Somsuk Rungtongbaisuree,
Wisanuporn Ratanatrivong and Sanga Leeaa-nga**
Aquatic Animal Genetic Research and Development Institute (AAGRDI)
Department of Fisheries, Thailand

Although the giant freshwater prawn (*Macrobrachium rosenbergii*) has been domesticated in Thailand for decades, a suitable selective breeding program has yet to be applied. Good quality seeds for the *Macrobrachium* industry are therefore not regularly produced. One of the selective breeding programs on the improvement of growth performance of the domesticated strain has been carried out at the Aquatic Animal Genetics Research and Development Institute (AAGRDI), Department of Fisheries of Thailand. AAGRDI has developed improved and domesticated stock of *Macrobrachium rosenbergii* for two generations. Meanwhile, domesticated stocks from private hatcheries have also been acquired. There is therefore a need to develop another improved stock of this species basically from these two domesticated stocks together with a wild stock in order to improve the genetic diversity of the base population for further selective breeding.

Three *Macrobrachium rosenbergii* stocks, namely, AAGRDI (Aquatic Animal Genetic Research and Development Institute), FARM (Petchaburi Farm) and WILD (Chantaburi) were used for a selective breeding program to develop a genetically improved giant freshwater prawn. For stocks to be considered as a good base population for any genetic improvement program, they generally should have high genetic variability and traits that allow them to be adaptable for each local environment. Hence, prior to conducting selective breeding, crosses of these three stocks were evaluated based on their performance and genetic diversity. The program was divided into two parts, first, the evaluation of growth performance of these three stocks and their reciprocal crosses under four common environments and second, the improvement of economic traits of the best cross through an appropriate selection procedure.

The stocks were compared in four types of environments, namely in 20 m² concrete ponds at the Aquatic Genetic Research and Development Research Center (AAGRDI), Pathomtanee province and in 5 x 5 x 1.5 m² mesh cages in three Fisheries Test and Research Centers located in Chumphon, Buriram and Uttaradit provinces. The aim of this study is to estimate the expected response to selection for growth of the intraspecific *M. rosenbergii* hybrid cross suitable for each type of culture area.

The test stocks had the following farming histories: the "AAGRDI" stock was selected for improved growth rate for two generations in the AAGRDI environment (Uraiwan *et al.*, 2003); the "FARM" stock originally came from a private hatchery in Petchaburi province in 2002, and was also reared at the AAGRDI for one generation; and the "WILD" stock was collected from a river in Chantaburi province in 2002 and has been domesticated in the AAGRDI hatchery for one generation.

Results of the one-year strain comparison program showed that there were differences in growth rate in the three *M. rosenbergii* stocks and their hybrids. (Uraiwan, *et al.*, 2005). Progenies from the nine crosses were reared in the four environments for eight months. Standard experimental procedures (stocking density, feeding regime and sampling) were used in all the rearing runs for the nine crosses. The stocking rate was 10 prawns/m². After eight months, results showed heterosis on the length and weight increments of these crosses at 0.65- 4.47% and 1.70-16.33%, respectively (Table 1). In the AAGRDI environment, the progenies of the WILD x AAGRDI cross showed statistically significant (P<0.05) growth advantage over the other crosses. In the Uttaradit Fisheries Test and Research Center and Chumphon Fisheries Test and Research Center, the progenies of the FARM x AAGRI cross were the (P<0.05) best growing stock while the progenies of the reciprocal cross AAGRI x FARM excelled in the Burirum Fisheries Test and Research Center.

Table 1. **Mean growth measurements, survival rate and the heterosis values of nine crosses of**
M. rosenbergii reared in cages for eight months in the four environments

Environment (Province)	Cross	Performance indicators			% heterosis	
		Length (cm) + sd	Weight (g) + sd	% survivai + sd	Length	Weight
Pathomtanee	1.WILD x AAGRDI	13.578+1.506[b]	34.721+11.874[b]	80.0+7.8	2.34	9.51
	2.AAGRDI x WILD	13.365+1.700[b]	34.902+12.974[b]	75.5+0.5		
	3.AAGRDI x FARM	13.124+1.938[b]	31.827+14.174[a]	76.5+17.7	0.65	1.70
	4.FARM x AAGRDI	13.060+1.439[a]	30.658+10.495[a]	82.5+5.7		
	5.WILD x FARM	13.519+1.596[b]	34.193+11.990[b]	66.5+19.0	1.17	6.62
	6.FARM x WILD	13.135+1.468[a]	32.421+11.136[c]	63.0+14.0		
	7.FARM x FARM	12.885+1.275[d]	30.172+11.183[a]	66.0+9.2		
	8.WILD x WILD	13.461+1.638[b]	32.308+12.680[c]	82.0+00		
	9.AAGRDI x AAGRDI	13.131+ 1.386[a]	31.269+10.268[a]	89.0+1.4		
			Mean	75.7+8.8		
Uttaradit	1.WILDx AAGRDI	15.457+2.155[a]	51.373+27.615[a]	80.5+7.8	2.61	8.40
	2. AAGRDI x WILD	16.400+2.566[a]	60.975+31.569[d]	81.0+14.8		
	3.AAGRDI x FARM	15.897+1.861[b]	56.048+27.606[b]	89+7.0	4.41	15.47
	4.FARM x AAGRDI	16.574+2.139[b]	62.222+31.896[d]	80+0.0		
	5.WILD x FARM	15.646+2.297[b]	54.397+25.657[b]	79+3.0	1.38	12.41
	6.FARM x WILD	15.180+2.234[c]	50.105+28.509[a]	76.3+7.1		
	7.FARM x FARM	15.146+2.173[c]	45.876+24.510[c]	78.3+0.8		
	8.WILD x WILD	15.260+1.843[c]	47.085+19.470[c]	84.5+7.8		
	9.AAGRDI x AAGRDI	15.935+ 2.319[bc]	56.552+28.454[b]	89.0+3.6		
			Mean	81.9+4.6		
Buriram	1.WILD x AAGRDI	15.400+2.280[a]	50.695+26.38[a]	89.4+13.0	1.18	4.57
	2.AAGRDI x WILD	16.122+2.30[b]	58.397+29.883[c]	86.0+0.0		
	3.AAGRDI x FARM	16.550+2.692[bc]	64.031+25.262[d]	80.5+3.0	4.05	16.33
	4.FARM x AAGRDI	15.726+2.313[a]	55.057+25.962[c]	75.5+8.9		
	5.WILD x FARM	15.944+1.931[b]	56.443+28.355[c]	72.0+11.5	2.58	15.29
	6.FARM x WILD	15.179+2.276[d]	50.504+29.129[a]	80+0.0		
	7.FARM x FARM	15.102+1.514[d]	45.409+23.711[b]	71.0+2.5		
	8.WILD x WILD	15.238+1.840[c]	47.356+19.602[b]	80+8.0		
	9AAGRDI x AAGRDI	15.917+ 2.333[b]	56.964+28.450[c]	80+0.0		
			Mean	79.4+6.0		
Chumphon	1.WILD x AAGRDI	12.702+1.182[a]	23.196+9.216[a]	69.0+0.0	3.65	12.89
	2. AAGRDI x WILD	13.102+1.070[b]	25.602+8.067[b]	45.5+3.0		
	3.AAGRDI x FARM	13.180+1.034[b]	25.136+8.547[b]	51.0+2.5	4.71	14.06
	4.FARM x AAGRDI	13.003+1.147[b]	25.663+10.152[b]	61.5+7.5		
	5.WILD x FARM	11.946+0.874[c]	17.574+5.068[c]	70.0+10.4	-3.36	13.30
	6.FARM x WILD	12.502+1.141[a]	20.928+6.819[a]	77.0+4.2		
	7.FARM x FARM	12.704+0.969[a]	22.848+9.184[a]	76.0+11.5		
	8.WILD x WILD	12.593+0.969[a]	21.562+7.718[a]	79.5+7.0		
	9.AAGRDI x AAGRDI	12.303+ 1.274[a]	21.664+8.306[a]	60.5+5.2		
			Mean	65.6+11.8		

The different letters illustrate significant difference at P-value<0.05

Meanwhile, the AAGRDI and FARM stocks were paired for spawning to produce the P_0 generation of the selection experiment in Buriram and Uttaradit Fisheries Test and Research Center. Breeding has been set up at the AAGRDI . Twenty pairs of each stocks were set up to produce 20 full-sib families. _Macrobrachium_ larvae were reared separately by families until they reach the age of 45 days, after which they were transferred to the Burirum and Uttaradit Fisheries Test and Research Centers. Meanwhile the parental stocks used in the AAGRDI x FARM cross were pooled and kept for further genetic diversity analysis.

At the end of December 2006, the *Macrobrachium* stock in the Buriram Fisheries Test and Research Center were two months old. The average sizes of seven full-sib families are summarized in Table 2. There were sizes differences between families (Table 3). The estimate expected response of the *Macrobrachium* under the Buriram environment has not been estimated as the age of selection is set at four months old. Therefore, only when all then individuals in each family have reached four months shall selection for the best size within each family is conducted to produce the next generation.

Table 2. **Mean growth at two months of seven *M. rosenbergii* (AAGRDI x FARM) families reared in cages at the Buriram Genetics Test Center**

Family Number	Sex	Mean Length (cm) + sd	Mean Weight (g) + sd
1	Male	10.477+0.546	10.438+1.859
	Female	10.417+0.863	11.796+3.097
	Mixed	10.448+0.701	11.09+2.568
2	Male	9.7+0.906	9.924+0.983
	Female	10.45+2.56	11.097+3.141
	Mixed	9.852+0.946	10.89+2.93
3	Male	9.96+0.623	12.240+3.597
	Female	10.26+0.505	11.698+1.801
	Mixed	10.2+0.531	11.806+2.185
4	Male	9.756+0.72	10.036+2.792
	Female	10.014+0.801	10.693+3.277
	Mixed	9.828+0.736	10.22+2.88
5	Male	8.805+0.853	7.245+2.18
	Female	8.82+0.593	7.310+1.302
	Mixed	8.808+0.796	7.258+2.02
6	Male	8.592+0.610	6.546+1.120
	Female	8.415+0.638	6.038+1.166
	Mixed	8.5+0.618	6.282+1.15
7	Male	8.00+0.316	5.35+0.533
	Female	8.067+0.416	5.861+0.957
	Mixed	8.048+0.381	5.718+0.888

Table 3. **Analysis of variance on length-weight of seven families of *M. rosenbergii* (AAGRDI x FARM) reared for two months in cages at the Buriram Genetics Test Center**

Source	DF	Mean Square	F-Ratio	P
		LENGTH		
Families	6	21.258	43.991	0.00
Sex	1	0.194	0.401	0.528
Error	167	0.483		
		WEIGHT		
Families	6	158.105	32.166	0.00
Sex	1	4.551	0.926	0.337
Error	167	4.915		

The program plan included the application of selection on the best crosses for three Fisheries Test and Research Centers environments, namely Uttaradit, Buriram and Chumphon However, delays in the implementation have been encountered due to unusual seasonal/environmental changes such as flooding, prolonged wet and cold seasons. To deal with these problems, shelters must be provided to protect the experimental pond from rising floodwaters during the prolonged rainy season and heaters must be used in the hatchery to control the water temperature.

Genetic improvement programs require long periods for implementation to allow the attainment of set breeding goals. Therefore, selection for increased growth rate must be carried out for at least two generations. Thus far, the experiment we have conducted under the proposed program has covered mainly the P_0 generation (parent generation) of selection. Therefore, at least one generation of within-family selection on the best cross grown in the three environments, shall be pursued in 2007.

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