CHAPTER III

Egg hatching in Streptocephalus dichotomus

Growth in relation to volume of water
EGG HATCHING IN STREPTOCephALUS DICHOTOMUS

Temperature, dessication (degree and time), osmotic changes and relative concentration of sodium, potassium, magnesium, calcium and sulphur in the medium, are some of the factors influencing the hatching of eggs of anostracan fauna of temporary ponds.

Hall (1959 a, b, c) and Nourisson (1958, 1960, 1961) made comprehensive studies on Chirocephalus diaphanus. Hall found that besides temperature, osmotic changes, dessication, and deep immersion of eggs inhibit the development of eggs. While Nourisson found that deep immersion of eggs has no significant effect on hatching of eggs, but temperature definitely has the significant effect. Low temperature particularly, retards egg hatching drastically. Prophet (1963) found that Eubranchipus serratus Forbes, were found in temporary pools in Kansas, Oklahoma, in winter while Streptoccephalus sealii Ryder, were found in summer in the same pools. He observed that the temperature of 10°C. was not good for hatching of eggs of the summer species S. sealii, while temperature 6°C. was good enough for the winter species E. serratus and that their eggs would not hatch at 15°C. and more. Moore (1955) observed that S. sealii in Louisiana occurred almost every month in large and small pools and the adults could survive in a broad range of 5°C. to 42°C. Later, the same author (Moore, 1963) observed that there was no significant hatch of these eggs in the shaded ponds in winter.
He further observed that even when a favourable habitat temperature was attained, the eggs would not hatch for several weeks after initial flooding of the ponds. The same author (Moore, 1967) working on factors affecting the hatching of eggs of *S. seali* observed that the hatch at room temperature of 20°C to 21°C was about 95% to 50% while at temperature 10°C and 28°C, the adjusted percentage of hatch was 5.4 and 1.0 respectively. The best percentage of hatching at 20°C to 21°C was 72.6. The adjusted percentage hatch of eggs acclimated to 10°C and then raised to 25°C was zero, while the adjusted percentage of hatch of eggs acclimated to 20°C and varied from 19°C to 23°C was 84%. He further found that eggs kept at relative humidity of storage at 0%, rarely hatched. The maximum percentage of hatch was 1.3. With 100% relative humidity the percentage hatch was 66 which was the maximum.

In the present study, an attempt was made to observe the effects of dessication and daily water temperature maxima and minima for a few days in winter and summer, both in the field and laboratory.

Air dried eggs in the egg-case or with some soil attached and with ambient humidity of storage (40% and 20%) were taken as control. Eggs that would sink in water within thirty minutes were taken as viable eggs for experiments. These eggs were immediately recovered, quickly dried in the Sun, on blotting paper and stored for experiments. These eggs
with a little soil were then subjected to a temperature range of 5°C., 10°C., 20°C., 25°C., 30°C. and 40°C. for a period of four weeks. These eggs were then put in water already seasoned for five to eight days with about 10 gms. of soil to a litre of tap water and filtered through coarse filter paper. Percentage hatch and period required for hatching were then recorded. Results were recorded in Table No. 3 and Figure 5.

Eggs subjected to temperature 5°C. and 60°C. for over a period of four weeks did not hatch while those subjected to a temperature 10°C. took more than eight days to hatch and the percentage was zero or as low as 0.5.

The ambient temperature and the water temperature fluctuates from 10°C. to 32°C. and 10°C. to 26°C. respectively in winter (October to February) and 20°C. to 40°C. and 16°C. to 32°C. respectively in summer (in the ponds that survive till April). From March to June, the air and water temperature fluctuates between 22°C. to 28°C. and 10°C. to 25°C. in rainy season (July to September).

It was observed that in open habitats following monsoon flooding of the ponds, the eggs hatch in the first few days. Samples collected after three days of filling the ponds contained 1 mm. to 2 mm. larvae. Later, in the beginning of September, another brood was observed in quite a few ponds. This was understandable in the beginning but later it was observed that dust blowing over these ponds brought the eggs
and deposited them on the water of still existing ponds. It was observed during the period 1971 to 1975 that all ponds do not have new broods in September - October period. Some have very large populations and some do not have any in one season and the position may become reverse in the next.

**GROWTH IN RELATION TO VOLUME OF WATER**

While performing various experiments with *Streptoccephalus dichotomus*, it was observed that the animals in the laboratory conditions, i.e. in the culture dishes, hatch earlier than in the pond water. Bernice (1972) on the same species observed that there was 70% to 80% hatch of eggs on first day in the culture dish with distilled water. Whereas in nature, the nauplius was observed only after four to five days, after the first rain in the ponds.

Further in the post-embryonic development the fairy shrimp attends its complete development and become mature within a short period of twentyeight to thirty days and females become fully packed with eggs after about six to eight weeks in the laboratory conditions. Whereas in the nature, (habitat pond water) they attend their maturity not earlier than fourteen weeks. There are some temporary ponds which last till the end of April. In these ponds mature animals were collected in the month of February i.e. after thirty to thirtyfive weeks of first rain flushing.
It was also observed that the life span of these animals in the laboratory conditions was very short i.e. up to ten to twelve weeks only. In that period, the animals attain the maximum length of 20 mm. to 22 mm. whereas the animals collected from open ponds in February ranged from 30.0 mm. to 35.5 mm. in length. Some experiments were set to study the relation of volume of water with the period of development and life cycle.

**MATERIALS AND METHODS**

Five sets of experiment were arranged consisting each of twenty fairy shrimps. The first set was a glass jar of about 3.5 litre in volume. Second set was a glass pan of about 7.5 litre in volume. Third set was a small aquaria of 15 litre in volume. Fourth set was a large aquaria of 25 litre in volume and fifth set was an experimental pond of about 6 metre in length, 2 metre in width and 1 metre in depth. In all the experiments the same pond water was used to ensure that the environmental conditions were the same (pH 7.9, total alkalinity 180.0 ppm., oxygen 21.23 mg./litre, ammonia 10.0 ug. at NH₃ H/litre). In all the four experimental jars water level was maintained to compensate evaporational loss.

The larvae were collected from the experimental pond and were introduced in set number I, II, III and IV which were of two weeks old. Each set was having twenty larvae. The total length was recorded for every week. The water was changed once a week.
OBSERVATIONS AND RESULTS

It was observed that the shrimps in set I became mature earlier than in any other set. The females in set I were full of eggs in sixth week and all of them died after ten weeks. In set II the shrimps became mature after eight weeks and completed their life cycle after twelve weeks. The animals in the small aquaria of set III matured after thirteen weeks and completed their life span within sixteen weeks, whereas the shrimps in the large aquaria matured after nineteen weeks period. The shrimps in the pond of set V matured after twenty-four weeks and died after twentyseven weeks.

DISCUSSION

Baqai (1963) working on *Streptocephalus seali* observed that the shrimps attain 18 mm. of length after twentyeight days in laboratory conditions. At this stage immature eggs were developing in the brood pouch. Bernice (1972) working on *S. dichotomus* observed that after twentyfour days it attains 13 mm. to 14 mm. length and immature eggs were observed in the females. Whereas after thirty days it attains 16 mm. to 17 mm. of length in the laboratory conditions i.e. in the culture dishes having about one litre of pond water.

In the present experiment with *S. dichotomus* it was
observed that with the 3.5 litre of pond water the shrimp attains 19 mm. length in six weeks period and completes its life span within ten weeks. As the volume of water increases, there was an increase in period of reaching maturity and completing the life span. The shrimp in set V attains the size of 30 mm. length after twentyfour weeks period and becomes fully mature after twentyfour weeks.

It seems that the volume of water has a direct relation with the life span of the Streptocephalus dichotomus. It appears that in nature the animal fully adapts to the changing environmental conditions, the principal one being the amount and the period of availability of water.
**TABLE 3**

Influence of subjecting the eggs of *S. dichotomus* to various temperatures for four weeks.

<table>
<thead>
<tr>
<th>Storage conditions</th>
<th>No. of observation</th>
<th>No. of eggs tested</th>
<th>No. of eggs hatched</th>
<th>% hatch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sundried</td>
<td>3</td>
<td>300</td>
<td>205</td>
<td>68</td>
</tr>
<tr>
<td>20°C.</td>
<td>3</td>
<td>300</td>
<td>215</td>
<td>72</td>
</tr>
<tr>
<td>25°C.</td>
<td>3</td>
<td>300</td>
<td>206</td>
<td>68</td>
</tr>
<tr>
<td>30°C.</td>
<td>3</td>
<td>300</td>
<td>144</td>
<td>48</td>
</tr>
<tr>
<td>40°C.</td>
<td>3</td>
<td>300</td>
<td>105</td>
<td>35</td>
</tr>
</tbody>
</table>

Experimental conditions:

- Daily temperature range in laboratory: 15°C to 28°C
- Ambient humidity: About 60%
- Direct Sunlight: For over 60 minutes every day.
FIGURE - 5

Growth in relation to volume of water in terms of length and maturity of *Streptocephalus dichotomus*.

M 1, M 2, M 3, M 4 and M 5 indicate the stage of maturity.

The terminal end of each curve in the first four experiments indicate completion of the life span.

- $\emptyset$: Volume of water 3.5 litre
- $\Diamond$: Volume of water 7.5 litre
- $\bigcirc$: Volume of water 15 litre
- $\times$: Volume of water 25 litre
- $\bullet$: Experimental pond
Figure 6

Effect of temperature on period of hatching in terms of percentage hatch.

0 : The eggs from Aurangabad were subjected to 20°C., 30°C., 40°C. at humidity under 5% for 30 days before hatching.

0 : The eggs from Panhala were subjected to 10°C. and 5°C. at humidity under 5% for 30 days in sealed ampules before hatching.
Effect of temperature on period of hatching

Egg hatch, %

Hatching period in days

- 20 °C
- 30 °C
- 40 °C
- 5 °C
- 10 °C


Hall, R.E. (1959 c) : The development of eggs of *Chirocephalus diaphanus* Prevost in relation to depth of water. Hydrobiologia 14 : 79-84.


