Photoperiodic Stimulation of Ovary & Testis Maturation in the Immature Marine Crab, *Scylla serrata* Forskal

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Increase in ovarian index, testis index and oocyte diameter of the crabs exposed to 14L: 10D, 16L: 8D and 18L: 6D photoperiods was observed. The crabs exposed to 10L: 14D, 8L: 16D and 6L: 18D did not show any change over the control (12L: 12D group) crabs.

Functional adaptation to withstand a particular environmental parameter is necessary for the survival of the organism\(^1\). The environmental factors of the intertidal zone, to which the crab *Scylla serrata* belongs, show wide fluctuations and the crab has to face extreme conditions than other marine organisms\(^1\).

In crustaceans photoperiodic regulation of ovarian maturation has been studied\(^2\)\(^-\)\(^7\). However, the role of photoperiod in the reproductive processes of intertidal crustaceans is poorly understood. Knudsen\(^8\) has shown in the crabs *Hemigrapsus nudus* and *Lophopanopeus bellus* that copulation begins during and continues after the shortest day in the year as photoperiod lengthens. While Segerstrale\(^9\) has shown that maturation is induced by decrease in illumination in late summer. However, role of photoperiod in the reproductive process in the crab *S. serrata* has not been studied so far. The present communication describes the effect of photoperiod on ovarian and testis maturation of *S. serrata*.

Immature male and female *S. serrata* of intermoult stage (stage C), ranging from 7-7.2 cm in carapace width and 90-100 g in weight, were collected from the Karla backwaters, Ratnagiri, West coast of India. They were acclimated to the laboratory conditions under constant temperature (24°C) and salinity (33‰) for about 1 week before the experiment. They were fed *ad libitum* on clam meat twice a week. Water of the aquaria was changed twice a day. Male and female crabs were grouped into groups A to J of 10 each (Fig. 1). Group A (initial control) crabs were sacrificed before the experiment, whereas, remaining groups of crabs (groups B to J) were sacrificed after 1 month of the respective experimental conditions (Fig. 1). Ovaries and testes were dissected and fixed in aqueous Bouin’s fluid. Tissues were dehydrated and embedded in paraffin wax (58-60°C). Serial sections (6 μm) were cut and stained with Harris’ haematoxylin-eosin. Oocyte diameters were measured with an ocular micrometer.

A fluorescent light of 10 ftc was used for the photoperiodic regimens shown in Fig. 1. Ovarian index and testis index were calculated using formulae\(^10\).

Ovarian index = \( \frac{\text{wet wt of ovary} \times 100}{\text{wet wt of crab}} \)

Testis index = \( \frac{\text{wet wt of testis} \times 100}{\text{wet wt of crab}} \)

Significant increase \((P < 0.05)\) in ovarian and testis index was seen (Fig. 2). Previtellogenic oocytes change to vitellogenic oocytes after exposure to 14L: 10D, 16L: 8D, 18L: 6D photoperiodic regimens and constant light as revealed by increase in the oocyte diameters (Fig. 3). However, all these parameters in crabs exposed to 10L: 14D, 8L: 16D and 6L: 18D did not show significant change \((P > 0.05)\) over the control (12L: 12D group) crabs.

The data show that 14L: 10D, 16L: 8D and 18L: 6D photoperiod and constant light increase oogenesis and testis index in immature *S. serrata*. An increase in the ovarian index in mature *S. serrata* exposed to 16L: 8D photoperiodic regimen has also been reported earlier\(^11\). The present results are in good agreement with the earlier observations\(^2\)\(^,\)\(^3\)\(^,\)\(^5\), wherein, photoperiod is shown to cause more rapid cycling of the maturation and resorption of oocytes. However, Segerstrale\(^9\) in an amphipod *Pontoporcia affinis* has demonstrated that a decrease in the illumination in late summer caused gonadal maturation. He has shown that the decrease in light during summer triggers maturation process rather than temperature. This hypothesis is supported by the finding that *P. affinis* in baltic waters breeds during both cold and warmer periods at depths extending 100 m, in spite of low light penetration at these depths\(^4\).

In the present study 14L: 10D, 16L: 8D and 18L: 6D photoperiods are effective for the gonadal maturations
Fig. 1—Experimental conditions and photoperiodic regimens to which immature male and female *S. serrata* were exposed.

Group A: Initial control (Exposed to 16L:8D, photoperiod)

Group B: Exposed to 12L:12D subnormal light condition (Simultaneous control)

Group C: Exposed to 6L:16D, photoperiod

Group D: Exposed to 8L:16D, photoperiod

Group E: Exposed to 18L:18D, photoperiod

Group F: Exposed to 16L:8D, constant light

Group G: Exposed to 16L:8D, constant dark

Group H: Exposed to 6L:24D, constant light

Group I: Exposed to 6L:24D, constant dark

Group J: Exposed to 12L:12D, constant light

Fig. 2—Ovarian index, testis index and oocyte diameter of immature *S. serrata* exposed to various photoperiodic conditions for 1 month.
indicating that long-day photoperiod favours the
reproductions. These observations are supported by
the finding that more mature crabs are found in the
catch during May-June, when days are long
(14L:10D)\textsuperscript{1,2}. But in the barnacle, \textit{Balanus balanoides}
Crisp and Patel\textsuperscript{7} found that the field studies and the
laboratory observations do not coincide with each
other. They have observed that the breeding in these
barnacles was delayed by 3 months in the laboratory,
when subjected to a condition similar to that of the
field.

References
1 Vernberg W B & Vernberg F J, \textit{Environmental physiology of
marine animals} (Springer-Verlag, Berlin, Heidelberg, New
York) 1972.
10 Giese A C & Pearse J, \textit{Reproduction in marine invertebrates'}
11 Nagabhushanam R & Farooqui U M, in \textit{First All India
Symposium on Invertebrate Reproduction}, University of
Madras, Madras, 1980.
12 Nagabhushanam R & Farooqui U M, Unpublished data.