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STUDY ON THE MORPHOLOGY, DAILY GROWTH FORM AND LIFE CYCLE OF *ARTEMIA* SP (BRINE SHRIMP) USING DIFFERENT KINDS OF FEEDING

Wint Yee Paing[1]

Abstract

The morphology, daily growth form and life cycle of *Artemia* were observed under different kinds of feeding such as S*pirulina* dry powder, yeast, and rice bran and formulated diet (shrimp meal) in the laboratory culture conditions. The optimum survival rate for *Artemia* was observed in the feeding of rice bran. And as well the second were observed in the feeding of *Spirulina* dry powder, yeast and formulated diet (shrimp meal) receptively but their high fraction of water soluble components which cannot be ingested by the brine shrimp that interferes with the water quality of the culture medium.

Keywords: *Artemia*, Brine shrimp, *Spirulia* powder.

Introduction

Artemia is the genus of aquatic crustaceans known as brine shrimp. and the only genus in the family Artemiidae. It lives in high saline waters. It is widely distributed throughout the world. It is the most important live feed organism. The genus *Artemia* is comprised of both bisexual and parthenogenetic strains (Stappen,1996). *Artemia* is a typical primitive arthropod with a segmented body to which is attached broad leaf-like appendages. *Artemia* is a continuous, nonselective, particle filtering organism (Coutteau and Sorgeloos, 1989). The coupling of propulsion, respiration, and filtration by the thaoracopods results in a practically continuous filter feeding (Coutteau and et.al, 1992). *Artemia* becomes an important input for the success of aquaculture, which has tremendously developed in recent years. As aquaculture is likely to develop manifold in future, the demand for *Artemia* would likely to increase in conjunction with its phased development (Coutteau and Sorgeloos, 1989). At present, the availability of *Artemia* from its natural resources is very much limited. To meet the ever increasing demand for *Artemia* biomass and cysts, culture of *Artemia* in the ponds is as an alternative source of their availability. The present study was also focused on the morphology and life cycle of *Artemia* and to know the optimum growth rate of *Artemia* with different kinds of foods. And also to develop the basic knowledge of *Artemia* culture in laboratory conditions.

Materials and Methods

Dry *Artemia* cysts 0.1g were soaked in freshwater for 30minutes under continuous illumination at room temperature in a cylindrical tank. Generally, all the nauplii hatch out within 48 hours. After completion of all cysts, the container has to be covered with a dark cloth. Light source has to be provided at the bottom of the container. Positive phototactic behavior of the *Artemia* nauplii is exploited for separating the hatched nauplii from empty and unhatched cysts. Nauplii swam towards the lighted bottom of the culture container and accumulate from where they have to be collected by siphoning through the provision in the bottom. In the present study, the types of feeds for *Artemia* are *Spirulina* powder, yeast, rice bran and formulated diet (shrimp meal). For one crop culture, there was taken a period of over 14 days. In one culture crop, two different kinds of feeds are introduced into two tanks and tested for one kind of feed in three times. The experiment was carried out at the laboratory of Department of Marine Science, Pathein University.

[1] Assistant Lecturer, Marine Science Department, Pathein university, Myanmar

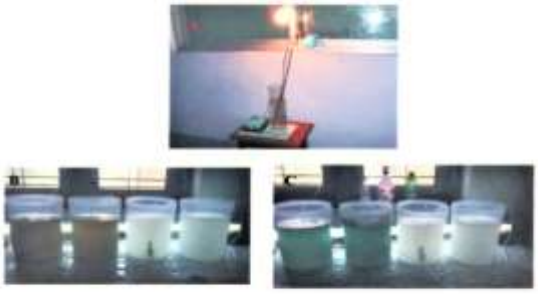

Figure 1 A. Hatching of *Artemia* cysts and B-C. Culture chambers.

Results

Scientific classification

Phylum	Arthropoda
Class	Crustacea
Order	Anostreca
Family	Artemiidae
Genus	*Artemia*
Species	*Artemia* sp

Figure 2 Life cycle of *Artemia*.

After about 20 hours the outer membrane of the cysts burst (= "breaking") and the embryo appears, surrounded by the hatching membrane. While the embryo hangs underneath the empty shell (= "umbrella" stage) the development of the nauplius is completed and within a short period of time the hatching membrane is ruptured (= "hatching") and the free swimming nauplius is born.

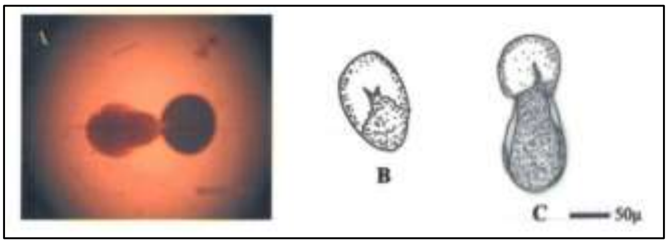

Figure 3 A. Breaking stage (umbrella stage), B- C. Sketch drawing of breaking cyst (umbrella stage).

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 1	-Nauplius eye -1st antennae -2nd antennae -Labrum	-Nauplius eye -1st antennae -2nd antennae -Labrum	-Nauplius eye -1st antennae -2nd antennae -Labrum	-Nauplius eye -1st antennae -2nd antennae -Labrum

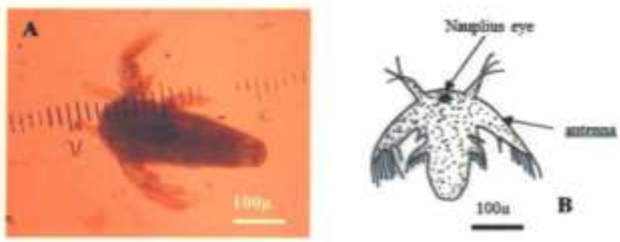

Figure 4 A. The first larval stage (instar I), B. Sketch drawing of the first larval stage (instar I).

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 2	-Nauplius eye -Larger & swim faster -Intennae -Intennula -Labrum	-Nauplius eye -Larger & swim faster -Intennae -Intennula -Labrum	-Nauplius eye -Larger & swim faster -Intennae -Intennula -Labrum	-Nauplius eye -Larger & swim faster -Intennae -Intennula -Labrum

Figure 5 A. The 2nd larval stage (instar II), B. Sketch drawing of the 2nd larval stage (instar II).

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 3	-Intennae -Nauplius eye -Digestive tract open	-Nauplius eye -Mandible -1st body segment -2nd body segment	-Intennae -Nauplius eye -Digestive tract open	-Nauplius eye -Mandible -1st body segment -2nd body segment

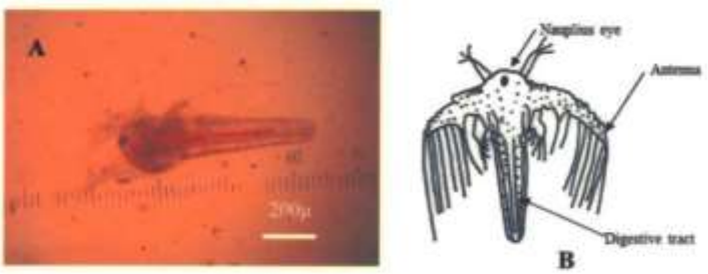

Figure 6 A. The larval stage, B. Sketch drawing of the larval stage.

Day	**Rice Bran**	**Yeast**	***Spirulina* Powder**	**Shrimp Meal**
Day- 4	-Intennae -Nauplius eye -Digestive tract open	-Nauplius eye -Mandible -1st body segment -2nd body segment	-Intennae -Nauplius eye -Digestive tract open	-Nauplius eye -Mandible -1st body segment -2nd body segment

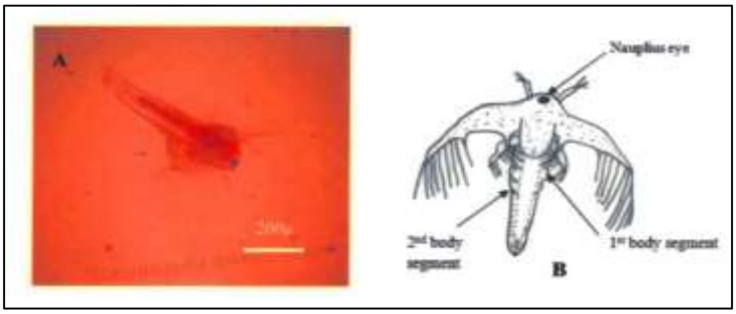

Figure 7 A. The larval stage, B. Sketch drawing of the larval stage.

Day	**Rice Bran**	**Yeast**	***Spirulina* Powder**	**Shrimp Meal**
Day-5	-Nauplius eye -Labrum distinct -Pairs of thoracopods (5) buds	-Lateral complex eyes develop -Pairs of thoracopods (7) buds	-Lateral complex eyes develop -Pairs of thoracopods (7) buds	-Lateral complex eyes develop -Pairs of thoracopods (7) buds

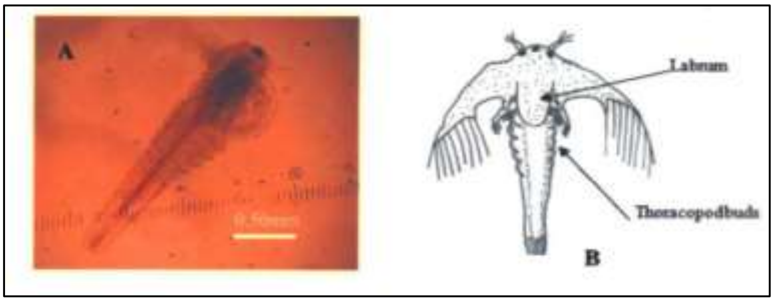

Figure 8 A. The larval stage, B. Sketch drawing of the larval stage.

Day	**Rice Bran**	**Yeast**	***Spirulina* Powder**	**Shrimp Meal**
Day-6	-Lateral complex eyes develop -Pairs of Thoracopods (7) buds	-Thoracopods Buds biramous & slightly longer	-Lateral complex eyes develop -Pairs of thoracopods (7) buds	-Thoracopods Buds biramous & slightly longer

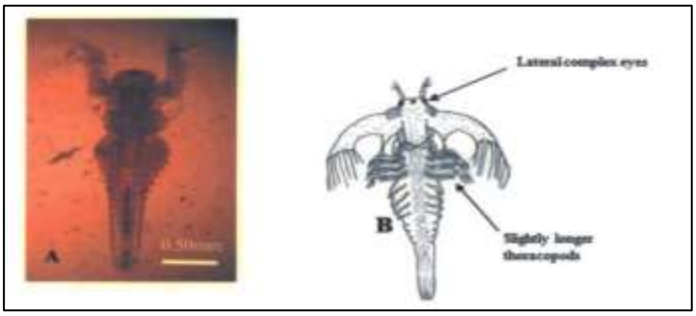

Figure 9 A. The pre-adult stage, B. Sketch drawing of the pre-adult stage.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day-7	-Thoracopods Buds biramous & slightly longer	-Lateral complex eyes develop -Thoracopods buds slightly longer	-Thoracopods buds biramous & slightly longer	-Thoracopods buds slightly longer

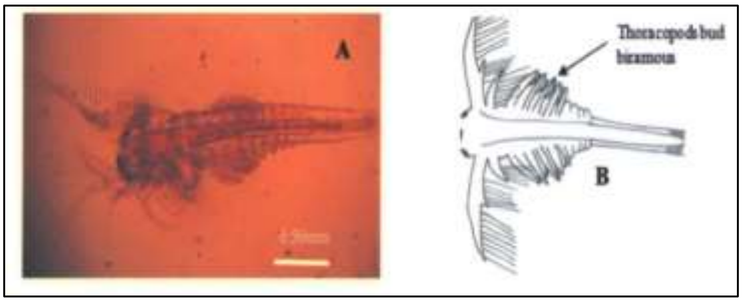

Figure 10 A. The pre-adult stage, B. Sketch drawing of the pre-adult stage.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 8	-Thoracopods buds biramous & slightly longer	-Lateral complex eyes develop -Thoracopods buds slightly longer	-Thoracopods buds biramous & slightly longer	-Thoracopods buds slightly longer

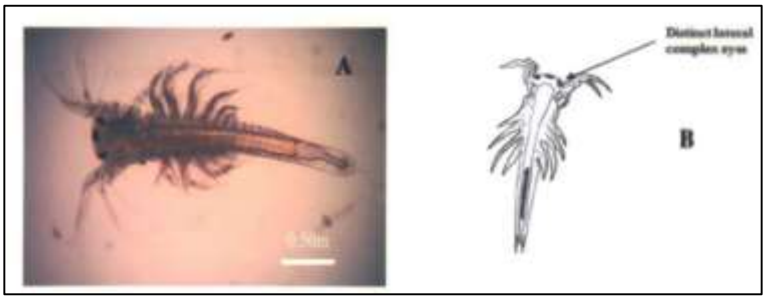

Figure 11 A. The pre-adult stage, B. Sketch drawing of the pre-adult stage.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 9	Thoracopods buds biramous & slightly longer	-Lateral Complex eyes develop -Thoracopods buds longer	Thoracopods buds biramous & slightly longer	-Thoracopods buds slightly longer

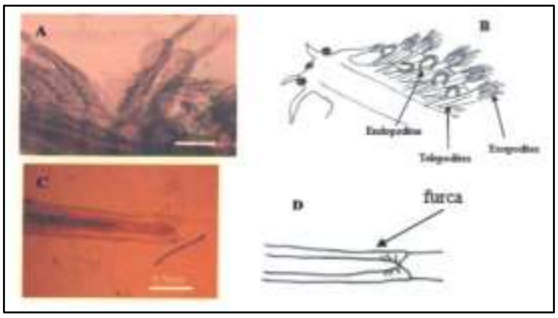

Figure 12 A. Detail structure of thoracopods, B. Sketch drawing of thoracopods, C. Tail of *Artemia*, D. Sketch drawing of tail of *Artemia*.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day-10	-Lateral compound eyes protruding -Furca with setae	-Thoracopods differentiate into 1)exopodites 2)endopodites 3)telepodites -Abdomen longer -Furca appear	-(7) pairs of appendages	-(7) pairs of appendages

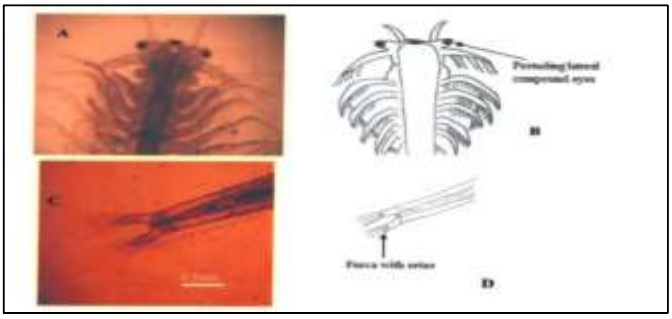

Figure 13 A. Larval development stage, B. Sketch drawing of larval stage, C. Tail of *Artemia*, D. Sketch drawing of tail of *Artemia*.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 11	-Stalked complex eyes -Linear digestive tract -Sensorial antennulae -(11) pairs of thoracopods appendages	-Lateral compound eyes protruding -Furca with setae	-Thoracopods differentiate into 1)exopodites 2)endopodites 3)telepodites -Abdomen longer -Furca appear	-Thoracopods differentiate into 1)exopodites 2)endopodites 3)telepodites -Abdomen longer -Furca appear

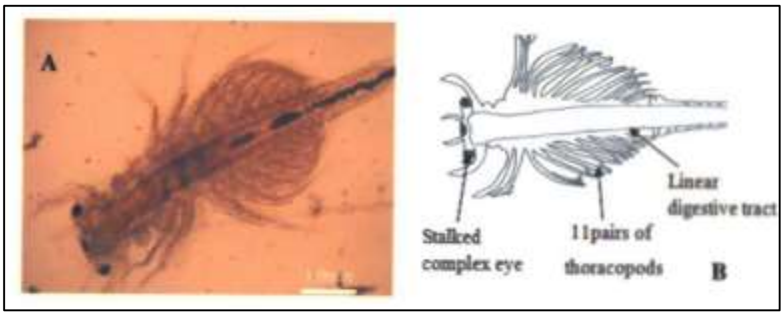

Figure 14 A. The adult stage, B. Sketch drawing of adult stage.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day -12	-Antennae change for sexual differentiation -In female, sensorial appendages -In male, hooked gasper	-Stalked complex eyes -Linear digestive tract -Sensorial antennulae -(11) pairs of thoracopods appendages	-Lateral compound eyes protruding -Furca with setae	-Lateral compound eyes protruding -Furca with setae

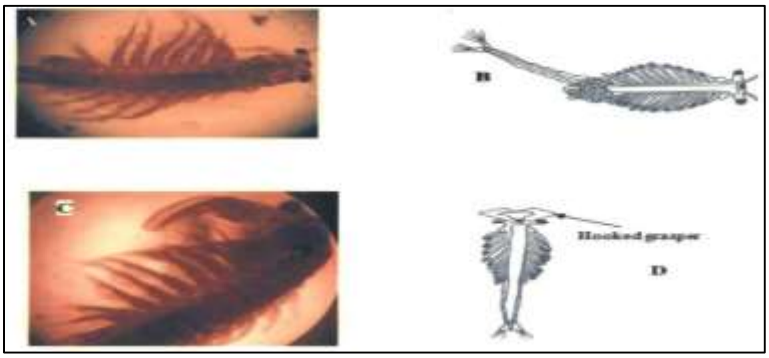

Figure 15 A. Female *Artemia*, B. Sketch drawing of female *Artemia*, C. Male *Artemia*, D. Sketch drawing of male *Artemia*.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 13	-In male, paired penis -In female, brood pouch	-Antennae change for sexual differentiation -In female, sensorial appendages -In male, hooked gasper	-Stalked complex eyes -Linear digestive tract -Sensorial antennulae - (11) pairs of thoracopods appendages	-Stalked complex eyes -Linear digestive tract -Sensorial antennulae -(11) pairs of thoracopods appendages

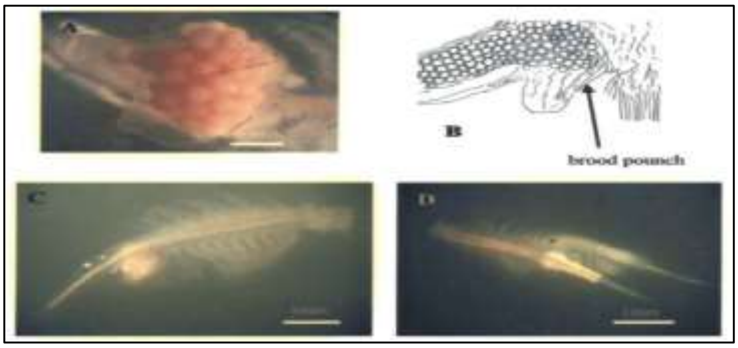

Figure 16 A. Brood pouch of female *Artemia*, B. Sketch drawing of female brood pouch, C. Female *Artemia*, D. Male *Artemia*.

Day	Rice Bran	Yeast	*Spirulina* Powder	Shrimp Meal
Day- 14	-In male, paired penis -In female, brood pouch	-Antennae change for sexual differentiation -In female, sensorial appendages -In male, hooked gasper	-Stalked complex eyes -Linear digestive tract -Sensorial antennulae -(11) pairs of thoracopods appendages	-Stalked complex eyes -Linear digestive tract -Sensorial antennulae -(11) pairs of thoracopods appendages
Day- 15		-Reproduction -Fertilization take place in uterus	-In male, paired penis -In female, brood pouch	-In male, paired penis -In female, brood pouch
Day- 16			-Reproduction -Fertilization take place in uterus	-Reproduction -Fertilization take place in uterus

Discussion

In this study, the breaking stage started after 18-25 hours. The hatching will be completed within 24-48 hours depending on the quality of the cysts. And if the cysts were not used after opening, it wouldn't be good to use. Broone and et.al (1991) stated that *Artemia*'s ingestion, however, can be interrupted at high particle concentrations: i.e., mandibles and maxillae stop their action and the borlus accumulated behind the labrum is rejected into the medium by the first pair of thoracopods. Furthermore, there are no sizes that can be ingested by the naupliar stages have not been exactly determined, diameters should not exceed 50 to 70µm (Coutteau and Sorgeloos, 1989.In this study, good performances were recorded for the brine shrimp that are fed on baking yeast, obtained good growth rate and survival rate. At the adult stage, the survival rate varied because of their high fraction of water soluble components which cannot be ingested by the brine shrimp and interfere with the water quality of the culture medium. Bacteria and protozoans which develop easily in *Artemia* cultures are indeed able to biosynthesize essential nutrients as they use the supplied brine shrimp food as a substrate. In this experiment, *Spirulina* powder is a suitable diet for *Artemia* growth in the early culture period. But during the late culture period, these food particles affected the culture medium by their interference at food uptake and propulsion by *Artemia*, or by bacterial growth and consequently, oxygen demand. In this experiment, rice bran is the optimal food for *Artemia* growth. Their main advantages are low cost and availability. Although soluble products in the food material are not taken up by *Artemia* and they will be decomposed by bacteria in the culture medium thereby deteriorating the water quality, the adult *Artemia* was fed the insoluble food material attached to the culture tank and this process provided for quality of culture water. In this study, the formulated diet (shrimp meal) has good result for *Artemia* growth but at later culture stage, the insoluble particles were decomposed in the bottom of the culture tank and polluted the cultured water. The insoluble products attached the appendages of *Artemia* and disturbed their swimming activity. This is the main problem of the diet.

Conclusion

In this study, the best performances of growth rate and survival rate were recorded for the brine shrimp that are fed on baker's yeast. At the adult stage, the survival rate varied because of their high fraction of water soluble components which cannot be ingested by the brine shrimp and interfere with the water quality of the culture medium. Bacteria and protozoans which develop easily in the *Artemia* cultures are indeed able to biosynthesize essential nutrients as they use the supplied brine shrimp.

Spirulina powder is a suitable diet for *Artemia* growth in the early culture period. In later culture period, these food particles affected the culture medium by their interference at food uptake and propulsion by *Artemia*, otherwise bacterial growth and consequently oxygen demand in cultured seawater.

Rice bran is the optimal food for *Artemia* growth. Their main advantages are low cost and their availability. Although soluble products in the food materials are not taken up by *Artemia* and they will be decomposed by bacteria in the culture medium thereby deteriorating the water quality, the adult *Artemia* was fed the insoluble food material attached to the culture tank and this process provided for water quality. The shrimp meal has good result for *Artemia* growth but at later culture stage, the insoluble particles were decomposed in the bottom of the culture tank and polluted the culture tank. The insoluble products attached the appendages of *Artemia* and disturbed the appendages of *Artemia*.

According to the recent study, knowledge of the life cycle of *Artemia* essential to carry out the culture operation successfully. Nowadays it was found that brine shrimp and their cysts could be produced as a by-product of solar salt-works. *Artemia* is the suitable food sources for most of the cultured finfish and shellfish. Furthermore, a better knowledge of the feeding of *Artemia* was the origin of the development of application in hatchery, nursery and brood stock rearing. All these developments resulted in optimized and cost-effective applications of this live food in hatchery production will help to provide in shrimp farming for development of aquaculture in Myanmar.

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