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STUDY ON THE SPECIES COMPOSITION AND ABUNDANCE OF PLANKTON, WATER QUALITY AND STOMACH CONTENTS OF PACIFIC WHITE SHRIMP (*Litopenaeus vannamei* Boone,1931) REARED IN LOW SALINITY CONDITIONS

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STUDY ON THE LARVAL DEVELOPMENT OF THE CREEPER SNAIL, *Cerithium* sp. BRUGUIERE

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EFFECT OF STOCKING DENSITY ON SURVIVAL RATE AND BACTERIAL COMPOSITIONS IN THE LARVAL REARING OF THE GIANT FRESHWATER PRAWN *(Macrobrachium rosenbergii)*

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Study on the Larval Development of the Creeper Snail, *Cerithium* sp. Bruguiere

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Abstract

The creeper snail (*Cerithium* sp.) is commonly found on muddy beaches in nature, but when it invades shrimp rearing ponds it can multiply very quickly. This study of the creeper snail's life cycle started with observing its mating behavior. Creeper snails began to lay eggs four days after they mated. The eggs came out in strings, appearing like gelatinous white threads attached to various surfaces. Females could lay one string of eggs per day, and another string 10 days later, for a continuous period after mating. The number of individual eggs per string was found to be 2,109 to 4,991. Each egg was a slender oval, about 170 microns long and 150 microns wide.

The creeper snail started its life as a one-cell zygote. Cell division began at 2-7 hours. After the seventh hour, the embryo entered the blastula stage. The parts were difficult to differentiate in the gastrula stage. By hours 19-39 the embryo developed into a trocophore that looked like a top with cilia all around. By hour 40 the trocophore developed into the veliger stage, but it remained inside the egg until hour 73, at which time it hatched as a free-living veliger. In short, within about three days it then developed into a creeping larva which dropped to the bottom of the pond. Within about one month it grew a shell with five spirals.

Key words : larvae development, the creeper snail (*Cerithium* sp. Bruguiere)
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Introduction

One problem in shrimp farming these days is outbreaks of other animals such as creeper snails (*Cerithium* sp.) in the shrimp ponds. Sanprasert and Piromchart (1975) reported that creeper snails were often found in large numbers in the feeding areas in shrimp culture ponds. They compete with the shrimp for food, so the shrimp grow slowly or die off when they are young. If the outbreak of creeper snails is severe, it can reduce shrimp production by over 90%. Tiansongrasmee (1978) found that it was difficult to eradicate creeper snails when they are reproducing in black tiger shrimp ponds. The creeper snails feed on microorganisms on the mud bottoms of the ponds, upsetting the natural balance of the pond system. Limsuwan (2000) reported that creeper snails could be found everywhere, from the edges to the bottom of the pond. Large populations of these snails can cause problems. When they take in calcium to build up their shells it causes the alkalinity of the water to drop in the early stages. This causes the shrimp to eat less.

At present, more shrimp farmers are complaining of problems with creeper snails. The problem gets especially serious in the hot season, when the water is more saline, or in places close to the sea. It has been found that once creeper snails become established in a pond, they remain there when the next generation of shrimp is introduced. In ponds that have large numbers of creeper snails it is more difficult to maintain water quality and algae bloom. Some farmers try to scoop out all the creeper snails they can each day and leave them to dry out and die by the side of the pond. Still, their harvest from the ponds that have been invaded by creeper snails will not be as good as from the other ponds.

To date, there have been no previous studies about the larvae development of creeper snails in shrimp farms. Thus, this study was designed to discover the details of the creeper snails development for use in managing and controlling this pest on shrimp farms in the future.

Materials and Methods

- Preparation

1. Water was prepared with salinity of 30 ppt in a glass aquarium and 3 large beakers. All were aerated with aquarium pumps.

2. Creeper snails were taken from a shrimp pond and put into the aquarium. They were fed with shrimp food every day and watched for mating behavior.

3. Any pairs of snails that were mating were removed and put into the beakers (one pair to each beaker). They were continued to be fed with shrimp food and plankton.

- Experimental steps

1. When the creeper snails laid eggs, the eggs were removed and studied at different stages with a light microscope.

2. The life cycle was studied by noting the time the snails started mating, when they laid eggs, and when the embryos developed into different stages up to adults.

Results and Discussion

This study of the creeper snail life cycle began with observing their mating behavior. Three pairs of creeper snails that were mating were put into three separate tanks. The females began to lay eggs after four days the eggs came out in white strings (Figure 1). All the eggs were stuck together with mucilage, and the same mucilage held the eggs to a surface (Figure 2). Slippery strings of eggs were often observed stuck to the creeper snails that were taken from shrimp ponds, indicating that the population density was so high that the creeper snails had laid their eggs on other creeper snails.

The individual eggs in each string were arranged in a spiral. Each female creeper snail could lay one string of eggs a day, and could lay another string about 10 days later. They tended to lay their eggs where it was dark, such as at nighttime or in very murky water. Each string of eggs was 4.1-9.7 cm long and 0.2 cm wide, depending on the health of the female and the fertility of the environment. Usually the first string of eggs laid by a female after each mating episode was short, but they became longer in subsequent days, and then shorter again. The female continued to live and could mate and produce eggs again.

The number of eggs per string, as measured by using direct counting under a microscope, was found to be 2,109-4,991. Each egg was a slender oval, about 170 microns long and 150 microns wide. They were bilaterally symmetrical.

Table 1 shows the increase in size over time in the development of the creeper snail eggs after they are laid. Figure 3 shows what the egg looked like in the first hour, when it was still a one-cell zygote. By about the second hour, the cell divided into two cells of equal size (the first cleavage, Figure 4). In the third hour, the second cleavage occurred (Figure 5), resulting in four quandrant cells of equal size. By about the fourth hour, the first unequal divisions occurred, resulting in four small cells called micromeres and four large cells called macromeres, for a total of eight cells. This is the fourth cleavage. Thus, creeper snails have a yolk-rich form. The fifth and sixth cleavages could be readily discerned under a light microscope.

The embryo entered the blastula stage at about hour (Figure 6). The gastrula stage was difficult to differentiate from the blastula stage with light microscopic observations. The embryo appeared similar to the blastula stage, which was at hours 7-18, but it was observed that there was more cell division going on within the shell, leaving noticeably less space between the embryo and the shell (Figure 7). On the exterior, the mucilage covering the egg became less viscous. If the eggs were touched or shaken at this stage they easily fell off and floated with the current.

The embryo reached the trocophore stage at hours 19-39 (Figure 8). It was still inside the egg. At this stage the embryo resembled a child's spinning top. It was covered in cilia all around with a capical tuft. Under the microscope, the moving cilia could be observed.

By about hour 40 the embryo reached the veliger stage, manifested by an elongation of the cilia, a curving and constriction of the embryo and the beginnings of a thin, clear shell on the outside (Figure 9). By hour 44 one could discern an operculum, and the curvature of the veliger was more accentuated. By hour 57 the cilia cells divided and a velum was clearly noted. A larval shell was visible; through the shell distinct internal organs such as the heart, liver and digestive tract were present when observing the veliger under a light microscope. The velum was seen moving within the egg.

At hour 63 the embryo was still in the veliger stage but it twisted around more, and the intestine was also twisting. The operculum could be clearly seen. The velum split into two sections and the veliger began to use the velum to break the eggshell.

By hour 68 two small black dots appeared which were found to develop into tentacles. The shell twisted more and there was more movement within the shell. The veliger tried to break out of the eggshell. The operculum was more functional now as it could be seen opening and closing.

By hour 73 the velum broke through the eggshell and the veliger floated out to become a free-living veliger. In summary, it took approximately two days for the newly laid egg to develop into the free-living veliger stage. At that point it had a larval shell with a highly sensitive operculum. When the organism sensed something unusual it quickly pulled back its velum, retreating into the shell and closing the operculum.

In another three days the free-living veliger developed into the creeping larvae stage. It began to descend to the bottom of the pond or find something to attach itself to. After 15-20 days the velum was transformed into a simple strip of tissue above the mantle. The larvae crept about and fed on single-celled plankton. Observations under the light microscope showed that the larvae had *Oocystis* cells in their stomachs. Next, the larvae underwent metamorphosis and developed a genuine shell and a real adult pod. The transformation from a creeper larva to an adult with a 5-spiral shell took one month.

Walter (1972) reported that Cerithiliidae species are marine inhabitants of shallow waters of the intertidal region and the majority of species are found in clean coral or weedy sand while some species live under rocks on a hard substrate covered with sand. Sanprasert and Piromchart (1975) reported that creeper snails were often found in large numbers in the feeding areas in shrimp culture ponds. They compete with the shrimp for food, so the shrimp grow slowly or die off when they are young. Limsuwan (2000) reported that creeper snails could be found everywhere, from the edges to the bottom of the pond. Large populations of these snails can cause problems. When they take in calcium to build up their shells it causes the alkalinity of the water to drop in the early stages. This causes the shrimp to eat less. The growth of creeper snails in ponds can significantly affect the culture conditions in the ponds. In order to prevent the problem from creeper snails, shrimp farmers should eliminated the creeper veliger stage and scoop out all creeper snails before stocking postlarvae into a pond. Benzalkonium chloride (BKC) at the concentration of 2 ppm, tea seed cake 50-60 ppm or calcium hypochlorite 35 ppm are proved to be effective against the creeper veliger stage.

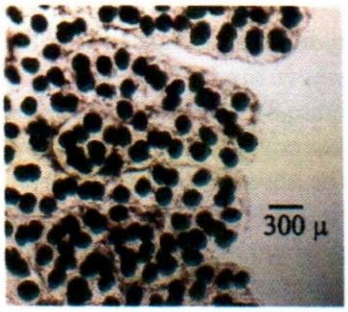

Figure 1 The eggs come out in white strings.

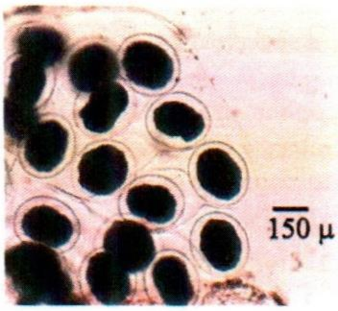

Figure 2 All the eggs are struck together with mucilage.

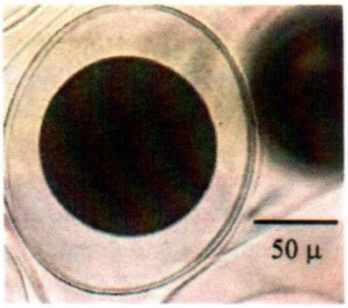

Figure 3 fertilized egg

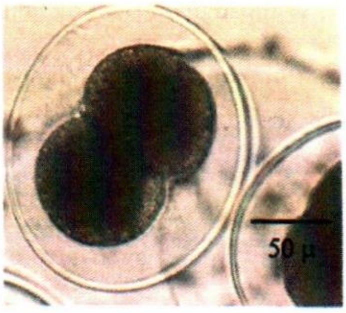

Figure 4 first cleavage

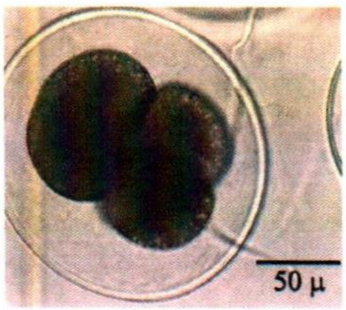

Figure 5 second cleavage

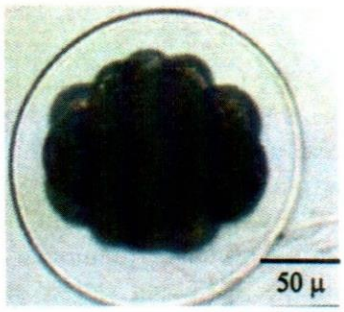

Figure 6 blastula stage

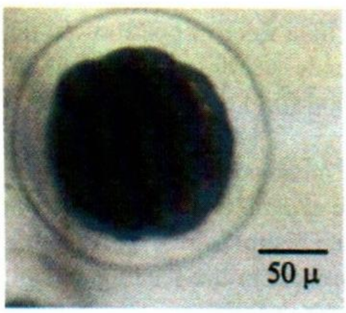

Figure 7 gastrula stage

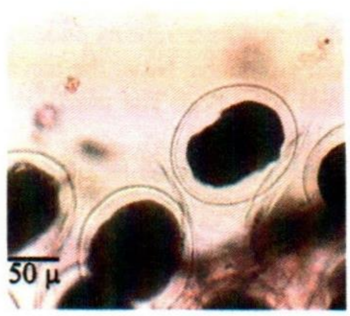

Figure 8 trochophore stage

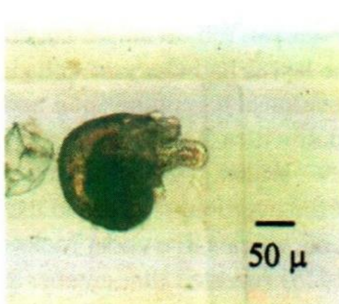

Figure 9 veliger stage

Table 1 Shows the increase in size over time in the development of the creeper snail eggs.

Stage	Size		Developing time
	Width (μ)	Length (μ)	
Fertilized egg	135	160	2 hours
First cleavage	130	145	3 hours
Second cleavage	130	150	7 hours
Blastula	135	150	7 hours
Gastrula	145	150	7-18 hours
Early cleavage	145	150	19-39 hours
Late cleavage	130	150	19-39 hours
Early veliger	146	165	40 hours
Hatching	-	-	73 hours
Late veliger	-	-	3 days
Creeping larvae	-	-	15-20 days
Adult with a 5-spiral snail takes 1 month	-	1.45 mm.	30 days

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