CHAPTER IV

RESULTS

1. The proximate analysis of *B. superba* powder, major ingredients and feed

The proximate analysis of major ingredients and feed for 4 treatments are shown in **Table 4-1** and **Table 4-2**, respectively.

Table 4-1. Proximate analysis of major ingredients (means ± S.E.).

Ingredients	Proximate				
	Protein (%)	Lipid (%)	Ash (%)	Moisture(%)	Fiber (%)
Fish meal	54.68±0.08	8.44±0.14	22.90±0.24	5.57±0.08	0.08±0.00
Soybean	42.63±0.12	1.76±0.04	6.76±0.03	8.81±0.05	5.83±0.28
Wheat gluten	69.27±0.60	2.28±0.24	0.86±0.00	7.85±0.06	1.10±0.18
Wheat flour	14.27±0.23	0.96±0.06	0.52±0.03	10.69±0.08	0.42±0.20
Whole wheat	17.81±0.12	4.09±0.00	5.51±0.08	7.09±0.04	9.62±0.26
Butea superba (BS)	5.83±0.07	0.93±0.02	8.85±0.00	10.20±0.01	15.06±0.04

The major ingredient, 40 g soybean in 100 g diet, the dietary protein and lipid were 42.63±0.12% and 1.76±0.04%, respectively. The sub-major ingredient, 30 g fish meal in 100 g diet, the dietary protein and lipid were 54.68±0.08 % and 8.44±0.14%, respectively. The protein content of whole wheat was 17.81±0.12%, while that of BS was lower (5.83±0.07%). The lipid content was higher in wheat bran (4.09±0.00%) but lower in BS (0.93±0.02%).

Table 4-2. Proximate analysis of giant freshwater prawn diet (means ± S.E.)

Treatments	Proximate				
	Protein (%)	Lipid (%)	Ash (%)	Moisture(%)	Fiber (%)
A	41.00±0.31 [a]	8.18±0.05[a]	12.50±0.95 [a]	8.08±0.04 [b]	2.80±0.47 [a]
B	41.11±0.27 [a]	8.07±0.05[a]	12.25±0.18 [a]	7.67±0.04 [b]	2.93±0.12 [a]
C	41.70±0.18 [a]	9.51±0.02[c]	12.03±0.23 [a]	6.42±0.21 [a]	3.41±0.24 [a]
D	41.70±0.12 [a]	8.45±0.07[b]	11.92±0.06 [a]	6.60±0.00 [a]	3.80±0.14 [a]

[a,b,c]The different letters in the same column stand for the significant different of the mean ($p < 0.05$)

The average protein content of feed for 4 treatments was 41.38%. The contents of ash and fiber in 4 experimental diets were averaged to be 12.18% and 3.24%, respectively. There was no significant different of protein content in all treatments of the experimental feed, which also obtain in the same result in ash and fiber contents ($p > 0.05$). The lipid contents of feed C and D were significantly higher than those of feed A and B ($p < 0.05$). The highest lipid content was diet in treatment C (9.51±0.02%). The lowest level of lipid content was treatment B (8.07±0.05%). The moisture contents of diets A and B were significantly higher than those of diets C and D ($p < 0.05$).

2. Body weight and body length

The effect of body weight and body length of *M. rosenbergii* fed with different levels of *B. superba* during 20 weeks of the experimental period are illustrated in **Table 4-3** and **Table 4-4,** respectively. The final body weight and body length of male and

female *M. rosenbergii* fed with different levels of *B. superba* at the carry out period are shown in **Table 4-5** and **Table 4-6,** respectively.

Table 4-3. Body weight (g) of *M. rosenbergii* fed different amounts of *B. superba* in 20 weeks (means ± S.E.).

Time (week)	Body weight (g)			
	A	B	C	D
0	0.01±0.01 [a]	0.01±0.01 [a]	0.01±0.01 [a]	0.01±0.01 [a]
4	0.27±0.02 [a]	0.31±0.02 [ab]	0.33±0.02 [b]	0.34±0.00 [b]
8	1.94±0.09 [a]	1.90±0.10 [a]	1.84±0.10 [a]	1.85±0.11 [a]
12	5.45±0.24 [b]	5.33±0.27 [b]	4.51±0.23 [a]	4.82±0.29 [ab]
16	8.97±0.42 [a]	8.46±0.41 [a]	7.63±0.36 [a]	8.22±0.52 [a]
20	12.70±0.32 [b]	12.10±0.32 [b]	10.72±0.34 [a]	10.96±0.39 [a]

[a,b,c]The different letters in the same row stand for the significant different of the mean ($p < 0.05$)

M. rosenbergii fed different 4 diets had the same body weight at stocking. In the fourth week, the body weight of prawn fed with diets C and D were significantly greater than that of control group ($p < 0.05$). The prawn fed with diet D had the highest body weight (0.34±0.22 g) and in control group had the lowest body weight (0.27±0.17 g). In the twelfth week, the body weight of prawn had significant different ($p < 0.05$). The body weights of prawns fed with diet A (control) and diet B were significantly higher than that of group C. The prawn in control group had the highest body weight (5.45±0.24 g) and that fed with diet C had the lowest body weight (4.51±0.23 g). At the end of the experiment, the body weight of prawn fed with diet A (control) and diet B were

significantly greater than those of C and D group ($p < 0.05$). The prawn in control group had the highest body weight (12.70±0.32 g) and that fed with diet C had the lowest body weight (10.72±0.34 g). The diagram of body weights of *M. rosenbergii* during 20 weeks of the experimental period is presented in **Figure 4-1**.

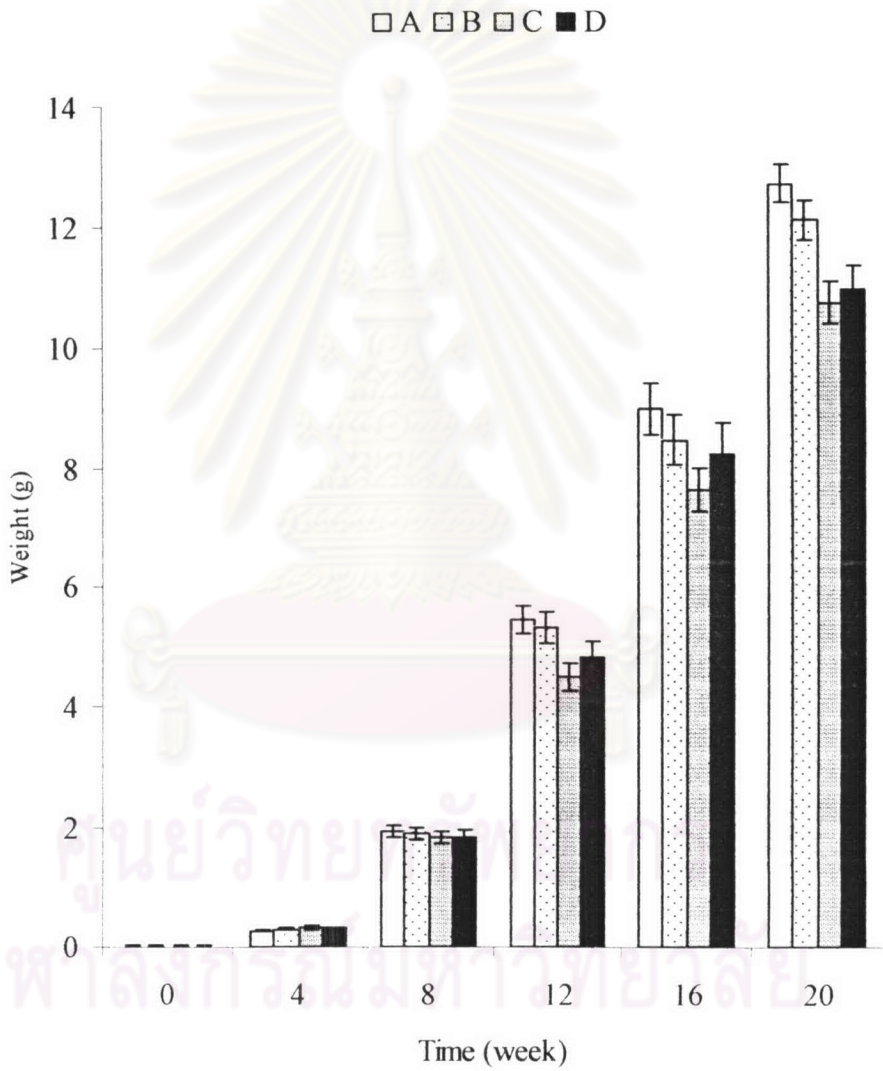

Figure 4-1. Effect of feed supplemented with *B. superba* on the body weight of *M. rosenbergii*.

Table 4-4. Body length (cm) of *M. rosenbergii* fed different amounts of *B. superba* in 20 weeks (means ±S.E.).

Time	Body length (cm)			
(week)	A	B	C	D
0	0.97±0.13 [a]	0.97±0.13 [a]	0.97±0.13 [a]	0.97±0.13 [a]
4	2.53±0.05 [a]	2.64±0.04 [ab]	2.74±0.04 [b]	2.70±0.05 [b]
8	4.51±0.07 [a]	4.51±0.07 [a]	4.43±0.07 [a]	4.42±0.08 [a]
12	6.07±0.09 [bc]	5.95±0.09 [bc]	5.68±0.08 [a]	5.70±0.09 [ab]
16	6.81±0.11 [a]	6.71±0.11 [a]	6.51±0.09 [a]	6.54±0.11 [a]
20	8.09±0.07 [b]	7.99±0.07 [b]	7.62±0.08 [a]	7.74±0.08 [a]

[a,b,c]The different letters in the same row stand for the significant different of the mean ($p < 0.05$)

In the beginning, *M. rosenbergii* fed with 4 formulated diets exhibited the same body length. In the fourth week, the body lengths of prawns fed with diets C and diet D were significantly higher than that of control group ($p < 0.05$). The prawn fed with diet C had the highest body length (2.74±0.04 cm) and that in control group had the lowest body length (2.53±0.05 cm). In the twelfth week, the body length had significant different ($p < 0.05$). The body lengths of prawns fed with diets A (control) and B were significantly higher than that of group C. The prawn in control group had the highest body length (6.07±0.09 cm) and that fed with diet C had the lowest body length (5.68±0.08 cm). At the end of the experiment, the body lengths of prawns fed with diet A (control) and diet B were significantly higher than those of group C and D ($p < 0.05$). The prawn in control group had the highest body length (8.09±0.07 cm) and that fed with diet C had the lowest

body length (7.62±0.08 cm). The diagram of body lengths of *M. rosenbergii* during 20 weeks of the experimental period is shown in **Figure 4-2**.

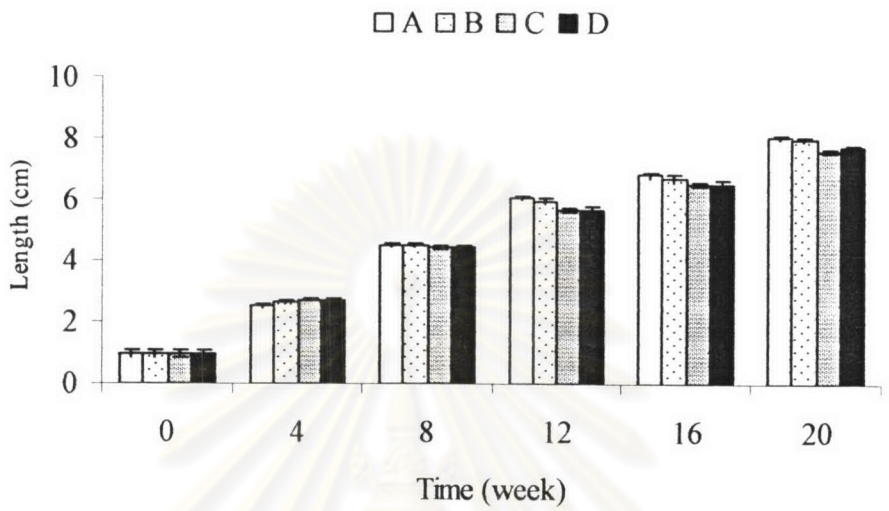

Figure 4-2. Effect of feed supplemented with *B. superba* on body length of *M. rosenbergii*.

Table 4-5. Final body weight (g) of male and female *M. rosenbergii* fed different amounts of *B. superba* at the end of the experiment (means ± S.E.).

Sex	Body weight (g)			
	A	B	C	D
Male	12.59±0.49 [b]	11.97±0.51 [b]	10.13±0.51 [a]	10.43±0.57 [a]
Female	12.86±0.37 [b]	12.24±0.39 [b]	11.31±0.45 [ab]	11.54±0.53 [ab]

[a,b,c]The different letters stand for the significant different of the mean ($p < 0.05$)

The final body weights of male and female *M. rosenbergii* in group A and B were significantly greater than those of group C and D ($p < 0.05$). There was significant different of final body weight of male group ($p < 0.05$). The final male body weights of prawns fed with diet A (control) and diet B were higher than those fed with diet C and

diet D. The highest final male body weight was control group (12.59±0.49 g), while the lowest final male body weight was group C (10.13±0.51 g). There was no significant different of final body weight of female group ($p > 0.05$). The highest final female body weight was control group (12.86±0.37 g), while the lowest final female body weight was group C (11.31±0.45 g). The diagram of body weights of male and female prawns during 20 weeks of the experimental period is shown in **Figure 4-3**. The frequency histograms of final body weight of male and female prawns in 4 groups were illustrated in **Figure 4-4**.

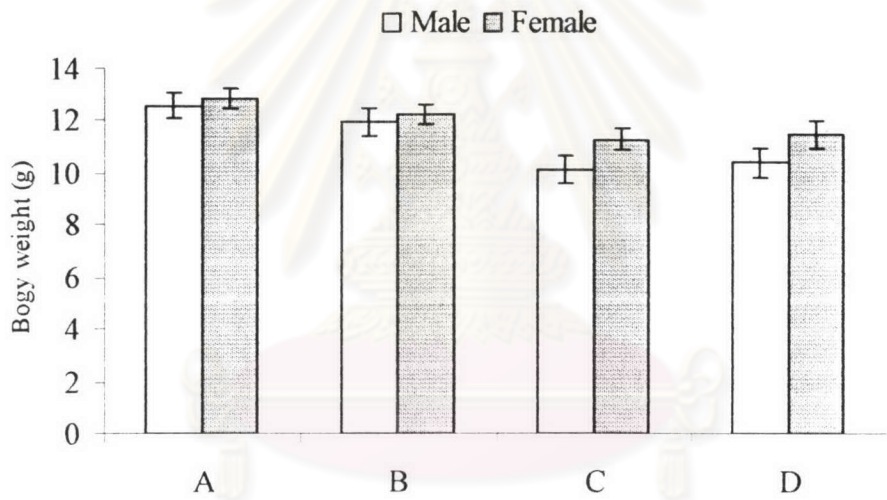

Figure 4-3. Effect of feed supplemented with *B. superba* on final body weight of male and female *M. rosenbergii*.

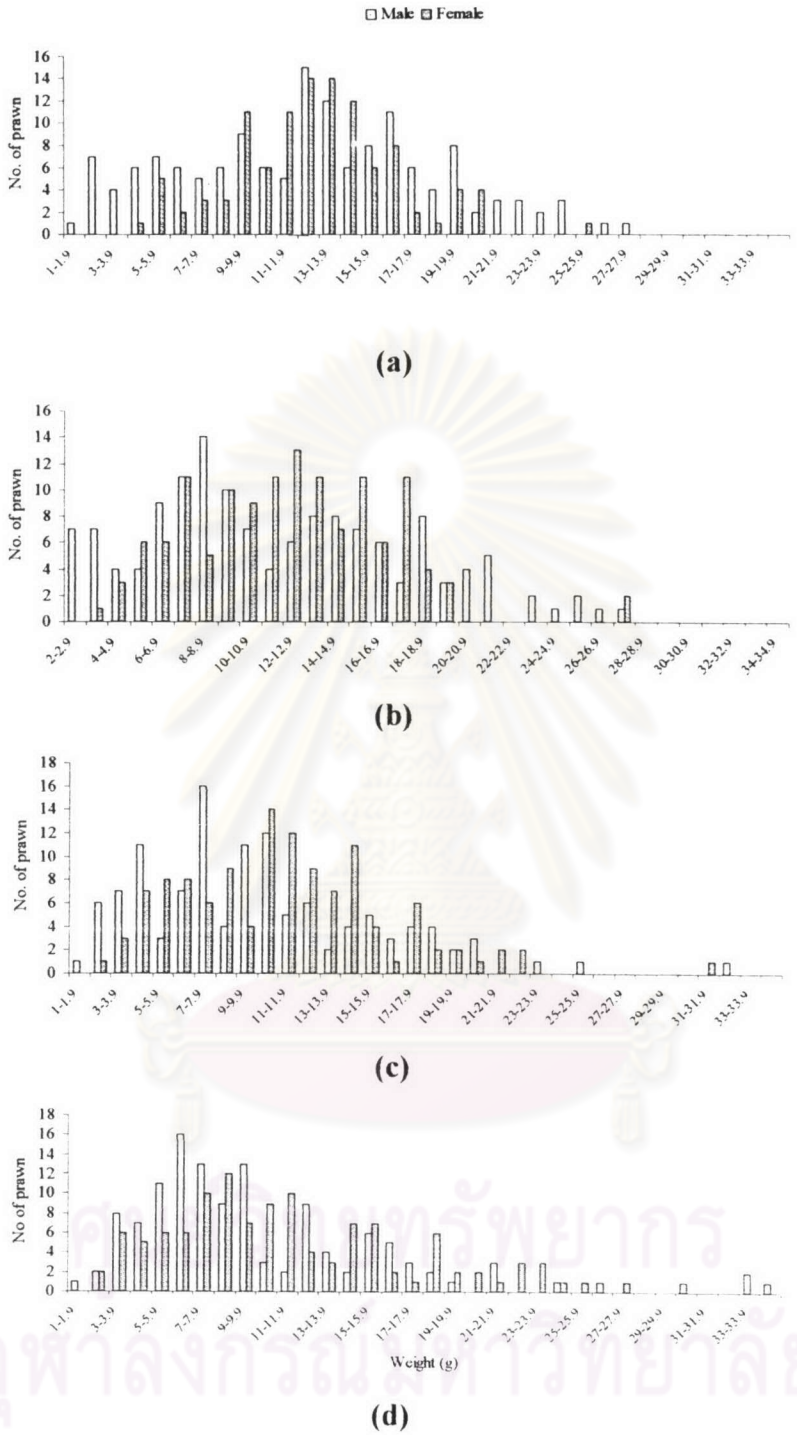

Figure 4-4. The frequency histograms of final body weights of male and female *M. rosenbergii* in 4 groups. (a) group A or control (b) group B or 0.05% BS (c) group C or 5% BS (d) group D or 5% BS

Table 4-6. Final body length (cm) of male and female *M. rosenbergii* fed different amounts of *B. superba* at the end of the experiment (means ± S.E.).

Sex	Body length (cm)			
	A	B	C	D
Male	7.96±0.10 [c]	7.87±0.10 [bc]	7.41±0.11 [a]	7.39±0.13 [ab]
Female	8.28±0.08 [d]	8.13±0.08 [cd]	7.82±0.09 [bc]	7.92±0.11 [c]

[a,b,c]The different letters stand for the significant different of the mean ($p < 0.05$)

The final body lengths of male and female *M. rosenbergii* of group C and D were significantly lower than that of control group ($p < 0.05$). The body lengths of female prawns in group A, C and D was significantly lower than those of male prawns in the same group. There was significant different of final body length of male group, those of group C and D were significantly different with that of control group ($p < 0.05$). The highest final male body length was group A or control group (7.96±0.10 cm), while the lowest final male body length was group C (7.41±0.11 cm). There was significant different of final body length of female group, those of group B, C and D were significantly different with that of control group ($p < 0.05$). The highest final female body length was group A or control group (8.28±0.08 cm), while the lowest final female body length was group C (7.82±0.09 cm). To compare with all groups of male and female prawns, the highest body length of prawn was the female in control group (8.28±0.08 cm) and the lowest body length of prawn was the male group fed with diet C (7.41±0.11 cm). The diagram of body length of male and female prawns during 20 weeks of the experimental period is shown in **Figure 4-**5. The frequency histograms of final body lengths of male and female prawns in 4 groups were illustrated in **Figure 4-**6. In all

treated groups, the frequency of small sizes of males was greater than females. The size is ranged from 4.5 to 7.9 cm of group A. In group B, the size ranges from 5.0 to 5.9 cm and 6.5 to 7.9 cm. The greater frequency of male of group C was demonstrated in size ranges from 4.5 to 5.9 cm, 6.5 to 6.9 cm and 7.5 to 7.9 cm. The size ranges from 4.5-7.4 cm of male in group D had the higher frequency than female.

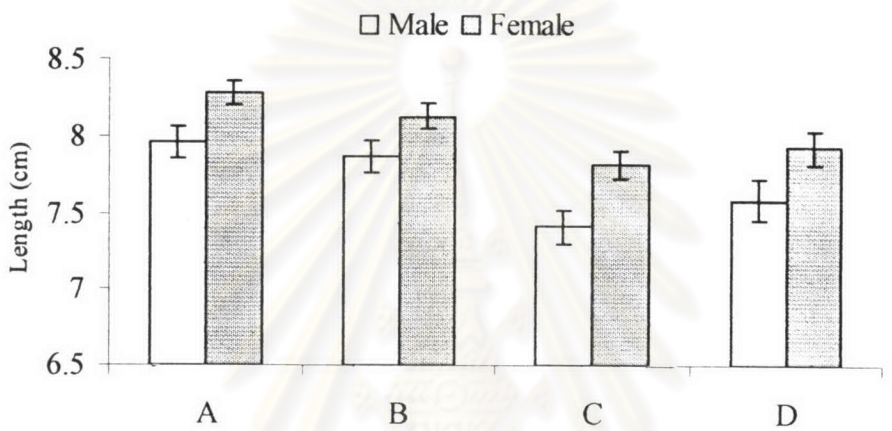

Figure 4-5. Effect of feed supplemented with *B. superba* on final bogy length of male and female *M. rosenbergii*.

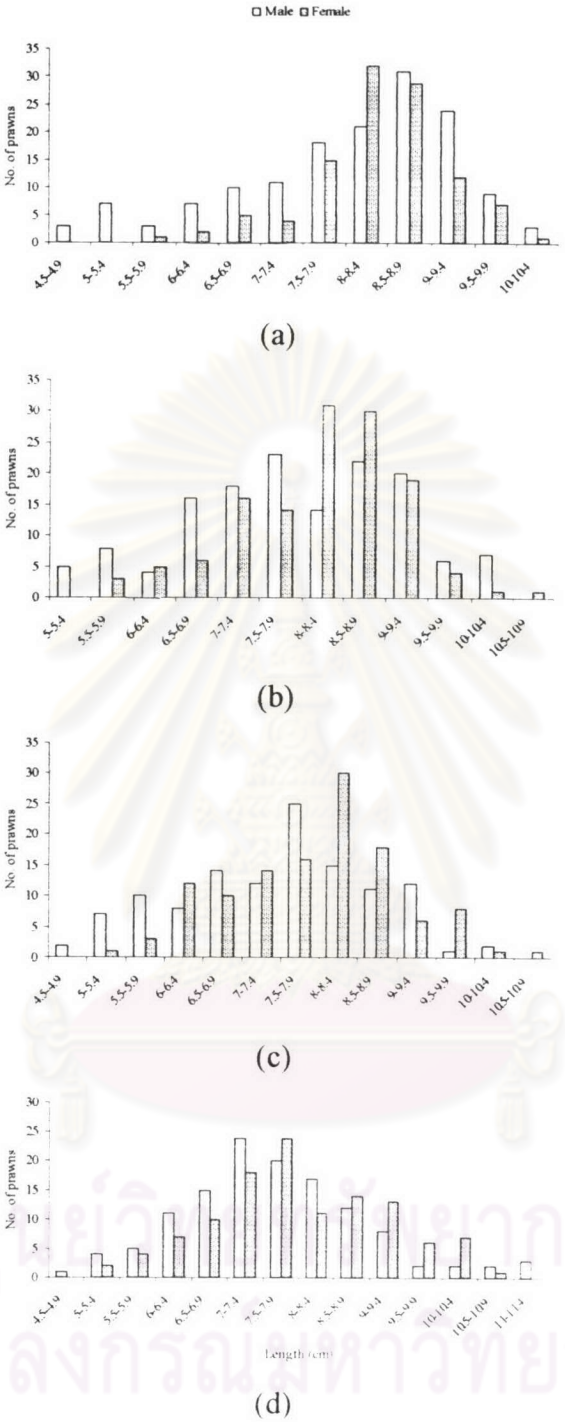

Figure 4-6. The frequency histograms of final body lengths of male and female *M. rosenbergii* in 4 groups. (a) group A or control (b) group B or 0.05% BS (c) group C or 5% BS (d) group D or 5% BS

3. Size determination of the first abdominal segment

The size of the first abdominal segment of *M. rosenbergii* fed different amounts of *B. superba* is shown in **Table 4-7**.

Table 4-7. The size of the first abdominal segment (mm) of *M. rosenbergii* fed different amounts of *B. superba* (means ± S.E.).

Sex	Size of the first abdominal segment (mm)			
	A	B	C	D
Male	13.39±0.19 [c]	13.31±0.19 [bc]	12.43±0.22 [a]	12.76±0.21 [ab]
Female	14.24±0.16 [d]	14.01±0.17 [d]	13.17±0.20 [bc]	13.41±0.24 [c]

[a,b,c]The different letters stand for the significant different of the mean ($p < 0.05$)

In groups all groups, the sizes of the first segment of the abdomen of female M. rosenbergii were significantly higher than that of male group ($p < 0.05$). There was significant different of size of the first segment of the abdomen of male group, those of groups C and D were significantly different with that of control group ($p < 0.05$). The highest final male size of the first segment of the abdomen was control group (13.39±0.19 mm), while the lowest male size of the first segment of the abdomen was group C (12.43±0.22 mm). In all female groups, there was significant different of size of the first segment of the abdomen, those of groups C and D were significantly different with that of control group ($p < 0.05$). The highest female size of the first segment of the abdomen was group A or control group (14.24±0.16 mm), while the lowest female size of the first segment of the abdomen was group C (13.17±0.20 mm). To compare with all groups of male and female prawns, the highest size of the first segment of the abdomen of prawn was the female in control group (14.24±0.16 mm) and the lowest size of the first

segment of the abdomen of prawn was the male group fed with diet C (12.43±0.22 mm). The diagram of the size of the first segment of the abdomen of male and female prawns during 20 weeks of the experimental period is shown in **Figure 4-**7.

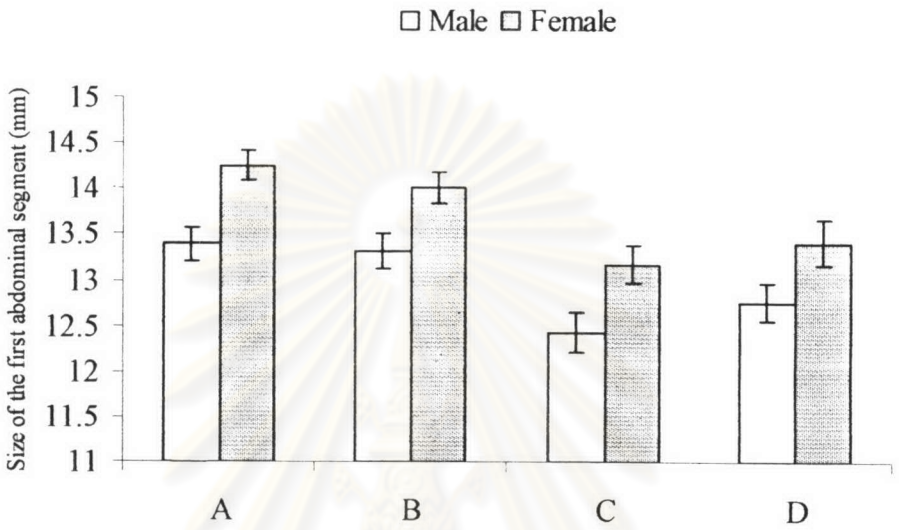

Figure 4-7. Effect of feed supplemented with *B. superba* on the size of the first abdominal segment of male and female *M. rosenbergii*.

4. The claw length

The response of propodus, carpus, merus and ichium, and total claw of *M. rosenbergii* fed different amounts of *B. superba* is illustrated in **Table 4-8**.

Table 4-8. Propodus, carpus, merus and ichium, and total claw length (mm) of male and female *M. rosenbergii* fed different amounts of *B. superba* (means ± S.E.).

Source	Length (mm)			
	A	B	C	D
Propodus				
Male	2.70±0.07 [c]	2.67±0.06 [c]	2.35±0.08 [ab]	2.27±0.08 [a]
Female	2.53±0.06 [bc]	2.59±0.04 [c]	2.25±0.07 [a]	2.34±0.06 [ab]
Carpus				
Male	1.76±0.06 [c]	1.65±0.05 [bc]	1.44±0.06 [a]	1.41±0.05 [a]
Female	1.63±0.04 [bc]	1.69±0.03 [c]	1.48±0.05 [a]	1.51±0.04 [ab]
Merus and Ichium				
Male	2.86±0.11 [c]	2.77±0.10 [c]	2.24±0.12 [b]	2.17±0.12 [ab]
Female	2.20±0.07 [ab]	2.25±0.06 [b]	1.92±0.08 [a]	2.06±0.08 [ab]
Total claw				
Male	7.33±0.23 [e]	7.09±0.21 [de]	6.03±0.26 [abc]	5.85±0.22 [ab]
Female	6.35±0.17 [bc]	6.53±0.12 [cd]	5.66±0.19 [a]	5.91±0.19 [ab]

[a,b,c]The different letters in each segment of the second walking leg stand for the significant different of the mean ($p < 0.05$)

The propodus lengths of male *M. rosenbergii* in all groups had no significant different with those of female in the same group ($p > 0.05$). There was significant different of propodus length of male only in groups C and D that were significantly lower than that of the control group ($p < 0.05$). The highest male propodus length was presented in the control group (2.70±0.07 mm), while the lowest male propodus length was presented in group D (2.27±0.08 mm). In female, there was significant different of final propodus length of prawns in group C and control group ($p < 0.05$). The highest female propodus length was presented in group B (2.59±0.04 mm), while the lowest female propodus length was presented in group C (2.25±0.07 mm). To compare with all groups

of male and female prawns, the highest propodus length of prawn was belong to male in group A (2.70±0.07 mm) and the lowest propodus length was belong to female in group C (2.25±0.07 mm). The diagram of propodus of male and female prawns during 20 weeks of the experimental period is shown in **Figure 4-8**.

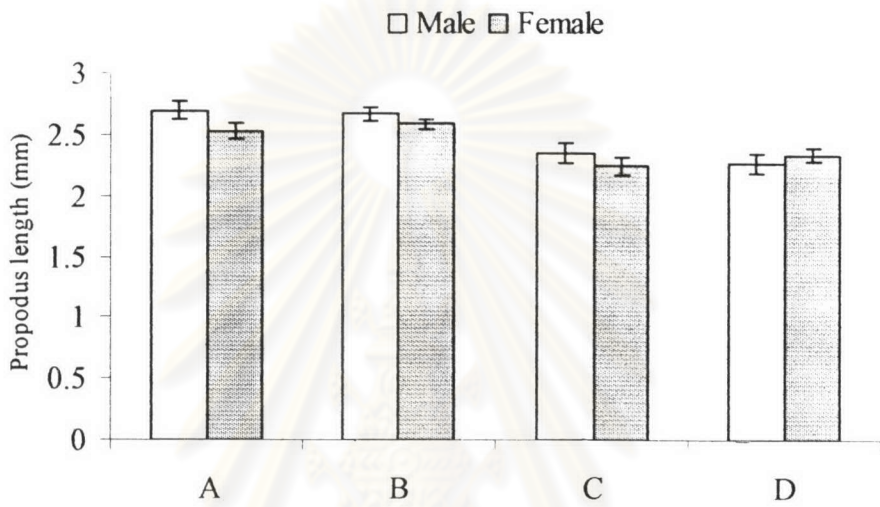

Figure 4-8. Effect of feed supplemented with *B. superba* on propodus length of male and female *M. rosenbergii*.

The carpus length of male *M. rosenbergii* in all groups had no significant different with those of female in the same group ($p > 0.05$). There was significant different of carpus length of male in group C and D which were significantly lower than that of group A ($p < 0.05$). The highest male carpus length was belonging to group A (1.76±0.06 mm), while the lowest final male carpus length was belong to group D (1.41±0.05 mm). In female, there was significant different of carpus length in group A, B and C ($p < 0.05$). The highest female carpus length was belonging to group B (1.69±0.23 mm), while the lowest female carpus length was belong to group C (1.48±0.05 mm). To compare with all groups of male and female prawns, the highest carpus length was presented in male of

group A (1.76±0.06 mm) and the lowest carpus length of prawn was presented in male in group D (1.41±0.05 mm). The diagram of carpus of male and female prawns during 20 weeks of the experimental period is shown in **Figure 4-**9.

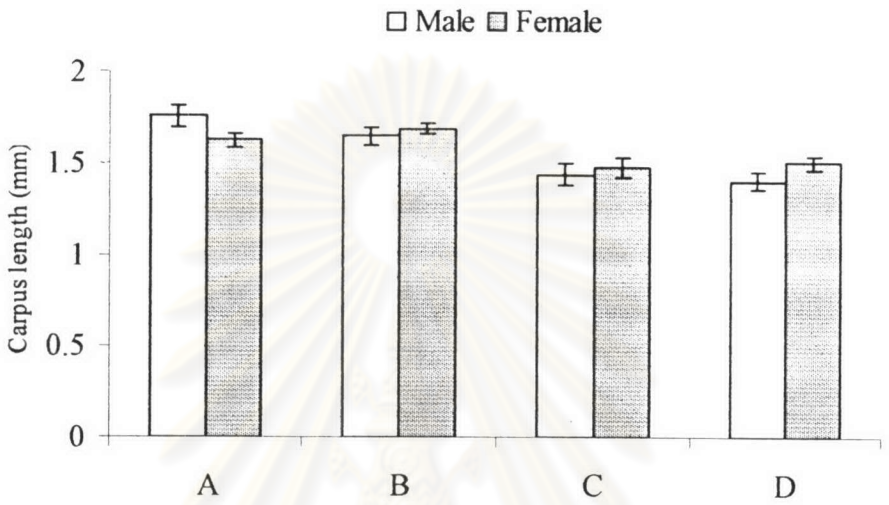

Figure 4-9. Effect of feed supplemented with *B. superba* on carpus length of male and female *M. rosenbergii*.

The merus and ichium length of male *M. rosenbergii* in groups A, B, and C were significantly greater than female in the same group ($p < 0.05$). There was significant lower of merus and ichium length of male in group C and D than group A and B ($p < 0.05$). The highest final male merus and ichium was presented in group A (2.86±0.11 mm), while the lowest final male merus and ichium length was presented in group D (2.17±0.12 mm). In female, there had no significant different of merus and ichium length ($p > 0.05$). To compare with all groups of male and female prawns, the highest merus and ichium length of prawn was belong to male in group A (2.86±0.11 mm) and the lowest merus and ichium length of prawn was female in group C (1.92±0.08 mm). The diagram

of merus and ichium of male and female prawns during 20 weeks of the experimental period is shown in **Figure 4-**10.

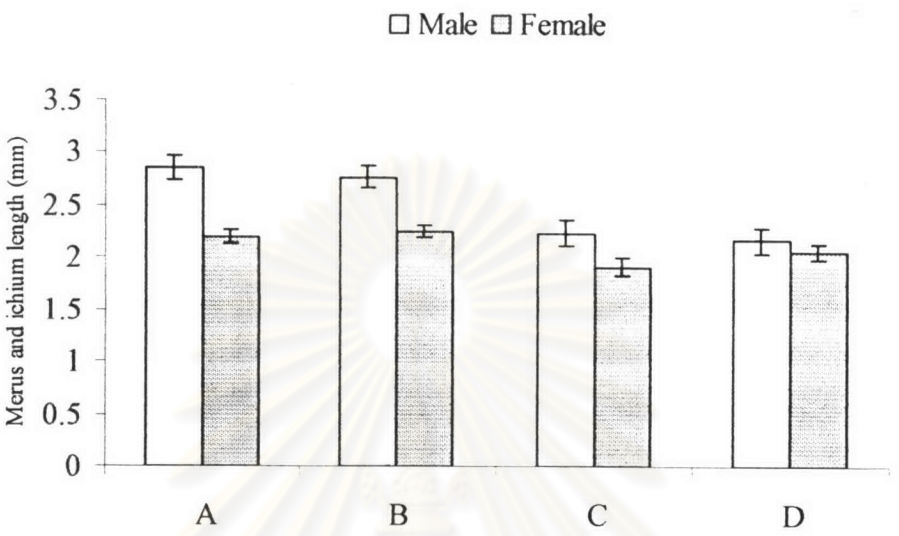

Figure 4-10. Effect of feed supplemented with *B. superba* on merus and ichium length of male and female *M. rosenbergii*.

The total claw length of male *M. rosenbergii* in group A was significantly greater than female in the same group ($p > 0.05$), while there was no significant different in male and female of groups B, C and D. There was significant different of total claw length of male in group C and D which were significantly lower than group A ($p < 0.05$). The highest male total claw length was presented in group A (7.33±0.23 mm), while the lowest male total claw length was presented in group D (5.85±0.22 mm). In female, there was significant different of total claw length of group A and C ($p < 0.05$). The highest female total claw length was presented in group B (6.53±0.12 mm), while the lowest final female total claw length was presented in group C (5.66±0.19 mm). To compare with all groups of male and female prawns, the highest total claw length was presented in male in group A (7.33±0.23 mm) and the lowest total claw length was presented in female in

group C (5.66±0.19 mm). The diagram of total claw length of male and female prawns is shown in **Figure 4-11**.

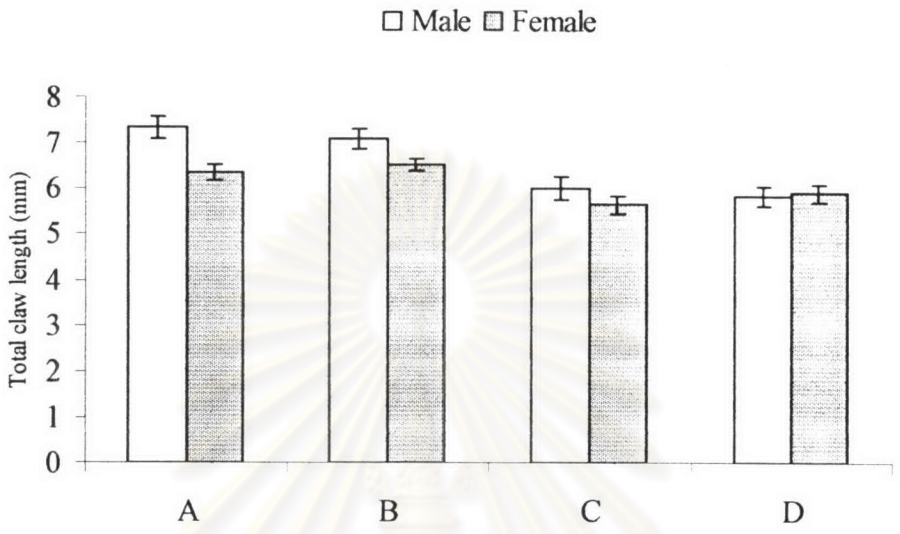

Figure 4-11. Effect of feed supplemented with *B. superba* on total claw length of male and female *M. rosenbergii*.

5. The growth rate

The growth rate of *M. rosenbergii* was analyzed according to weight and length basis. The growth rates of M. rosenbergii fed with different amounts of *B. superba* in are illustrated in **Table 4-9** and **Table 4-10**, respectively.

Table 4-9. Growth rate (base on weight) of *M. rosenbergii* fed different amounts of *B. superba* (means ± S.E.).

Time (week)	Growth rate (base on weight) (g day^{-1})			
	A	B	C	D
4	0.01±0.00	0.01±0.00	0.01±0.00	0.01±0.00
8	0.06±0.01	0.06±0.01	0.05±0.01	0.06±0.01
12	0.13±0.01	0.12±0.02	0.10±0.00	0.11±0.03
16	0.13±0.01	0.13±0.03	0.11±0.02	0.12±0.03
20	0.15±0.01	0.14±0.03	0.12±0.01	0.15±0.02

The growth rate (weight basis) of *M. rosenbergii* in group B, C and D was similar to that in the group A ($p > 0.05$). The growth rate in all groups (weight basis) was increased in parallel with time of the experiment. The growth rates (weight basis) in all groups were in the period of lasted 4 weeks (0.15±0.01, 0.14±0.03, 0.12±0.01 and 0.15±0.02 g/day, respectively). The diagram of growth rate (weight basis) during 20 weeks of the experimental period is shown in **Figure 4-1**2.

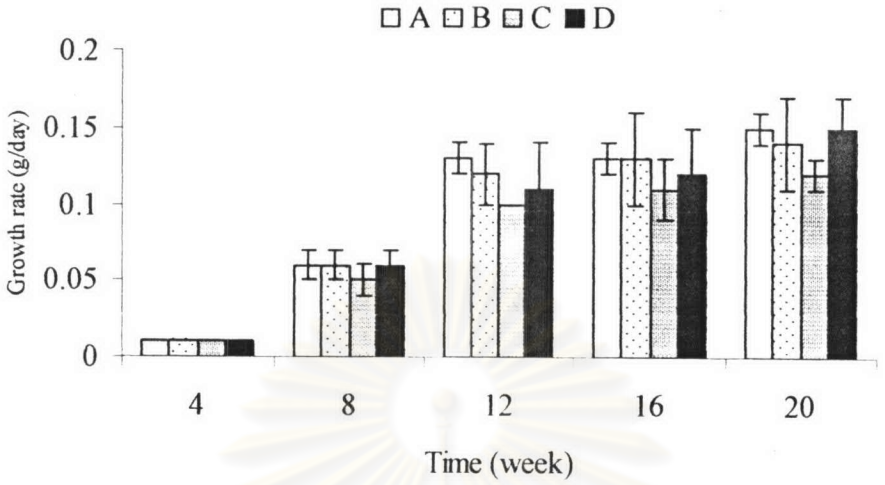

Figure 4-12. Effect of feed supplemented with *B. superba* on growth (weight basis) of *M. rosenbergii*.

Table 4-10. Growth rate (base on length) of *M. rosenbergii* fed different amounts of *B. superba* (means ± S.E.).

Time (week)	Growth rate (base on length) (mm day^{-1})			
	A	B	C	D
4	0.56±0.03	0.59±0.03	0.63±0.02	0.62±0.06
8	0.71±0.03	0.67±0.03	0.60±0.05	0.63±0.04
12	0.56±0.05	0.51±0.04	0.45±0.03	0.46±0.07
16	0.27±0.04	0.27±0.06	0.29±0.04	0.30±0.02
20	0.50±0.02	0.50±0.06	0.41±0.04	0.51±0.02

The growth rate (length basis) of *M. rosenbergii* in groups B, C and D was similar to group A ($p > 0.05$). The growth rates (length basis) in all groups were in the period of

the last 4 weeks (0.50±0.02, 0.50±0.06, 0.41±0.04 and 0.51±0.02 mm/day, respectively). The diagram of growth rate (length basis) is shown in **Figure 4-13**.

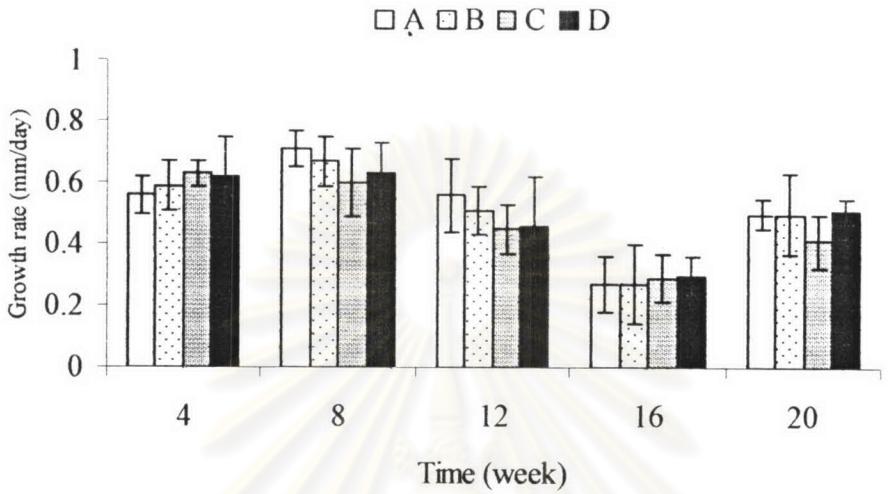

Figure 4-13. Effect of feed supplemented with *B. superba* on growth (length basis) of *M. rosenbergii*.

6. The sex ratio

The effect of *B. superba* on sex ratio of *M. rosenbergii* fed different amounts of *B. superba* was determined in **Table 4-11**.

Table 4-11. The percentage of male and female of *M. rosenbergii* fed different amounts of *B. superba* (means ± S .E.)

Sex	A	B	C	D
% males	56.28±3.67*[a]	51.37±4.30[a]	50.51±0.88[a]	48.79±4.78[a]
% female	43.72±3.67*[a]	48.63±4.30[a]	49.49±0.88[a]	51.21±4.78[a]

*The significant different between the number of male and female prawns ($p < 0.05$).
[a,b,c]The different letters stand for the significant different of the mean ($p < 0.05$)

The percentage of male and female was significant different in group A (χ^2 = 5.965, p = 0.0015), the percentage of male (56.28±3.67) is larger than that of female (43.72±3.67). In the other hand, the percentage of male in group B, C and D were not significant different ($p > 0.05$). The diagram of sex ratio of prawns during 20 weeks of the experimental period is shown in **Figure 4-14**.

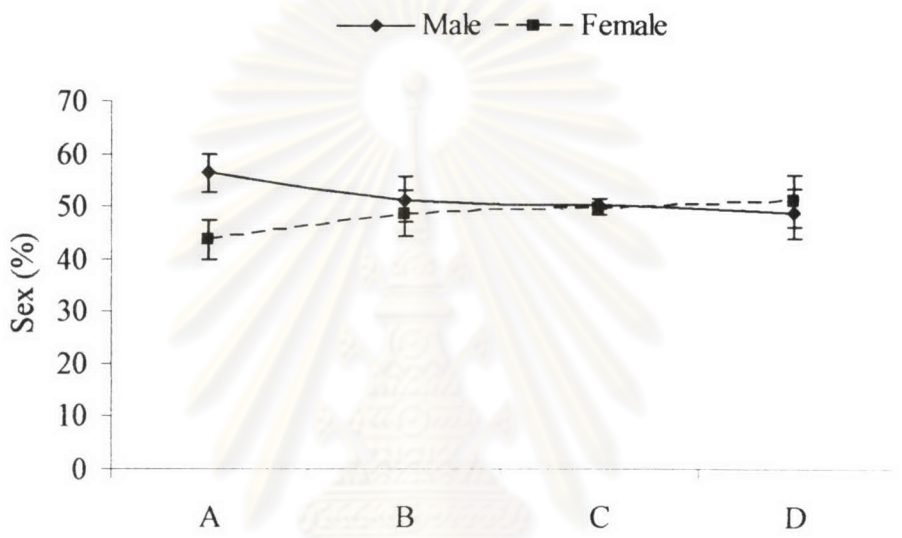

Figure 4-14. Effect of feed supplemented with *B. superba* on sex of *M. rosenbergii*.

7. The survival rate

The effect of *B. superba* on survival rate of *M. rosenbergii* fed different amounts of *B. superba* was determined in **Table 4-12**.

Table 4-12. Total weight, average and survival rate of *M. rosenbergii* fed different amounts of *B. superba* at the end of the experiment (means ± S.E.).

	Treatments			
	A	B	C	D
Total weight (g)	647.67±74.39 [a]	660.73±96.46 [a]	512.5±46.88 [a]	532.87±35.63 [a]
Average weight (g)	12.70±5.13 [b]	12.10±5.35 [b]	10.72±5.29 [a]	10.96±6.10 [a]
% survival	51.0±8.18 [a]	54.6±9.97 [a]	47.8±5.49 [a]	48.6±8.38 [a]

[a,b,c]The different letters stand for the significant different of the mean ($p < 0.05$)

The survival rate of *M. rosenbergii* fed with *B. superba* in group B, C and D was similar to group A ($p > 0.05$). The survival rates of prawns in all groups were 51.0±8.18, 54.6±9.97, 47.8±5.49 and 48.6±8.38%, respectively. The total weight in each treatment had no significant different ($p > 0.05$), while the average weight of prawns in group A and B were significantly higher than group C and D ($p < 0.05$). The diagram of survival rate of prawns during 20 weeks of the experimental period is shown in **Figure 4-15**.

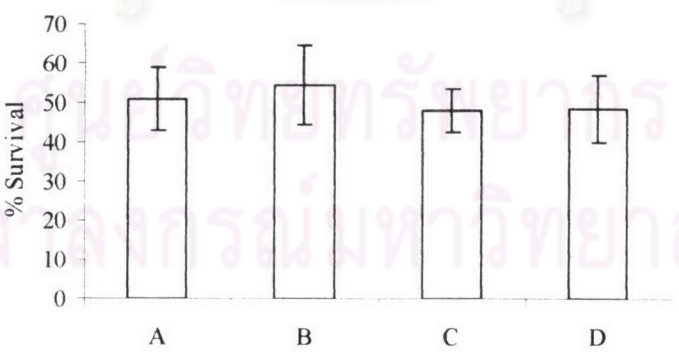

Figure 4-15. Effect of feed supplemented with *B. superba* on percentage of survival of *M. rosenbergii*.

8. The amount of ovigerous female

The effect of *B. superba* on the amount of ovigerous female of *M. rosenbergii* fed different amounts of *B. superba*. The average of ovigerous female at harvest was determined in **Table 4-13**.

Table 4-13. The average of ovigerous female *M. rosenbergii* fed different amount of *B. superba*.

Average of ovigerous female			
A	B	C	D
2.8 ± 0.66^{bc}	3.68 ± 1.12^{c}	0.8 ± 0.37^{ab}	0.6 ± 0.24^{a}

^{a,b,c}The different letters stand for the significant different of the mean ($p < 0.05$)

The average at harvest of ovigerous female *M. rosenbergii* fed different amounts of *B. superba* was significant different ($p < 0.05$). The average of ovigerous female in group D (0.6±0.24) was significantly lower than that of control group (2.8±0.66) and group B (3.68±1.12). The average of ovigerous female in group B was highest (3.68±1.12), and decreased to be 0.8±0.37 and 0.6±0.24 in group C and D respectively. The diagram of the average of ovigerous females at harvest is shown in **Figure 4-16**.

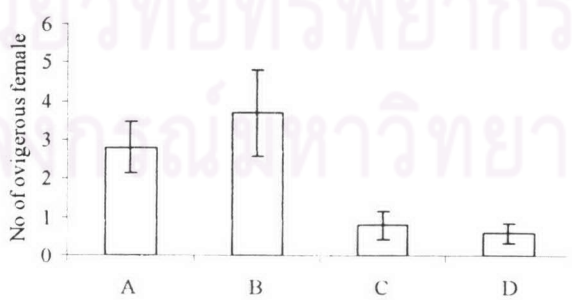

Figure 4-16. Effect of feed supplemented with *B. superba* on the number of ovigerous female *M. rosenbergii*.

9. The outstanding result of each treatment

The average weight, average length, average size of the first abdominal segment, percentage of male percentage of survival and average of ovigerous female of the outstanding cage in each treatment are shown in **Table 4-14**.

Table 4-14. The average weight, average length, average size of the first abdominal segment, percentage of male, percentage of survival and average of ovigerous female of the outstanding cage in each treatment of *M. rosenbergii* fed different amounts of *B. superba*.

	A		B		C		D	
	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
Average weight (g)	10.66	15.24	10.53	16.99	10.29	13.05	8.7	22.27
Average Length (cm)	7.59	8.64	7.7	8.79	7.04	8.03	7.37	9.89
Size of the first abdominal segment	12.77	14.78	12.91	15.08	11.64	13.57	12.12	17.2
% male	47.92	67.16	41.18	66.67	47.92	53.57	31.58	60.32
% survival	25	48	17	73	28	61	19	63
No. of ovigerous female	1	5	1	6	0	2	0	1

The greatest average weight, average length and average size of the first abdominal segment of prawn were belonging to prawn of group D (22.27 g, 9.89 cm, 17.20 mm, respectively). The highest percentage of male was belonging to the prawn in the control group (67.16%). The highest percentage of survival and average of ovigerous female was belonging to the prawn in group B (73% and 6, respectively).

10. Water quality

The water quality analysis of the experiment was described in **Table 4-15**. The quality of water is in normal control and acceptable.

Table 4-15. Water quality of the prawn experiment.

Parameters	Range
Salinity (ppt)	2.7-3.4
Temperature (°C)	30.1-33.2
Alkalinity (mg l^{-1})	68-102
pH	7.6-8.5
Ammonia (mg l^{-1})	0-0.5
Nitrite (mg l^{-1})	0-0.3
Nitrate (mg l^{-1})	0-10

11. Histological studies

The high magnification of ovaries of *M. rosenbergii* was portrayed in **Figure 4-17** (a-1, b-1, c-1, d-1). The previtellogenic oocytes were illustrated in the enlarge view of photomicrographs (**Figure 4-1**7; a-2, b-2, c-2, d-2), cytoplasm was basophilic and nucleus was easily seen. Follicular cells are apparent. The resultant previtellogenic cells are referred to as oocytes. The oocytes are surrounded in nodules or cysts by follicle cells. According to the histological characteristics, the oocytes in the ovaries of prawns were not different. Maturational changes did not occur simultaneously in all follicles of the ovaries.

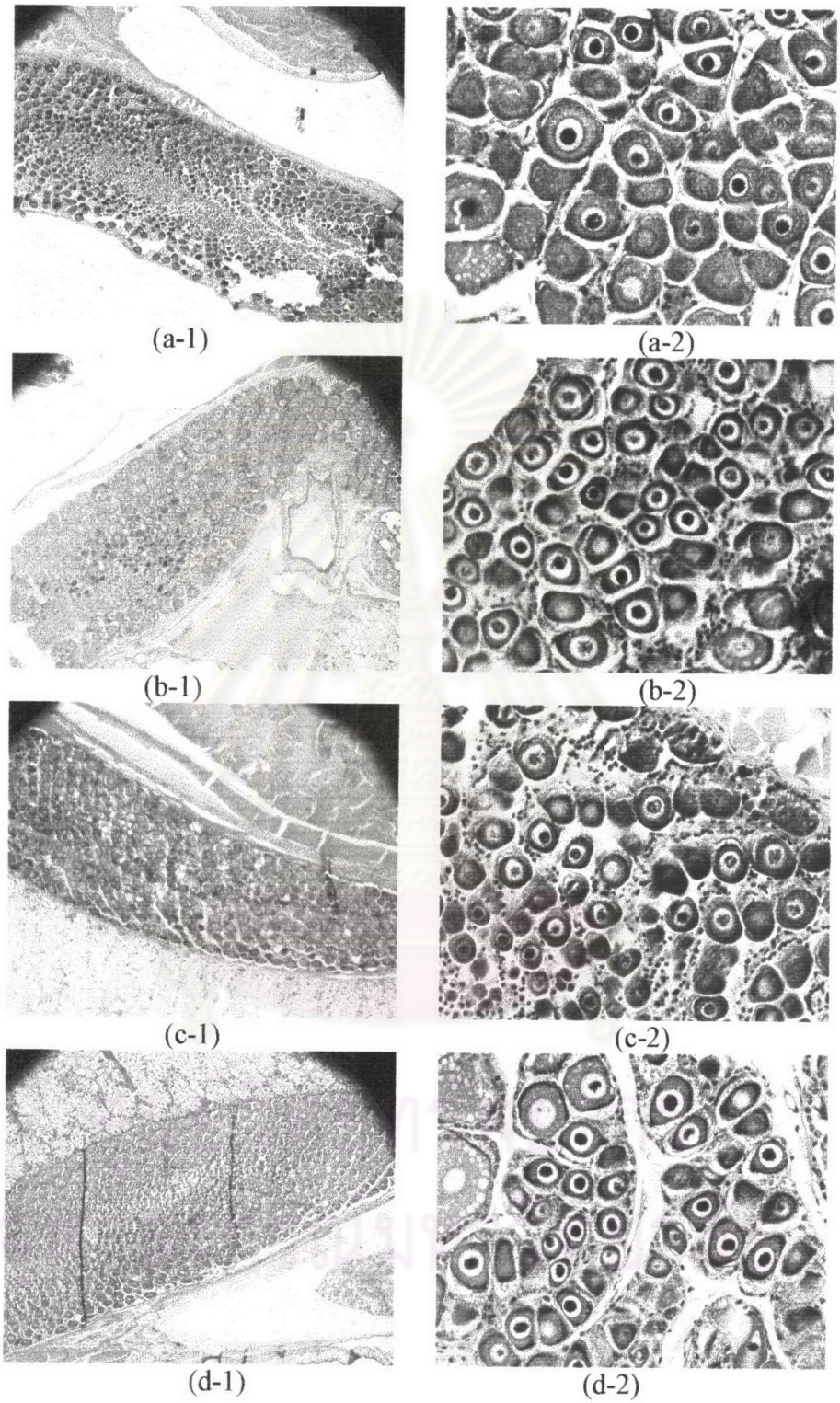

Figure 4-17. The oocytes in the ovaries of *M. rosenbergii* showing the developing oocytes when treated with feed mixed (a) 0% BS (b) 0.05% BS (c) 0.5% BS (d) 5% BS (1, 4X and 2, 20X)

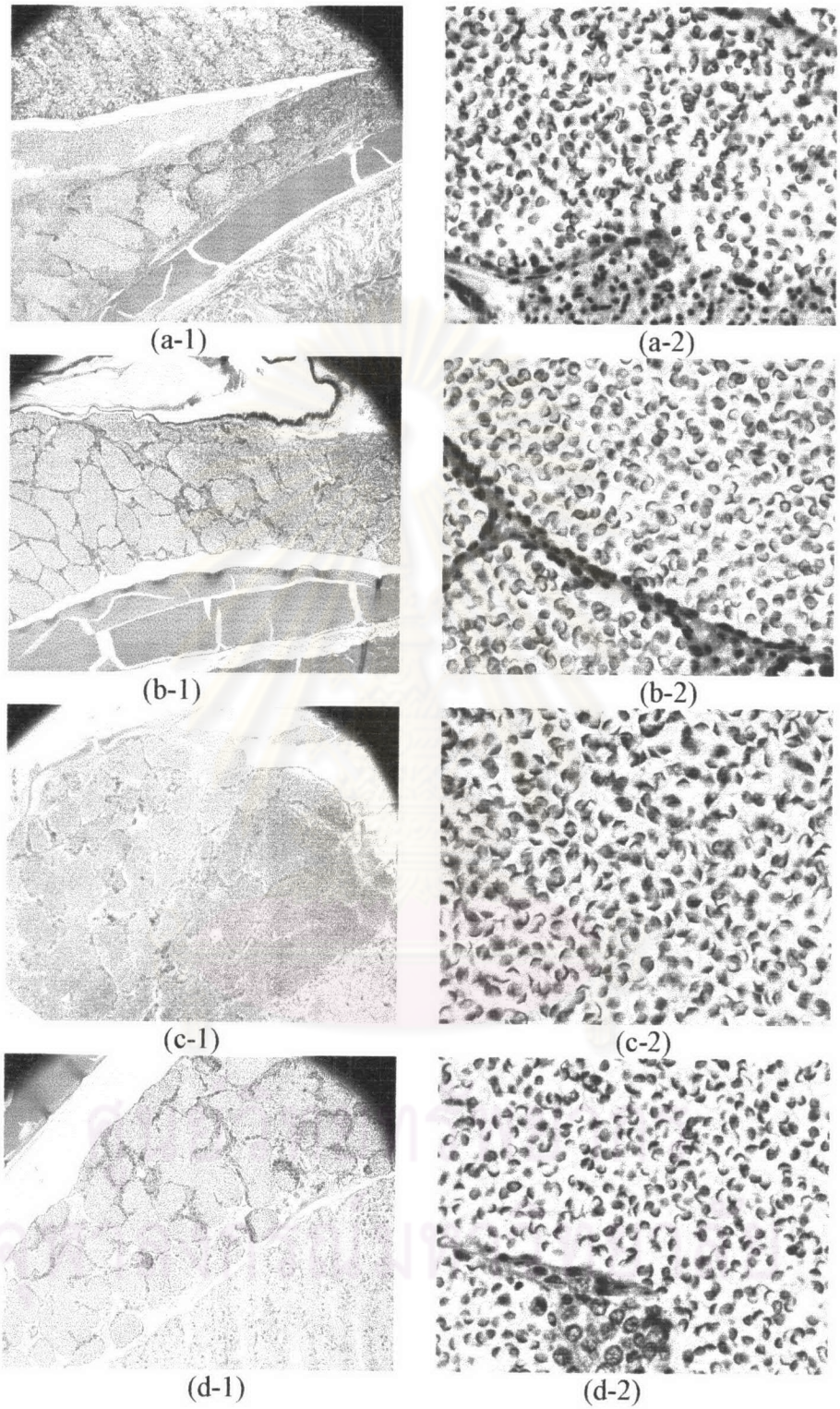

Figure 4-18. The spermatozoa in the testes of male *M. rosenbergii* showing the developing oocytes when treated with feed mixed (a) 0% BS (b) 0.05% BS (c) 0.5% BS (d) 5% BS (1, 4X and 2, 40X)

The testes of all groups exhibited similar results. Males from all testes showed fully developed spermatogenesis to the latest stage, for example, containing mature sperm with cup-shaped base. The mature spermatozoa were arranged in bundles, each of which was presumably surrounded by primary spermatophore layer as shown in **Figure 4-1**8(a-1, b-1, c-1, d-1). The enlarge view of mature sperm or spermatozoa from the terminal ampoule is depicted in **Figure 4-1**8(a-2, b-2, c-2, d-2). The spermatozoa are non-flagellated and nonmotile.