Effects of different feeds on the growth performance and survival rates of juvenile mud crab *Scylla paramamosain* Estampador, 1950 (Crustacea: Portunidae)

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Abstract. Improving the rearing technique of mud crab *(Scylla paramamosain* Estampador, 1950) by selecting suitable feed is one of the most important solutions to improve survival rate and growth rate, creating large and uniform-sized fry is necessary. This study aimed to evaluate the effects of different types of feed on growth, coefficient of variation, survival rate, and productivity of juvenile green crab *S. paramamosain*. The study included 4 treatments: live Artemia biomass, frozen Artemia biomass, processed feed, and commercial feed. The experimental results showed that feed significantly affected the growth in length, shell width, crab body weight, relative and absolute growth rate, coefficient of variation in length, width and crab body weight, survival rate, and crab seedling productivity ($p<0.05$), in which processed feed gave the best results including the highest growth rate, survival rate, and productivity. This study provides a practical basis for the application of suitable feed in crab seedling rearing, contributing significantly to improving growth performance and survival rate in rearing mud crab *S. paramamosain*.
Key Words: *S. paramamosain*, feed, growth, survival.

Introduction. The mud crab (*Scylla paramamosain* Estampador, 1950) is a species of the genus *Scylla*, widely distributed throughout the tropical and subtropical waters of the Pacific Ocean, providing a resource for exploitation and a source of seed for aquaculture, creating an important livelihood for residents in many coastal countries (Keenan 1999; Vay et al 2001). Mud crabs are ideal for polyculture in brackish water ponds with shrimp, fish, and other aquatic species, contributing to efficient and sustainable resource utilization (Anand et al 2018; Bonifacio 2017). However, studies on crab seeds for farming are mainly focused on catching juvenile crabs from the wild (Mirera 2011; Sujan et al 2021). In Vietnam, mud crab *S. paramamosain* has been farmed since 1989 (Flix et al 1995) and is the most commonly farmed species due to its fast growth, large size, wide food spectrum, and high tolerance to environmental factors, making it suitable for saline intrusion areas. In recent years, artificially produced crab seeds have gradually replaced the depleted natural ones. However, these are often small (CW: 3-4 mm), making commercial production inefficient due to the low survival rate and long farming time (Hai et al 2017).

Each animal species has different nutritional needs and nutrient composition for growth and development; they also vary with the developmental stage, season, gender, and molting stage, among others, etc., Mud crabs are active predators and have a wide range of food that includes crustaceans, mollusks, fish, and even detritus (Hill 1976). Currently, the rearing of *S. paramamosain* crabs, in particular, *Scylla genus* in general, uses many different types of food, resulting in various conflicting outcomes. Commonly used foods for crabs include mackerel (*Decapterus spp.*), fresh squid (Fatihah et al 2017); *Artemia* larvae, shrimp meat, artificial food (post-larvae shrimp food), *Acetes sp.*, frozen *Artemia* nauplius, frozen *Artemia* biomass (Syafaat et al 2017, 2019, 2020); *Artemia* biomass, chopped peeled shrimp (Ut et al 2007); Live *Acetes sp.*, processed food, commercial food, shrimp meat (Ong et al 2020); *Artemia* nauplius, enriched *Artemia* nauplius, *Acetes sp.* dried, dried marine worms *(Marphysa spp.)* (Williams et al 1999); brown mussel meat, trash fish (Hasan et al 2011).

In, commercial seed production of aquaculture species, feed is always a decisive factor for productivity and economic efficiency, with survival and growth rates as two main indicators of production efficiency, in addition to maintaining water quality (Watanabe, 2002; Glencross et al 2007). The main purpose of this study was to select the most suitable feed for *S. paramamosain* in the juvenile stage, evaluating the effects of four different feeds based on growth and survival. In this study, live *Artemia* biomass, frozen *Artemia* biomass, processed feed *(Acetes sp.),* and commercial feed were selected as experimental feeds, which are commonly used feeds in commercial mud crab seed production and rearing in Vietnam. The results of this study could provide practical information for farmers in rearing *S. paramamosain* to increase the survival and growth that would lead to increased profit.

Materials and Method

Research materials. The present study was conducted at the Agricultural Seed Center of Binh Dinh Province, Vietnam, from August to September 2023. The experimental crabs were obtained from the Agricultural Seed Center of Binh Dinh Province, Vietnam, and were artificially produced. Measurements of the initial crab groups were as follows: length, carapace width (CW), and body weight (BW) were 2.47±0.17 mm, 3.38±0.19 mm, and 0.013±0.001 g, respectively. The stocking density was 300 individuals m^{-2}; the juvenile crabs were reared in a circular brown cement tank with an area of 3 m^2. The water used for crab rearing is seawater mixed with fresh water to a salinity of 15‰, treated with chlorine at a concentration of 25 ppm, and filtered through a sand filter (Phat et al 2024). The water quality of the tank is maintained by using probiotics daily, and the water 15 ‰ is changed every 5 days at 30% volume.

Saltwater was filtered through a sand filter and treated with chlorine at 25 ppm (Anh 2011). The water quality of the tank is maintained by using probiotics (Vibrotech product is manufactured by CP Vietnam Joint Stock Company (main ingredients as announced by the manufacturer include: *Bacillus subtilis* 10^8 CFU g^{-1}, *Bacillus lateosporus* 10^8 CFU g^{-1}, carrier) daily and 30% of the water is changed every 5 days.

Experimental design. This experiment included four randomly designed feed treatments with three replications: Treatment 1: Live *Artemia* biomass (LA); Treatment 2: Processed feed (PF); Treatment 3: Frozen *Artemia* biomass (FA); Treatment 4: Commercial feed (CF). The initial salinity of the water in the experimental tanks was 22‰, which was adjusted to decrease by 3‰/day until the salinity of the experimental treatments became 15‰. Each tank was equipped with an aerator to ensure adequate oxygen for the rearing crabs. The tanks were arranged with black orchid nets (0.25 m^2, eight panels/m^2) + mollusk shells + Meretrix meretrix's shells (covering a density of 60-70% of the tank bottom area).

Frozen *Acetes sp.* is steamed, then dried in mild sunlight, and stored in a refrigerator at 4-7 °C. Live and frozen *Artemia* biomass is produced in Binh Dinh from ARTEMIA HIGH 5 source of INVE. Commercial food brand LOPE No.3, a product of HAI THAN CO., LTD, is specialized for raising crab larvae. Processed feed and commercial feed were fed from 5-10% of body weight.

Table 1
Nutritional composition of the feeds used in the experiment (calculated as % dry weight)

Ingredients (nutrition)	*Experimental formulas*			
	LA	*PF*	*FA*	*CF*
Moisture		19.23		8
Crud protein	56.45±5.17*	47.41	55.28±0.57*	46
Crud lipid	11.24±0.42*	4.71	10.73±0.31*	6
Ash	15.1±1.8**	15.12	24.1±4.7**	
Crud fiber	9.3±0.7**	2.72	10.1±1.2**	2.7
Carbohydrat	15.6±2.3**	13.63	13.2±2.2**	
Source	*; **	Author	*; **	Producer

*Anh 2011; ** Van et al 2011
LA: Live Artemia biomass; PF: Processed feed; FA: Frozen Artemia biomass; CF: Commercial feed.

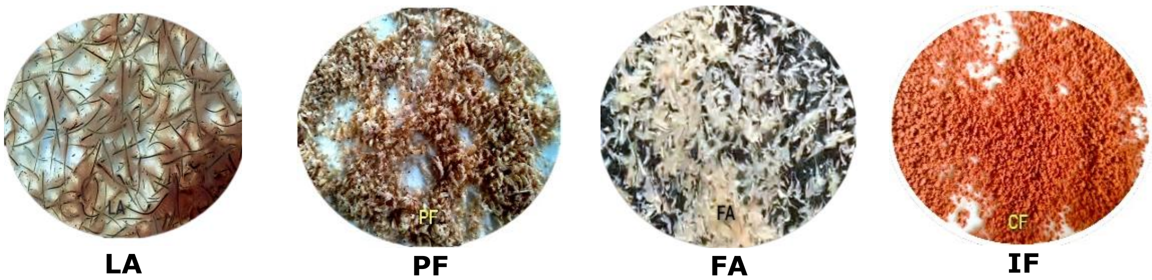

Figure 1. Types of feed in the experiment.

***Environmental factors of the experiment**.* During the experiment, the water environment parameters in each tank were monitored twice a day between 06:00 and 07:00 in the morning and from 2:00 to 3:00 p.m. Water temperature was measured with a digital thermometer (model: Mi 106), Dissolved oxygen (DO) with a digital DO meter (Model: Mi 605) in mg L^{-1} and pH with a digital pH meter (Model: Mi 106). Alkalinity, NH_3, NO_2 and salinity were measured with Checker MARINE Alkalinity HI755, Checker MARINE line Ammonia HI784, Checker MARINE Nitrite ULR HI764, HANA Instrument Romania, and with a handheld refractometer (ATAGO), respectively.

***Crab measurement**.* The body weight (BW), length (CL), and carapace width (CW) of crabs were measured using an electronic scale (±0.001 g) and an electronic caliper (±0.01 mm) as described by Fazhan et al (2021). The body weight (BW), length (CL), and carapace width (CW) at the beginning and end were randomly sampled and measured from 30 or 90 crabs for each treatment, respectively. The number of surviving crabs was recorded to calculate the survival rate and yield.

Experimental indices. The relative growth rate of crab: Specific growth rate (SGR) in length (SGRCL) or carapace width (SGRCW) or body weight (SGRBW) was calculated according to the formula of Anh et al (2011).

$$SGRCL\ or\ SGR_{CW}\ or\ SGR_{BW}(\%/day) = \left[\frac{\log(X_2) - \log(X_1)}{t_2 - t_1}\right] \times 100$$

Absolute growth rate (DG) in length (DCLG) carapace width (DCWG) or body weight (DBWG) was calculated using the formula of Anand et al 2018, and Zhang et al 2022.

$$DCLG\ or\ DCWG\ or\ DBWWG(mm/day) = \left[\frac{X_2 - X_1}{t_2 - t_1}\right] \times 100$$

Where X_1 is the length, width or body weight at measurement time t_1 and X_2 is the width, width or body weight at measurement time t_2.

Survival rate (SR) (%):

$$SR\ (\%) = \frac{\text{The number of crab alive at the end of the experiment}}{\text{The number of crab at the beginning of the experiment}} \times 100$$

Productivity (ind m^{-2}):

$$\text{Productivity (ind } m^{-2}) = \frac{\text{Final crab number}}{\text{Floor area of the tank } (m^2)}$$

Coefficient of variation (CV%):

$$CV\ (\%) = \frac{\text{Standard deviation of CW or BW}}{\text{Mean of CW or BW}}$$

Statistical analysis. All experimental data were compared for statistically significant differences between treatments in length, carapace width, body weight as well as growth rate, coefficient of variation, and survival rate by One Way ANOVA using Tukey's post-hoc test. Calculation analysis was performed using SPSS 20.0 software with a significance level of $p<0.05$.

Results

Water quality. There were no major fluctuations in water temperature (°C), pH, DO (mg L^{-1}), salinity (S‰), alkalinity (mg $CaCO_3$ L^{-1}), NH_3 (mg L^{-1}), NO_2^- (mg L^{-1}), and their values were within the optimal range for mud crab rearing (Table 2).

Table 2

Mean (±SD) of environmental factors recorded in the nursery tanks in the treatments after 30 days of experiment

Factors	*Treatments*			
	LA	*PF*	*FA*	*CF*
Temperature (°C)	29.10-30.20 29.66±0.49[a]	29.10-30.40 29.67±0.50[a]	29.10-30.40 29.67±0.51[a]	29.10-30.30 29.68±0.51[a]
DO (mg L^{-1})	5.66-6.06 5.87±0.09[a]	5.69-6.05 5.88±0.09[a]	5.66-6.04 5.88±0.09[a]	5.68-6.04 5.87±0.09[a]
pH	7.80-8.01 7.89±0.06[a]	7.79-8.00 7.89±0.05[a]	7.79-8.02 7.88±0.06[a]	7.78-8.01 7.88±0.05[a]
Alkalinity (mg$CaCO_3$ L^{-1})	131-144 138.9±4.2[a]	128-147 138.1±6.2[a]	125-144 135.6±6.5[a]	128-145 137±5.9[a]
Salinity (‰)	15-22 15.7±2.14[a]	15-22 15.7±2.14[a]	15-22 15.7±2.14[a]	15-22 15.7±2.14[a]
NH_3 (mg L^{-1})	0.001-0.010 0.006±0.003[a]	0.001-0.012 0.007±0.003[a]	0.001-0.011 0.006±0.003[a]	0.001-0.013 0.008±0.003[a]
NO_2^- (mg L^{-1})	0.00-2.50 1.09±0.92[a]	0.00-2.83 1.35±1.08[a]	0.00-2.63 1.23±1.00[a]	0.00-3.09 1.43±1.06[a]

LA: Live Artemia biomass; PF: Processed feed; FA: Frozen Artemia biomass; CF: Commercial feed
Values with the same letter ([a]) represent statistically insignificant differences (p> 0.05).

Growth and survival rate. Growth performance, survival rate, and productivity of *S. paramamosain* juveniles were significantly different between treatments (Table 3).

Table 3

Growth performance, survival rate, and productivity of *S. paramamosain* juveniles on different types of feed

Indicators	*Treatments*			
	LA	*PF*	*FA*	*CF*
CL_i (mm)	2.47±0.17	2.47±0.17	2.47±0.17	2.47±0.17
CL_f (mm)	13.18±0.02[b]	13.23±0.02[b]	13.15±0.02[b]	12.65±0.04[a]
SGR_{CL} (% day^{-1})	5.58±0.01[b]	5.60±0.00[b]	5.57±0.00[b]	5.45±0.01[a]
DCLG (mm day^{-1})	0.357±0.001[b]	0.359±0.001[b]	0.356±0.000[b]	0.339±0.001[a]
CWi (mm)	3.38±0.19	3.38±0.19	3.38±0.19	3.38±0.19
CW_f (mm)	18.52±0.03[b]	18.59±0.03[b]	18.48±0.06[b]	17.78±0.05[a]
SGR_{cw} (% day^{-1})	5.67±0.01[b]	5.68±0.01[b]	5.66±0.01[b]	5.53±0.01[a]
DCLG (mm day^{-1})	0.505±0.001[b]	0.507±0.001[b]	0.503±0.002[b]	0.480±0.002[a]
BW_i (g)	0.013±0.001	0.013±0.001	0.013±0.001	0.013±0.001
BW_f (g)	1.06±0.00[b]	1.06±0.00[b]	1.05±0.00[b]	0.96±0.01[a]
SGR_{BW} (% day^{-1})	14.70±0.01[b]	14.72±0.01[b]	14.67±0.02[b]	14.38±0.05[c]
DCLG (mm day^{-1})	0.035±0.000[b]	0.035±0.000[b]	0.035±0.000[b]	0.032±0.000[a]
SR (%)	39.81±0.61[b]	43.89±0.84[c]	39.59±0.63[b]	33.93±0.79[a]
P (ind m^{-2})	119.44±1.84[b]	131.67±2.52[c]	118.78±1.90[b]	101.78±2.36[a]
CV_{CL} (%)	11.89±0.20[a]	12.40±0.15[a]	12.03±0.12[a]	13,48±0.21[b]
CV_{CW} (%)	11.98±0.18[a]	12.20±0.17[a]	12.15±0.18[a]	13.53±0.16[b]
CV_{BW} (%)	29.28±0.14[a]	29.42±0.18[a]	29.63±0.30[a]	34.24±0.42[b]

Different characters ([a, b, c]) in the same row show statistically significant differences ($p<0.05$).±indicates the standard deviation. Cwi, CWi, and BWi: Initial length, carapace width, and body weight of crabs (± SD); CWf, CWf, and BWf (± SE): Length, carapace width, and body weight of crabs at the end of the experiment; SGRCL (% day^{-1}), SGRcw (% day^{-1}) or SGRBW (% day^{-1}) (± SE) are the specific growth rates of crabs in terms of length, carapace width or body weight; DCLG (mm/day^{-1}), DCWG (mm day^{-1}) or DBWG (mm day^{-1}) (± SE) are the absolute growth rates of crabs in terms of length, carapace width or body weight; SR (%) (± SD): survival rate; P (ind m^{-2}): Production (± SD); CV (± SE): coefficient of variation.

The growth rate of *S. paramamosain* (length, shell width, and body weight) was affected by the experimental feed. *S. paramamosain* fed commercial feed exhibited a statistically significant slower growth rate in terms of length, shell width, and body weight compared to the remaining feed treatments ($p<0.05$). Similarly, the growth rate in length, shell width, and body weight also had a statistically significant difference with the remaining feed treatments ($p<0.05$). Processed feed exhibited the highest growth rate in length, shell width, and body weight, followed by live biomass *Artemia*, then live biomass *Artemia* and the lowest was commercial feed. The highest crab seed yield and survival rate at the end of the experiment were recorded in the processed feed compared to the remaining feed types ($p<0.05$). However, the survival rate and productivity of the *S. paramamosain* did not show statistically significant differences ($p>0.05$) among the treatments (Figure 2).

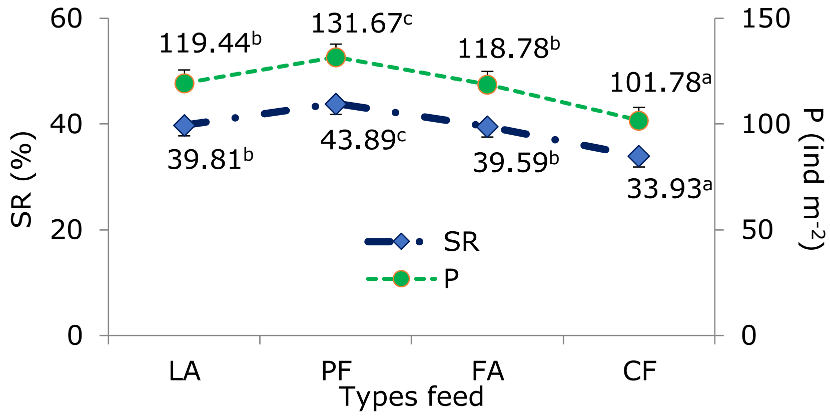

Figure 2. Survival rate and productivity of *S. paramamosain* in different feeding treatments Different letters (a, b, c) in the same graph are significantly different ($p<0.05$). SR: survival rate (%), P: productivity (ind m^{-2}).

From Figure 2, it can be seen that the survival rate and productivity in the PF treatment were significantly different ($p<0.05$) compared to the LA, FA, and CF treatments.

The highest coefficient of variation in length and width of the carapace was recorded in the commercial feed treatment, followed by processed feed, then frozen *Artemia* biomass and the lowest was the live *Artemia* biomass treatment. However, the highest coefficient of variation in body weight was recorded in the commercial feed treatment followed by frozen *Artemia* biomass and the lowest was the live *Artemia* biomass treatment. The highest coefficient of variation at the end of the experiment was recorded in the commercial feed compared to the remaining feeds ($p<0.05$), although, there was no statistically significant difference ($p>0.05$) between the processed feed, live *Artemia* biomass and frozen *Artemia* biomass treatments.

Mud crabs C_1 | Mud crab catch feed | Mud crab after 30 day of nursery

Figure 3. *Scylla paramamosain* in the experiment.

Discussion

Water quality. Water quality is one of the main external factors affecting the growth of mud crabs (Hubatsch et al 2015). Recommended water quality parameters for rearing and raising mud crabs include DO>5 mg L^{-1}, ideal alkalinity 120 mg$CaCO_3$ L^{-1}, nitrite (NO_2^-), <10 mg L^{-1} (Shelley & Lovatelli 2011); suitable temperature 25-35 °C (Hasnidar et al 2021); suitable pH 7.5-8.5, NH_3<0.01 mg L^{-1} (Ganesh et al 2015). All water environment parameters during the 30 days of rearing in the experimental treatments had slight fluctuation and were within the appropriate range and equivalent to the results of the above authors. Water environment parameters exhibited no significant differences between treatments ($p>0.05$).

Growth performance. The nutritional requirements of crustaceans vary and depend on species, stage of development, health, season of the year, and habitat. Some of the main nutrients include protein, lipids, vitamins, and minerals. For most juvenile crustaceans, good growth can be achieved with a protein content of 30-60% and a lipid content of 2-

17% in the diet (Holme et al 2009). Catacutan (2002) has demonstrated that the shell width and body weight of crabs did not differ in diets containing 40% and 32% protein and were not affected by the lipid level in the diet at all protein levels; *S. serrata* crabs grew well when fed diets containing 32–40% crude protein and 6–12% lipid. Similarly, Unnikrishnan and Paulraj (2010) demonstrated that the best growth performance and nutrient conversion were recorded when fed diets containing 45% crude protein. However, the growth rate (SGR), as well as the increase in body protein compared with the protein level in the diet, showed that the diet should contain 46.9–47.03% protein to meet the best growth and protein accumulation in the juvenile stage of *S. serrata*. Zhao et al (2015) showed that the survival rate, final body weight, carapace width, specific growth rate, and molting frequency of crabs fed a 6% lipid diet were significantly higher than those fed a 3% or 12% lipid diet. Furthermore, Zheng et al (2020) showed that in the diet of juvenile *S. paramamosain*, 47.06% protein was required to achieve maximum growth.

The four experimental feeds all had protein levels ranging from 46.0-56.45% protein and 4.71-11.24% lipid, which are the two main nutritional components of the feed as well as the animal's needs. Compared with the results of the other authors, the main nutritional components, including protein, lipid, ash, crude fiber, and carbohydrates in the feed in the present study were all suitable for the nutritional needs of *S. paramamosain* crabs in the juvenile stage. In our assessment, in the nutritional composition of commercial feed, some essential amino acids and polyunsaturated fatty acids (DHA, EPA) had very low or no content, so commercial feed (CF) did not meet the growth and development needs of mud crabs in the juvenile stage. Anh et al (2010) demonstrated that the growth performance *of S. paramamosain* (including CW, BW, SGRCW, and SGRBW) decreased in the following order: live *Artemia* to frozen *Artemia* to fresh peeled shrimp meat and dried *Artemia* feed. Similarly, Zhang et al (2022) demonstrated that the molting time of *S. paramamosain* at stage C5 when fed with *Artemia* or fish mixture was significantly shorter than when fed with commercial feed.

Feed types. The availability of feed, in terms of both quantity and quality, is one of the main factors affecting the survival rate of cultured crabs (Sheen 2000). Williams et al. (1999) indicated that high mortality during the molting stage is often a result of the poor nutritional status of S. serrata larvae. Quinitio et al. (2001) and Roslan et al. (2016) also suggested that the absence of suitable food contributes to cannibalism and reduced survival rates in crabs. In this study, the survival rate and productivity in the PF treatment were the highest compared to the LA, FA, and CF treatments (Figure 2). The survival rate in the CF treatment was the lowest, possibly because the nutritional composition of the commercial feed failed to meet the crabs' nutritional needs, leading to a soft-shell phenomenon after molting. Additionally, the levels of DHA, EPA, certain amino acids, and minerals were very low and lacked a balanced ratio. Moreover, the particles of commercial feed decompose quickly in water, which decreases the crabs' ability to catch food. In pelleted feed, the ingredients contain few natural binders, so the pellets need to be manufactured in a microencapsulated form (Holme et al. 2009). Similarly, the growth performance and survival of aquatic organisms can be influenced by the nutritional balance of commercial feed (Tom and Van-Nostrand 1989). Rodriguez et al. (2007) observed that when rearing crabs from C1 to C5-6 stages in ponds and in net stages using commercial feed (shrimp feed), they achieved a very low survival rate.

Although accounting for a very small portion of food, the n-3 group, especially DHA and EPA, plays a very important role in the nutrition of marine shrimp and fish larvae such as stimulating growth, increasing the ability to withstand environmental stress, and is also an important component in the structure of the nervous system, eyes, pigment formation, and immunity (Merican et al 1997). Similarly, EPA: DHA ratio can alter neurogenesis through regulatory effects on membrane proteins, cytokines, and/or neurons (Barbara et al 2007). Mud crab larvae need eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) to survive and develop; in the nutritional composition of the larvae's food, there must be at least 1.3% EPA and 0.46% DHA (Kobayashi et al 2000). Therefore, during the rearing of crustaceans, if the diets are provided with nutritional components that do not meet their needs and are unbalanced, it will lead to the inability to molt in crustaceans.

Similarly, crabs usually need about 35-50% protein, 5-10% lipid, 1-2% eicosapentaenoic acid, and docosahexaenoic acid (Esmaelli et al 2024). Therefore, the failure of molting in mud crabs can be related to the lack or imbalance of essential fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

Artemia biomass is a good source of animal protein but considering the amino acid composition, it may lack methionine and threonine to meet the amino acid requirements of shrimp and crab larvae, leading to slow growth (Sorgeloos et al 1998; Evjemo, 2001). However, the two most important essential fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are present in very low levels or even absent in *Artemia* biomass Evjemo 2001; Lim et al 2001). It has an EPA content of 7.5 mg g^{-1} and a DHA content of 0.5 mg g^{-1} (Anh 2009). Balange et al (2017) analyzed the nutritional composition of *Acetes sp.* and found that it contained 15.69% docosahexaenoic acid (DHA), 13.45% eicosapentaenoic acid (EPA), 4.55% calcium, 23.4 mg/g threonine and 12.12 mg/g methionine. The nutritional needs of DHA and EPA in marine shrimp and fish should vary from 1:1.5 to 1:8, which is best (Sargent et al 1999; Copeman et al 2002). In addition, Zanotto et al (2009) observed that calcium is essential for crustaceans due to the accumulation of calcium carbonate ($CaCO_3$) in the new external skeleton after molting to harden the shell. Calcium and chitin in crustaceans help crabs absorb well and harden their shells quickly when molting, which is also the reason for increasing the survival rate of crustaceans.

From the studies of the authors mentioned above, it has been shown that the nutritional composition of *Acetes sp.* contains many essential amino acids, DHA, EPA, Caxi, and chitin more fully and abundantly than in *Artemia* biomass as well as in industrial feed, so it has met the nutritional needs of the crabs in the juvenile stage of growth and molting better. Our results agree with those of Viet and Hai (2020), raising green crab *(S. paramamosain*) with different types of feed, showing that the use of *Acetes sp.* as feed gives the best results with the highest survival rate and biomass achieved and is significantly different from the remaining feeds (frozen *Artemia* biomass and industrial feed). Moreover, according to Viet et al (2015a, 2015b), the selling price of *Acetes sp.* Biomass (0.4–0.5 USD/kg) is much cheaper than *Artemia* biomass (2–3 USD/kg), and the source of *Acetes sp* biomass is very easy to find. The surveyed crab breeding households recorded 82.8% using *Acetes* as food to raise *S. paramamosain* at the juvenile stage.

Conclusions. After 30 days of experiment with different types of feed (live *Artemia* biomass, frozen *Artemia* biomass, processed feed, and commercial feed), it was found that the feed types affected the growth in length, shell width, body weight, survival rate, productivity and coefficient of variation of *S. paramamosain* crab larvae. The experimental results showed that the use of feed processed from shrimp (*Acetes* sp.) gave the best results with the highest survival rate and productivity of juvenile crabs (43.89%; 131.67 crabs m^{-1}) which was significantly different from the remaining feed types.

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Conflict of interest. The authors declare no conflict of interest.

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