CHAPTER V

DISCUSSION

The dietary nutrients of feed in 4 treatments were analyzed before the rearing experiment in order to prove that dietary nutrient of experimental feed was in requirement and demonstration. A principle dietary requirement of aquatic animals in growth performance was the dietary protein levels. The minimum protein requirement of juvenile *M. rosenbergii* is approximately 30 to 35% of the diet (Balazs, and Ross 1976). The major dietary nutrient of prawns feed was protein, the average protein content of feed in 4 treatments was 41.38%. The protein level of this experiment was in the same level, but the lipid contents of diets C (0.5% BS) (9.51±0.03) and D (5% BS) (8.45±0.11) were significantly higher than the control group (8.18±0.08). This result was possibly due to the fact that the moisture content of the control group (8.08±0.06) was significantly higher than those of diet C (6.42±0.30) and D (6.60±0).

The administration of 4 concentrations of *B. superba* mixed diet (0, 0.05 0.5 and 5%) in the period of 140 days, it was obvious that *B. superba* mixed diet did promote the giant freshwater prawn's weight and length during the beginning of the experiment, but it did not promote the prawn's weight and length after that. In the first 4 weeks, the prawns obtained 0.5% BS in feed (group C) and 5% BS in feed (group D) caused a greater weight and length than the control group. On the contrary, the weight and length of prawn in group C (0.5% BS) was significantly smaller than the control group in the

twelfth week. The result of weight and length of prawn at the end of the experiment was contradicted to the result in the fourth week. In the carry out period, the prawns that obtain the percentage of BS in feed at the concentrations of 0.5 (group C) and 5 (group D) had the smaller weight and length than the prawn that obtain the feed with the absence of BS (control group). From this result, it was suggested that *B. superba* played a role in the growth promotion of immature giant freshwater prawn. Contrarily, it could not promote the growth of mature prawn.

It presumably involved in cAMP phosphodiesterase inhibitory effect of *B. superba* (Roengsumran et al., 2000). Its effect caused an elevation of cAMP in cell membrane (Smith and Wood, 1992). The cAMP played a role in mandibular organs inhibiting hormone (MO-IH) inhibitory effect in methyl farnessoate (MF) synthesis in a crab, *Cancer pagurus* (Wainwright et al., 1999). The role of MF in crustaceans are (a) stimulation of general protein synthesis; (b) promotion of the molt cycle; and (c) reproduction both male and female (Homola and Chang, 1997). MF, the unepoxidated form of the insect juvenile, was observed in ovarian development of *M. rosenbergii* (Wilder et al., 1995). The range of MF is similar in male and female *M. rosenbergii* (Sagi et al., 1991). The physiological doses of MF can stimulate an increase in oocyte development of *Penaeus vannamei* (Tsukimura and Kamemoto, 1991). The administration of MF to postlarvae brought about a general retardation of larval development (Abdu et al., 1998; Laufer and Biggers, 2001). For this reason, the elevation effect of cAMP level of this herb might decrease the concentration of MF which bought about the growth promotion in the postlarvae. In mature prawn, the elevation of cAMP

level caused the concentration of MF decreased. Hence, the prawn was not promoted the molt cycle completely.

From the experimental period of 20 weeks, it was cleared that the growth rates (weight basis and length basis) in each 4 weeks of prawns were not differed in 4 treatments of diet. It was demonstrated that there was no promotion of prawn's growth by the feed supplemented by *B. superba*. Piyatiratitivorakul et al. (1996) reported that the administration of steroid sapogenin from *Agave sisalana*, a herb, mixed diet promoted the growth performance and shorten the molten period of giant freshwater prawn.

The comparison of final body length of prawns was microscopically differed from that of final body weight of prawns. The final body length of male prawn in group C (0.5%BS) and group D (5% BS) were significant smaller than the control. In female prawn, the same result was obtained as in male prawn. The final body length of female prawn was significantly higher than male in group A (control), group C (0.5% BS) and group D (5% BS). The result described from **Figure 4-6** that the high size distribution was performed in male prawns. The number of small male in each treatment was numerously greater than female, while the larger size was obtained frequently in female. Male and female prawns show the distinctly different size distribution patterns.

Ra'anan et al. (1991) suggested that both sexes have similar size distributions in the populations of immature prawns. Fujimura and Okamoto (1972) demonstrated in mature prawns' population that female prawns perform normal size distribution whereas

male prawns exhibit bi-normal size distribution. The male population consists of two groups, the former is smaller than the female prawns and the latter is larger than the female prawns. Kuris et al. (1987) illustrated that 50% of adult males are small males, 40% of adult males are orange claw male and the remaining are blue claw male. For this reason, the average final body length of this experiment was smaller than those of female. The average bogy length of male and female prawn in group A (control) was larger than those of male and female prawn group C (0.5% BS) and D (5% BS). It was suggested that *B. superba* mixed in particulate diet inhibited the growth performance of mature prawns and the size composition of the harvest prawn population was also in variation.

The final body weight of male and female *M. rosenbergii* fed different concentrations of *B. superba* exhibited that the growth of male and female prawn in each group was not significant different. The growth of male prawn in group C (0.5% BS) and D (5% BS) were smaller not only than the male in group A (control) and B (0.05%BS) but also the female in group A (control) and B (0.05%BS). It was elucidated that *B. superba* mixed diet reduced the growth performance of mature prawns.

The giant freshwater prawn *M. rosenbergii* is characterized by sexually dimorphic growth, with a relatively slow and uniform growth rate for females and variable growth rate in males (Cohen et al., 1981; Karplus et al., 1986). The growth of male and female demonstrate distinct growth pattern, which apparent after six month of grow-out. The male develop a wide, positively skewed weight distribution; while female exhibit a homogenous, normal weight distribution (Smith et al., 1978; Brody et al, 1980; Cohen et

al., 1981). The growth performance of female when stocked in the presence of male, shows that the females' growth are strongly affected by the presence of the opposite sex (Cohen et al., 1988; Hulata et al., 1988; Sagi et al., 1986). It may be suggested that the body weight of male and female prawn will be different if the time is extended.

Factors controlling growth variation of giant freshwater prawns were involved in genetic, environment and social control. Ra'anan (1987) suggested that selecting the earliest maturing females, as broodstock would improve the genetic base because these are also the fast growing females. (Karplus et al., 2000). Heritability of prawn size was found to be a sexually dimorphic trait, with female exhibiting significant genetic control ($h^2 \approx 0.350$) of size variation, while in males the genetic control of size variation was close to zero. Heterogenous individual growth in male prawns is non-genetic and is controlled by intra population environmental-social factors. The study on environmental effects on growth rate and survival of juveniles was revealed. (Melecha, 1984). The lower temperatures resulted in a shift in female reproductive state because a temperature-mediated delay in the onset of reproductive maturity. Temperature, however, were high enough to support rapid growth, which resulted in unexpectedly superior production at the higher latitudes (Tidwell et al., 1996). Continuous darkness stimulated the growth of male but not female *M. rosenbergii* (Chantapreeda, 1998). Added feeding attractant resulted in a 17% increase in mean weight. The size distribution increased concomitantly with the increase in growth rate because of the reduction of growth of some of the smaller individuals. Nevertheless, the effect of growth variation was probably mediated through competitive interactions among the prawns (Harpaz, 1997). The blue claw male are

dominant, the advantage of being dominant was clearly evident in competition for limited resources. The dominant male gained priority of access to food and shelter (Barki et al., 1992). The blue claw male was attractiveness to female; more energy directed to fighting and guard female before mating and less energy invested in growing. The orange claw male was fast growing; the reproductive activity is low in the present of dominant male. The small male was sneak copulation with females that are guarded as part of a BC harem. It was slow growing male; more energy was invested in high mobility (Ra'anan and Sagi, 1985).

From the experimental result of the size of the first abdominal segment of prawn, it was depicted that the control group had the larger size of the first abdominal segment than group C (0.5% BS) and D (5% BS). Female prawns in each group had the greater size of the first abdominal segment than male. It was portrayed that the particulate diet supplemented with *B. superba* decreased the size of the first abdominal segment of prawns. Charniaux-cotton and Payen (1985) demonstrated that the most remarkable sexual characteristic of Caridea is the existence of the brood chamber. This spacious chamber is formed by certain modifications of the first three somites of the pleon, namely broadening of the sternites and lengthening of the coxopodites. They form in juvenile females and persist throughout the life span, thus they constitute a permanent female characteristic. They do not exist in male. Consequently, the larger size of the first abdominal segment in female giant freshwater prawns was a common incidence.

The claw segments study of prawn in the experiment were categorized into 3 parts, namely propodus, carpus, and the fusion of merus and ichium. The effect of *B. superba* on claw segments' length of prawns was elucidated that male's propodus, carpus, and the fusion of merus and ichium length of group C (0.5% BS) and D (5% BS) was smaller than control group. While the female's merus and ichium length in every group was similar, the female's propodus length of group C (0.5% BS) and the female's carpus length of group C (0.5% BS) and D (5% BS) was smaller than the control group. From this result, the restraint of claw segments' growth was appeared in the feeding of diet mixed *B. superba*.

The suppression of total claw's growth was also occurred in this experiment. The prawn fed 0.5% BS (group c) and 5% BS (group D) in feed had smaller claw length than control. Nagamine and Knight (1980) described that immature male chelipeds are similar in morphology and articular lengths to female cheliped, but mature male chelipeds are larger than the majority of female cheliped. The result was cleared that the claw length of male prawn in control group was greater than that of female, but the same result was not being in the remaining groups. It was comprehended that *B. superba* inhibited the claw growth not only in female but also in male.

Higher proportions of females than males were found in the prawn populations in a number of studies when prawns were raised in different geographical areas at a wide range of densities, in earthen ponds and in tanks (Smith et al., 1978; D'Abramo et al., 1986; Karplus et al., 1986; Lin and Boonyaratpalin, 1988; Siddiqui et al., 1995). There is

an equal sex balance in the two progeny of two normal mating (Sagi and Cohen, 1990). The sex ratio of male and female prawns in this experiment was equal in prawn fed 0.05% BS (group B), 0.5%BS (group C) and 5%BS (group D), while the sex ratio was significant different in the control group. The higher proportion of male prawns was determined in the control group. It was deduced that the proportion of male to female prawns that obtained *B. superba* did not greater than that of the control group. Any concentration of it could not promote the maleness of giant freshwater prawns. This result showed that *B. superba* did not play androgenic activity in giant freshwater prawn.

In the prior case studies, no achievement of giant freshwater prawn's masculinization, except the manipulation of the androgenic gland. The sex-reversal of female to male was completed in the grafting of androgenic gland of mature males into young females. Those females could initiate the primary and secondary sexual characteristics (Nagamine et al., 1980b; Melacha et al., 1992; Sagi and Cohen, 1990). Contrarily, the sex manipulation of sex by the androgenic gland was not suitable in the giant freshwater prawn farming.

Generally, the higher ratio of female prawns was exhibited in the prawn population as mentioned above. Three different mechanisms have been suggested by Smith et al. (1978) as possibly regulate the bias the sex proportion in prawn populations. Firstly, environmental conditions may affect sex determination and favor the development of female. Secondly, female may already outnumber male at stocking. Thirdly, selective male mortality may occur. Charniaux-cotton and Payen (1985)

suggested that no morphological or structural difference between the protogonia of both sexes has been established in decapod crustaceans. The description showed that sexual differentiation in crustaceans is large regulated by a gland, and later termed the androgenic gland. Nagamine et al. (1980a) demonstrated that the presence of the androgenic glands in *M. rosenbergii* is necessary for the development and regeneration of male secondary sexual characteristics. These studies were, however, carried out before the existence of the different morphotypes had been recognized. The female differentiation was carried out in the absence of the androgenic gland.

A numerous of eggs was appeared in the abdominal segment of female *M. rosenbergii* at harvest of all treatment groups, but the average of ovigerous female that obtained 0.5% BS (group C) and 5% BS (group D) was reduced in the comparison of the control group. The average of ovigerous female was nearly ceased in group D which obtained the greatest proportion of *B. superba* in feed. This result showed that *B. superba* did not increase the egg development of prawns, and it did not entirely inhibit the oocyte development of female prawns.

Endocrine control of reproduction in crustaceans is a very complex process. The neurohormone inhibiting oocyte growth was initially called gonad-inhibiting hormone (GIH) and the opposite manner was gonad-stimulating hormone (GSH) (Skinner, 1985). One of the major changes that occur during the maturation of oocytes is the accumulation of yolk protein or vitellin (Vn) (Tsukimura, 2001). Vitellogenin concentration increased in the hemolymph of prawns in the early stages of ovarian development (stage I or II) and

was maintained at high levels until stage V (Lee and Chang, 1997). The ovarian development was presumably inhibited by dopamine, a biogenic amine. Dopamine plays a significant role in inhibitory of vitellogenin synthesis in eyestalked-ablated prawn in a similar manner as in intact prawn (Chen et al., 2003).

The survival rate of prawns in this experiment was in the same percentage. It was indicated that *B. superba* mixed feed did not affect the survival rate of *M. rosenbergii* in cage. The total weight of prawns at harvest in each treatment group was not different. It was obvious that *B. superba* mixed in the prawn diet would not improve the yield in the giant freshwater prawn culture.

The histological analysis revealed that none of the male giant freshwater prawn had any types of histological abnormality in the gonads. No obvious abnormalities were observed in the gonad of females. For this reason, *M. rosenbergii* gonad was not affected by the containing of *B. superba* in feed.