

## Effect of Artificial Feed and Algae on Growth Rate of Thorny Oyster (*Spondylus varians*)

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### Abstract

*Spondylus varians* or rock scallop or thorny oyster was native bivalve in Thailand and was used in many ways such as food in many countries but had never been raised before. It must be taken from the wild and more catches every year, especially in the eastern part of Thailand. Because it had the potential to develop into an economic mollusk in Thailand so this study was conducted on the possibility of raising *Spondylus varians* by using 3 different levels of artificial feed as 3, 4.5 and 6 mg/l and 3 different species of algae as *Chaetoceros* sp., *Tetraselmis* sp. and *Thalassiosira* sp. under experimental conditions in wet laboratory for 4 months. The experimental design was 3 x 3 factorial in CRD. It was found that all groups had no significant difference in length and height ( $P > 0.05$ ) after 4 months and had no significant difference in length and height when compared with the beginning of the experiment. In cases of survival rate, there were no statistically significant differences. Survival rates ranged from 83.3 to 100 percent, indicating that *Spondylus varians* could be raising under indoor condition.

**Keywords :** *Spondylus varians*, artificial feed, algae, growth rate

### 1. Introduction

*Spondylus varians* or rock scallop or thorny oyster or rabbit teeth shell (local name, because of a few prominent teeth in hinge) was native bivalve in Thailand. This species was classified in the Spondylidae family. In 1966, there was a report about mollusk species in Thailand but there was no record about this thorny oyster. In 2001, this family was found in the southern Gulf of Thailand (Swennen *et al.*, 2001). Soria *et al.* (2010) reported that this genus when mature, shell length was up to 210 mm. Thorny oyster was also found in Colombia, Mexico and Gulf of California (Poutiers, 1995). The outer shell was rough, spiny and dark color. The inner shell was white pearl. This spondylid was used in many ways and could be cooked into a variety of food. Currently, this thorny oyster was not cultured. It must be taken from nature and more natural catches every year, especially in the eastern part of Thailand.

Because it has the potential to develop into an economic mollusk in Thailand and can be exported abroad because other countries have consumed this type of oyster. In order to prevent extinction, it must be studied in terms of culture and breeding. This research was the starting project to study the feasibility of raising thorny oyster or rock scallop in indoor condition by used the knowledge gained from the other researches of aquatic shelled mollusk. The artificial feed that sold for feeding aquatic animals and algae were considered as the first choice for feeding this oyster. These

would make raising thorny oyster in the indoor tanks were convenient and reduced the workload of preparing algae while less used the area to prepare algae. This may be used as a prototype for the development of culture economic shellfish.



Figure 1 General morphology of thorny oyster.

A) Thorny oyster shell. B) Living thorny oyster in tank.

So the objectives of this research were to determine the growth rate and survival rate of *Spondylus varians* fed with artificial feed by using 3 different levels of artificial feed as 3, 4.5 and 6 mg/l and 3 different species of algae as *Chaetoceros* sp., *Tetraselmis* sp. and *Thalassiosira* sp. under experimental conditions in wet laboratory for 4 months.

## 2. Materials and Methods

### 2.1 Preparation of *Spondylus varians*

*Spondylus varians* were caught from the coast in Chonburi province, in the eastern part of Thailand on September 2019. The lengths and heights of *Spondylus varians* were more than 6 cm. After caught from the sea, they were brought to the indoor hatchery where the experiments were conducted at Department of Fisheries, Faculty of Agriculture and Natural Resources, Rajamangala University of Technology Tawan - ok, Chonburi, Thailand. Before the experiment, they were acclimatized for 10 days in the plastic tanks filled with 30-32 ppt of seawater which was disinfected with chlorine treated. *Spondylus varians* were fed with microalgae and artificial marine shrimp larval feed one time a day with the aeration in the tanks all the time.

### 2.2 Effect of feeds on growth and survival rate of *Spondylus varians*

After acclimatization, *Spondylus varians* were divided into 9 groups with 3 replications. The study was divided into 2 factors. Factor one was the different amounts of artificial feed by using 3 different levels of artificial feed as 3, 4.5 and 6 mg/l/day. Artificial feed used in this experiment was a fine powder feed for zoea and mysis shrimp contained 51% protein, 6% fat, and 3% fiber. Factor two was three different species of algae as *Chaetoceros* sp., *Tetraselmis* sp. and *Thalassiosira* sp. Algae densities were approximately  $6-30 \times 10^4$  cells/ml. Sediment suction and water change were done every 3 days. The experimental design was 3 x 3 factorial in CRD under experimental conditions in indoor wet laboratory for 4 months. The experimental groups were divided as shown in Table 1.

Table 1 Experimental groups fed with different amounts of artificial feed and different species of algae.

Experimental group	The amount of artificial feed (mg/l)	Species of algae
1	3	<i>Chaetoceros</i> sp.
2	3	<i>Tetraselmis</i> sp.
3	3	<i>Thalassiosira</i> sp.
4	4.5	<i>Chaetoceros</i> sp.
5	4.5	<i>Tetraselmis</i> sp.
6	4.5	<i>Thalassiosira</i> sp.
7	6	<i>Chaetoceros</i> sp.
8	6	<i>Tetraselmis</i> sp.
9	6	<i>Thalassiosira</i> sp.

### 3. Results and Discussion

#### 3.1 Mortality rate of *Spondylus* sp. during acclimatization

*Spondylus varians* were caught by fisherman from the coast near Koh Sichang (Sichang Island) in Chonburi province. It took half an hour to transport them from the island to main land and half an hour to the hatchery without aeration (Figure 2).

After transportation, they were acclimatized for 10 days in the plastic tanks filled with 30-32 ppt of seawater with aeration all the time (Figure 3).

At the third day of acclimatization, *Spondylus varians* have died 25 % of total amount that were send to the hatchery. After that mortality rate was decreased to 1-2 %.



Figure 2 Transpotation of *Spondylus varians* from Koh Sichang to hatchery.  
A) In rectangular tank. B) In round tank.



Figure 3 Acclimatization of *Spondylus varians* in plastic tanks.

### 3.2 Growth and survival rate of *Spondylus varians*

After acclimatization, healthy *Spondylus varians* were divided into 9 groups and fed with different amounts of artificial feed as 3, 4.5 and 6 mg/l and three different species of algae as *Chaetoceros* sp., *Tetraselmis* sp. and *Thalassiosira* sp. under experimental conditions in indoor wet laboratory for 4 months. *Spondylus varians* showed their growth rates as shown in Tables 2, 3 and 4.

Lengths and heights of *Spondylus varians* showed no enlarging in size. Lengths and heights of all *Spondylus varians* at the end of the experiment were similar to the initial lengths and heights. While their weights showed higher than the initial weights but had no statistical difference.

At the end of the trial, all experimental groups had a survival rate of 83.3-100 %, as shown in Table 5. They showed no statistical differences.

Table 2 The average length of *Spondylus varians* in each month.

Treatment	Initial length <sup>1/</sup> (cm) ± SD	Length (cm) at the end of each month			
		1	2	3	4
1	7.2 ± 0.71	7.2	7.2	7.2	7.2
2	7.7 ± 0.40	7.7	7.7	7.7	7.7
3	7.6 ± 1.14	7.6	7.6	7.6	7.6
4	7.0 ± 0.06	7.0	7.0	7.0	7.0
5	7.2 ± 0.80	7.2	7.2	7.2	7.2
6	7.0 ± 0.10	7.0	7.0	7.0	7.0
7	7.3 ± 0.30	7.3	7.3	7.3	7.3
8	7.8 ± 0.69	7.8	7.8	7.8	7.8
9	7.5 ± 0.59	7.5	7.5	7.5	7.5

<sup>1/</sup> No statistical differences in initial lengths.

Table 3 The average height of *Spondylus varians* in each month.

Treatment	Initial height <sup>1</sup> (cm) ± SD	Height (cm) at the end of each month			
		1	2	3	4
1	9.2 ± 1.59	9.2	9.2	9.2	9.2
2	9.8 ± 0.69	9.8	9.8	9.8	9.8
3	8.5 ± 1.68	8.5	8.5	8.5	8.5
4	9.1 ± 0.61	9.1	9.1	9.1	9.1
5	8.2 ± 1.00	8.2	8.2	8.2	8.2
6	9.4 ± 0.45	9.4	9.4	9.4	9.4
7	9.3 ± 0.65	9.3	9.3	9.3	9.3
8	9.8 ± 0.50	9.8	9.8	9.8	9.8
9	9.1 ± 1.11	9.1	9.1	9.1	9.1

<sup>1/</sup> No statistical differences in initial heights.

Table 4 The average weight of *Spondylus varians* in each month.

Treatment	Initial weight <sup>1</sup> (g) ± SD	Weight (g) at the end of each month <sup>2</sup>			
		1	2	3	4
1	205 ± 56.8	223.3	227.3	234.0	240.0
2	238 ± 27.6	258.3	260.7	260.5	267.7
3	241 ± 58.4	255.0	260.0	267.3	271.0
4	230 ± 18.0	235.0	240.3	250.7	259.5
5	171 ± 27.5	191.7	195.3	199.7	201.3
6	237 ± 23.1	236.7	241.3	245.0	251.0
7	220 ± 20.0	230.0	233.0	238.0	247.7
8	278 ± 66.6	280.0	285.7	292.3	302.3
9	261 ± 74.2	281.7	280.3	288.3	298.3

<sup>1/</sup> No statistical differences in initial weights.

<sup>2/</sup> No statistical differences in final weights.

Table 5 The survival rates of *Spondylus varians* in each month.

Treatment	Survival rate (%) at the end of each month <sup>1</sup>			
	1	2	3	4
1	100.0	100.0	100.0	83.3
2	100.0	100.0	100.0	100.0
3	83.3	83.3	83.3	83.3
4	83.3	83.3	83.3	83.3
5	83.3	83.3	83.3	83.3
6	100.0	100.0	100.0	100.0
7	100.0	83.3	83.3	83.3
8	100.0	100.0	83.3	83.3
9	100.0	83.3	83.3	83.3

<sup>1/</sup> No statistical differences.

## 4. Conclusion

*Spondylus varians* or rock scallop or spiny oyster or sometime called donkey thorny oyster were found in eastern of Thailand. Some species were found in the southern part of the Gulf of Thailand such as *Spondylus croceus* and *Spondylus imperialis* (Swennen *et al.*, 2001). Poutiers (1995) reported that rock scallop distributed along the rocky coastal area and from the littoral zone to the depth of 55 m.

There were very few studies on the biology of *Spondylus varians* and no commercial cultures were found. This was the first trial to raising *Spondylus varians* under indoor condition although *Spondylus varians* showed no increasing in lengths and heights but their weights appeared more weights gains every month. Soria *et al.* (2010) showed that larvae of *Spondylus calcifer* could be cultured in the laboratory. *Spondylus varians* fed with different amounts of artificial feed and different species of algae revealed no difference in growth rates and survival rates. From previous study, *Spondylus varians* fed with only artificial feed had low survival rate. Davenport *et al.* (2011) found that *Pinna nobilis* of different sizes consumed different food. In *Pinna bicolor*, Beer and Southgate (2006) found that this shell had a fast growth rate until 40 weeks of age after that growth rate started to decline because of the reproductive activity and repairing the damaged shells which caused by catching them from the nature (Saetung, 2018). Mature *Spondylus calcifer* had shell height about 86-113 mm. (Villalejo-Fuerte *et al.*, 2002) which nearly the same height as *Spondylus varians* in this experiment (66-103 mm). Growth rate also depended on shell size as *Pinna nobilis*, small shell grew faster, followed by a sharp decline to nearly constant level and a further decline with larger sizes down to almost zero (Katsanevakis, 2007).

*Spondylus varians* were easily raising by fed with artificial feed and small algae or rearing in the indoor tanks with aeration. In the future, they seemed to have the potential to develop into the economic species.

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