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SOME BIOLOGICAL CHARACTERISTICS OF ROTIFERS AND THE EFFECT OF DIFFERENT SALINITIES, FOODS AND START DENSITIES ON THE DEVELOPMENT OF ROTIFER POPULATIONS

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SUMMARY Studies on the biological characteristics of rotifers and the effects of various salinities, foods and starting densities on the growth of rotifer populations were performed in 1998 – 1999. The results showed that:

+ The mean size of cultured rotifers (Brachionus rotundiformis – Type S) in Khanhhoa was 173.33± 21.45 μm (S – Type). In the temperatures of 27 - 28^{0}C, the age at maturity was 18.13 ± 1.76 hours; the interval between two spawning times was 3.93 ± 0.53 hours; the total number of egg in one egg laying was 1-3 eggs; the total number of egg produced during one life cycle was 18.1 ± 2.04 eggs; the length of the life cycle was 4.47 ± 0.71 days.

+ The rotifer population developed best in salinities of 15 - 20ppt.

+ In the range of start densities from 5 to 30 inds/ml, higher start densities yielded, higher maximum densities.

+ The best food for rotifers was micro-algae, followed by yeast, mixture of micro-algae and yeast also gave the good result so this could be used to reduce the cost of rotifer production.

MOT SO ÑAC ÑIEM SINH HOC CUA LUAN TRUNG VA ANH HÖÔNG CUA ÑO MAN, THÖC AN, MAT ÑO GIONG BAN ÑAU LEN SÖ SINH TRÖÔNG QUAN THE LUAN TRUNG (BRACHIONUS)

Huynh Minh Sang, Nguyen Van Chung
Vien Hai Döông Hoc

TOM TAT Viec xac ñònh cac ñac ñiem sinh hoc cua luan trung cung nhö cac thí nghiem ve anh höông cua ño man, thöc an va mat ño giong ban ñau len sö phat trien quan the luan trung ñöôc thöc hien trong nam 1998 – 1999. Ket qua cho thay:

+ Quan the luan trung nuoi tai Khanh Hoa (thuoc dang S, vôi ten la Brachionus rotundiformis) co kích thöôc trung bình 173.33± 21.45 μm. Thôi gian thanh thuc la 18,13 ± 1,76h; thôi gian giöa hai lan ñe la 3,93 ± 0,53h; so tröng trung bình trong mot lan ñe la 1-3 tröng; tong so tröng trong vong ñôi 18,1 ± 2,04 tröng; tuoi tho 4,47 ± 0,71 ngay.

+ Quan the luan trung phat trien tot ô ño man 15 - 20‰.

+ Vôi mat ño ban ñau tö 5 - 30 ct/ml thì mat ño cang cao mat ño cöc ñai cang lôn.

+ Thöc an tot nhat cho Luan trung la tao nôn bao. Men banh mì co the la thöc an thay the tao trong thôi gian ngan. Tuy nhien viec ket hôp giöa tao + men banh mì cung cho ket qua rat tot nham giam chi phí san xuat Luan trung.

INTRODUCTION

Diet is one of the most important factors influencing the growth and survival of larval organisms in aquaculture systems. While a number of artificial diets for larvae are currently available, live foods are still believed to be much better in most cases. On one hand, live foods are often more nutritious than artificial diets and on the other hand cause less pollution to the culture environment. Rotifers (Brachionus spp.) are important live foods in aquaculture.

Knowledge about biological characters of rotifer helps us to get high productivity in the culture of rotifer. The previous studies have shown that there are various types of rotifers that develop well in the different conditions of environment especially in different temperatures (Dhert P., 1996). Rotifers have a short cycle life (about 4 days), they can produce 17 – 18 eggs during their life (Le Thi Nga, 1998).

Rotifers can feed on various kinds of foods such as microalgae, yeast, formulated diet… but the best food for them is microalgae (Dhert P., 1996).

In addition, rotifers are able to survive within the salinity range of 1 to 97 ppt, optimal reproduction takes place at salinities below 35 ppt (Lubzen, 1987).

The questions are: what is the type of rotifer in Khanhhoa?, what is the best range of salinities, the best food for the development of rotifer population?. This research seeks to establish the biological characteristics of rotifer growth and reproduction and to establish some of the technical parameters for their culture in the laboratory in Khanhhoa.

MATERIALS AND METHODS

- Rotifers are collected in nature and inoculated in the laboratory.

- The size of 30 adult individuals is measured by using microscope.

- Determination of microalgae density:

+ Count total number of cells in 5 squares of cell counting. (N)

+ Microalgae density = N. 10^5/5.

- Determination of rotifer density: Rotifers were collected at 8h everyday (15 ml was collected). Then they were fixed in 4% formalin. Total number of rotifers had been counted, repeated 3 times and the mean value had been determined.

- Define of biological characteristics: 10 individuals of rotifer bringing egg were put into 10 square plastic container, each square was filled with 1 ml of algae water (10 – 15.10^6 cells/ml). Then they were observed under microscope. After egg hatching out, adults rotifer were removed, young individuals were observed to determine the mean value of the age at maturity (hour), the interval between two spawning times (hour), the total number of eggs in one egg laying (egg), the total number of eggs produced during one life cycle (egg) and the length of the life cycle (day).

- Effect of different salinities, starting densities and foods on the development of rotifer population was studied by experiments performed from February to May 1998. Rotifers were cultured at different salinities (15 ppt, 20 ppt, 25 ppt and 30 ppt), and different starting densities (5 inds./ml, 10 inds./ml, 20 inds./ml and 30 inds./ml) to determine the effect of those to the development of rotifer population. Use three formulas of food: algae, algae + yeast, yeast to determine the effect of food on the development of rotifer population. All of those experiments were repeated three times to define the mean value (as shown in the Diagram of the experiment).

RESULTS

1. Some biological characteristics of rotifers

1.1. Mean size of rotifers

We measured 30 individuals of adult rotifers, defined the mean size of cultured rotifers in order to define the type of rotifer cultured in Khanhhoa (Table 1).

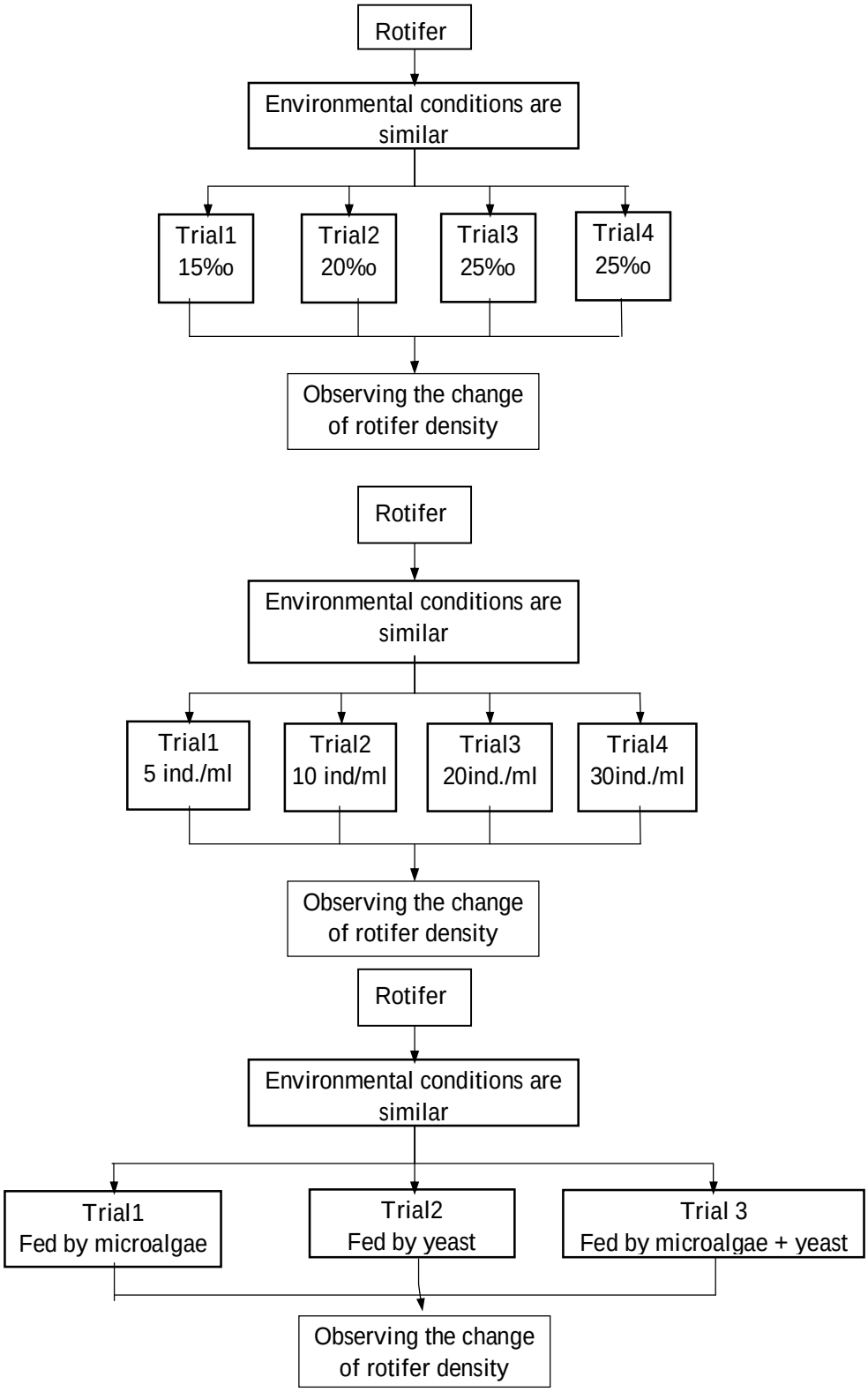

Diagram of experiments: Study on the effect of different starting densities, salinities and foods on the development of rotifer population

Table 1: Mean size of the studied rotifers

Size (μm)	Number of rotifers (ind.)
137.5	4
150	4
162.5	3
175	6
187.5	7
200	6
Mean size	**173.33 ± 21.45** μm

The result in Table 1 shows that the mean size is 173.33± 21.45 μm. According to Hino and Hirata (1977), the mean size of rotifer varies from 100 - 400 μm. Dhert P. (1996) distinguished two types of rotifers:

Brachionus rotundiformis or small (S-type) rotifer: lorica length is 100 to 210 μm (average 160 μm).

Brachionus plicatilis or large (L-type) rotifer: lorica length is 130 to 340 μm (average 239 μm).

Therefore, the population of rotifer in this study is S – type (Brachionus rotundiformis Tschugunoff, 1921).

1.2. Spawning characteristics of rotifers

We studied on spawning characters of rotifer to find out the age at maturity (hour); the interval between two spawning times (hour); the total number of eggs in one egg laying (egg); the total number of eggs produced during one life cycle (egg) and the length of the life cycle (day). The results observed in April - May 1999 at the temperature of 27 – 28^{0}C are shown as follows:

The age at maturity (h)	The interval between egg production (h)	The total number of egg in one egg laying (egg)	The total number of egg produced during one life cycle (egg)	The length of the life cycle (day)
18.13 ± 1.76	3.93 ± 0.53	1-3	18.1 ± 2.04	4.47 ± 0.71

Compare to the results of Le Thi Nga (1998) at temperatures of 31 – 35^{o}C, there are some differences as follows:

Parameter	Temperature	
	27-28^{0}C	31-35^{0}C
Age at mature(h)	18.13	12.97
Total number of egg in life cycle (egg)	18.1	17.70
Length of life cycle (day)	4.47	4.31

According to us, temperature is one of the major factors effecting on those differences.

2. The effect of salinity, starting density and different foods on the development of rotifers

2.1. The effect of salinity on the development of rotifers

The rotifers were cultured in 0.5 litter container, with a starting density of 15 ind./ml, using microalgae (Nannochloropsis sp.) as their food. Results of the experiment are shown in Figure 1.

Rotifers appeared to have better reproductive rates at salinities of 15ppt and 20ppt than at the higher salinities (572-607 and 571-622 inds./ml after four days culture).

The results suggest that rotifers should be cultured within the salinity range of 15 to 20ppt.

While rotifers are able to survive within the salinity range of 1 to 97 ppt, optimal reproduction takes place at salinities below 35 ppt (Lubzen, 1987). Hino (1991) suggested that suitable salinities for the development of rotifers range from 10 – 35 ppt. The results presented here suggest that better reproductive rates are achieved under brackish conditions than that at full seawater salinity, the suitable salinity for the development of rotifers is from 10 to 35 ppt.

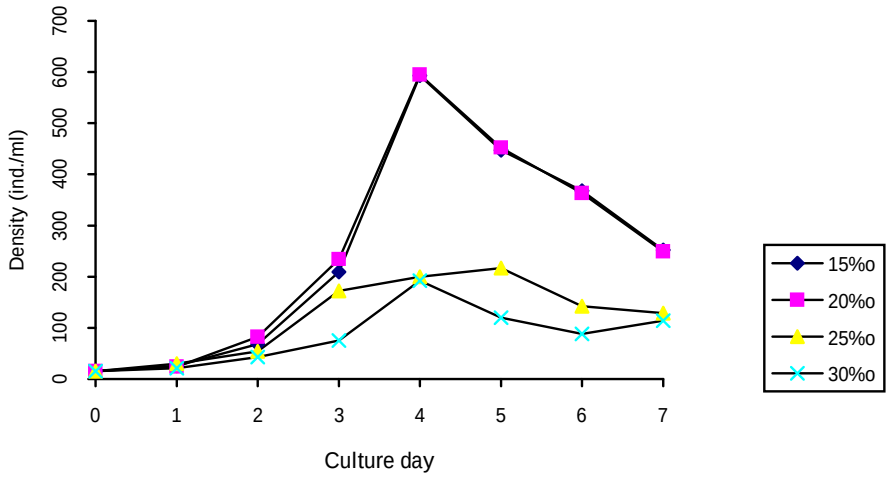

Figure1: The effect of salinity on the development of rotifers

2.2. The effect of different foods on the development of rotifer population

The previous studies have shown that microalgae are the best food for rotifers. However, providing sufficient amounts of micro-algae is often difficult. Yeast is sometimes used as a substitute for microalgae (Hino and Hirata, 1977). We tested the effect of diet on the reproductive growth of rotifers by using either only yeast, only microalgae or a mixture of them.

The culture volume was 0,5 litter. The three different diets were:

1) Nannochloropsis oculata (maintained at the density of 10 – 15.10^6 cells/ml).

2) Saccaromyces cerevisiae 1 – 1.2 gam/10^6 ind./day.

3) Nannochloropsis oculata combined with yeast (maintained at the density of 5 – 8.10^6 cells/ml + 0.5 – 0.6 gam yeast/10^6 ind./day).

The results (Fig. 2) suggest that cultured rotifers fed either on solely micro – algae or micro-algae combined with yeast had the similar reproductive rates (338-369 and 317-351 inds./ml, respectively, after 5 - 6 days), rotifers fed on only yeast gave result worse (185 inds./ml after 4 days).

According to Hirata and Mori (1976), rotifers fed only on yeast had low reproductive rates and couldn't be maintained for an extended period of time. Yeast is lacking in some unsaturated fatty acids, vitamin B_{12} and cystine, all of which are necessary for the

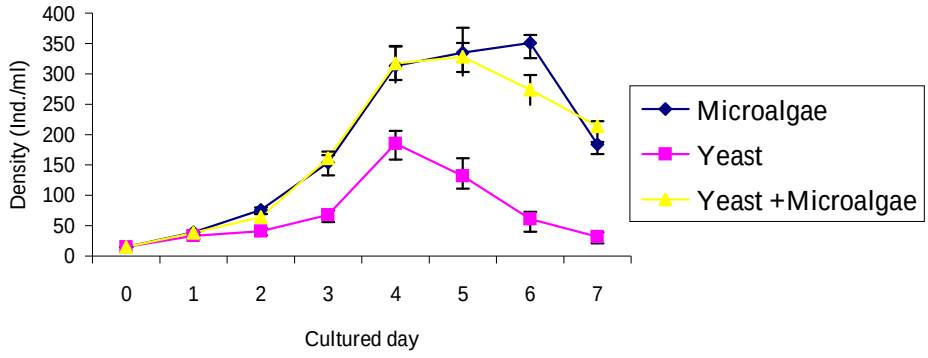

Figure 2: The results of cultured rotifers with different foods

development of rotifers. The results from this study suggest that using a mixture of microalgae and yeast to feed rotifers may be the best economically effective way to obtain high reproductive rates.

Our results are coincided with the results of Cai Ngoc Bao Anh (1998) and Le Thi Nga (1998). They both had conclusion that mixture of microalgae and yeast is the good food for rotifer.

2.3.The effect of starting density on the development of rotifer

The culture tanks were maintained at a salinity of 18-20ppt, with temperature of 27 - 28^{0}C and pH of 7.5 - 8; the rotifers in different tanks were fed by the same amount of mixture of yeast and algae.

The maximum rotifer densities change with different starting densities.

The maximum density tends to be higher in cultures with higher starting density. The reason may be the higher starting densities the more individuals participate in productive process.

The reproductive rate increases when the starting density decreases. In 5 Ind./ml trial, the maximum density is 47.4 times more than the starting density. At 10 inds./ml, this figure is 33.1; at 20 inds./ml it is 18.75 and at 30 inds. /ml the maximum density is 16.23 times greater than the starting density.

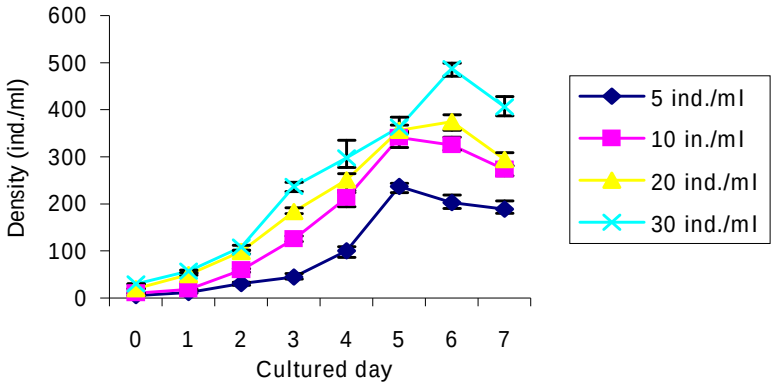

Figure 3: The effect of starting density on the development of rotifer population

CONCLUSIONS

1. The mean size of cultured rotifers in Khanhhoa was 173.33± 21.45μm is Brachionus rotundiformis Tschugunoff, 1921 (Type S).

2. In the temperatures of 27 - 28^{0}C, the age at maturity was 18.13 ± 1.76 hours; the interval between two spawning times was 3.93 ± 0.53 hours; the total number of eggs in one egg laying was 1-3 eggs; the total number of eggs produced during one life cycle was 18.1 ± 2.04 eggs; the length of the life cycle was 4.47 ± 0.71 days.

3. This rotifer population developed best at salinity range of 15 - 20ppt.

4. The best food for rotifer was micro-algae; mixture of micro-algae and yeast also gave a good result. So that could be used to reduce the cost of rotifer production.

5. In the range of initial densities from 5 to 30 inds./ml, the higher initial densities the higher maximum densities.

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