

SOME OBSERVATIONS ON THE RESPIRATION OF NEWLY RECORDED *SOLETELLINA VIOLACEA* (LAMARCK)

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ABSTRACT

The rate of oxygen consumption in *Soletellina violacea* (Lamarck) was affected by the environmental factors. It is recorded for the first time in India. The rate of oxygen consumption was increased along with decreased salinity. The rate of oxygen uptake did not change between 30 - 32‰. Below normal pH of 7.4 the rate of oxygen uptake was increased, but above that pH the rate was decreased with increase in temperature from 25 to 35°C, the rate of oxygen uptake increased stepwisely, but decreased sharply from 37°C upto 40°C. The starvation of this bivalves for four days resulted in 50% reduction in the rate of oxygen uptake.

INTRODUCTION

SEVERAL hydrological factors are known to affect the respiration of *Soletellina* directly and indirectly. The rate of oxygen consumption under the various environmental conditions are well documented by many investigators in marine and estuarine clams. *Meretrix meretrix* (Deshmukh, 1972), *M. striata* (Nagabhushanam, 1966), *Katelysia opima* (Mane, 1975).

The present investigation was undertaken to study the effect of salinity, pH, temperature and starvation, on the rate of oxygen uptake in *S. violacea* (Lam.). It is recorded for the first time in India off Mithbav Creek.

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MATERIAL AND METHODS

The bivalves *S. violacea* (Lam.) were collected from the Mithbav Creek. The specimens were brought to the laboratory, cleaned to remove the mud, sand and other sedentary organisms. As soon as the specimens opened their shell valves, the experiment was started and the

oxygen content of the seawater was determined before and after the experiment. The oxygen content of water samples was determined by the standard winkler's method. The bivalve shucked for their flesh, blotted to remove excess of water and weighed accurately. The results of each experiment are based on five determinations and expressed as oxygen uptake ml/gm/hr.

RESULTS

Low salinity

The batches of bivalves were subjected to different low salinities (8.2, 11.9, 15.7, 20.8, 25.1, 27.6, 30.0 and 32.2‰) for 2 to 3 hours before the start of experiment. The normal seawater (32.2‰) and pH (7.4) constant, the oxygen consumption in each salinity was determined. The results presented in Table 1 show

TABLE 1. Oxygen consumption in relation to salinity in *Soletellina violacea*

Salinity (‰)	mlO ₂ /gm/hr
10.2	0.321
13.5	0.415
20.9	0.506
25.0	0.491
28.1	0.310
30.0	0.228
32.2	0.215

that the rate of oxygen uptake was slightly decreased from 25.0‰ and below 25‰ the respiratory rate was decreased and above increased. The rate of oxygen uptake was gradually increased from 8.2‰ to 25‰, but suddenly dropped from 25.0‰ to 27.6‰ and then remained it somewhat steady.

pH

The rate of oxygen uptake was determined of 6 different pH. To obtain the required pH of the medium, dilute HCl or NaOH was added to normal sea water heavy pH 7.4. The results in Table 2 show that the rate of oxygen

TABLE 2. *Oxygen consumption in relation to pH in S. violacea*

pH	mlO ₂ /gm/hr
5.6	0.325
6.4	0.407
7.4	0.419
8.0	0.325
8.2	0.315
8.7	0.278

uptake was increased in low pH and decreased in high pH compared to the rate of 7.4 pH. The rate of oxygen consumption was 0.419 at 7.4 pH, but below this decreased gradually and suddenly dropped between 8.2 to 8.7 pH.

Temperature

Batches of bivalves were exposed to five different temperatures for 2 to 3 hours before the start of experiment. The respective temperature of the experimental media was thermostatically adjusted and kept constant. The salinity and pH were also kept constant (32.2‰ and 7.4 pH). The results presented in Table 3

TABLE 3. *Oxygen consumption in relation to temperature in S. violacea*

Temperature (°C)	mlO ₂ /gm/hr
20.5	0.281
25.0	0.306
30.0	0.341
35.0	0.403
40.0	0.131

show that the rate of oxygen uptake increased with increase in temperature upto 35° C and then suddenly decreased sharply at 40° C; this temperature is now the lethal temperature of the bivalve.

Starvation

Few bivalves were removed from the sea water and kept for starvation in the sea water which was double filtered through Whatmann filter paper so that no micro-organisms could remain in sea water. During the starvation period there was maximum siphonal activities to get food. On each day the oxygen uptake of the bivalves was determined for a period of five days. The result in Table 4 shows that

TABLE 4. *Oxygen consumption in relation to starvation in S. violacea*

Starvation period (in days)	mlO ₂ /gm/hr
1	0.301
2	0.275
3	0.157
4	0.085
5	0.085

the rate of oxygen uptake gradually decreased as the starvation period increased and 50% decreased in the rate took place on the third day of starvation, thereafter suddenly dropped to steady level.

DISCUSSION

Changes in salinity, pH, temperature and starvation are known to affect the rate of oxygen consumption in aquatic poikilothermic animals. In a number of euryhaline invertebrates, the rate of oxygen consumption varies inversely to the changes in the salinity of the external medium, Schwade (1933) showed that the rate of oxygen consumption of *Careinus maenus* increased in hypotonic media. It was noted that the decrease in salinity of the external medium caused increase in metabolism of animals (Schlieper, 1929; Winkren, 1953).

In the present study the oxygen uptake of *S. violacea* increased upto 25.0‰, beyond this salinity it decreased. Deshmukh (1972) showed that in *M. meretrix* oxygen consumption increase beyond 70‰ sea water.

Holff (1928) showed that the rate of oxygen uptake in *cambarus* was not dependent on the changes in pH of the external medium. Gopalakrishnan (1957) also found that in *Metapenaeus monoceros* the oxygen consumption was not directly affected by the changes in pH while Powers (1930) found that fishes are affected directly by increase or decrease in the pH of the medium. Nagabhushanam (1966) showed that the maximum rate of oxygen uptake in pH 6.4 and the minimum in pH 8.2 in *P. laterisulca*. In the present investigation the oxygen uptake increased gradually upto pH 7.4.

The rate of metabolic activity is mostly seen to increase with increase in temperature upto

certain level. Correlated with these activities the rates of routine and active oxygen consumption also increase markedly with temperature as in *Mytilus edulis* (Bayne, Thompson and Widdows 1973). In *Martesia striata* a little increase in oxygen uptake with the rise in temperature from 24° - 33° C was recorded by Nagabhushanam (1966). In *S. violacea* increase in oxygen uptake was observed with the rise in temperature from 20.5 - 35° C and then sharply decreased as the temperature reached 40° C.

Studies on the effect of starvation on the metabolism of poikilotherms are very few, such studies show that oxygen consumption of the animals decrease rapidly in the initial periods of starvation reaching a steady level (Roberts, 1957). The same phenomenon was witnessed in case of *S. violacea*.

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