TEMPERATURE AND SALINITY REQUIREMENTS FOR EMBRYONIC DEVELOPMENT OF SACCOSTREA CUCULLATA (BORN)

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ABSTRACT

The oyster Saccostrea cucullata is one among the commercially important bivalves of India. The combined effects of temperature and salinity was studied, and temperatures ranging from 25 to 30°C and salinities between 25-35% were found optimum for embryonic development.

Key-words: Temperature, salinity, embryonic development, Saccostrea cucullata.

Studies on the tolerance of embryos and larvae of commercially important bivalves to various environmental parameters help to clarify the relationship between the environment and the developmental stages of shellfish which are more sensitive. Several such bivalve larvae have been reared and summarized by Loosanoff and Davis (1963), Walne (1964) and Chanley and Andrews (1971). Combined effects of temperature and salinity on embryonic and larval development of several species has been reported. (Davis and Calabrese, 1964; Calabrese 1969; Hrs-Benko and Calabrese, 1969; Lough and Gonor, 1973a, b).

Awati and Rai (1931) observed the early development of Ostrea (Saccostrea) cucullata after artificial fertilization from Bombay waters. The oyster S. cucullata, a commercially important edible bivalve occurs on the east and west coasts of India. At Porto Novo, this oyster rarely occurs at the marine zone of the Vellar estuary and is associated with the edible oyster Crassostrea madrasensis. The present study is an attempt to investigate the combined effects of temperature and salinity on the early development of S. cucullata.

Sexually matured adults of S. cucullata collected from natural population of Porto Novo (Lat 11°30'N; Long 79°40'E) and Cuddalore waters, were thoroughly cleaned before placing them in trays for spawning. Batches of 8-10 oysters were taken at a time and spawning was induced by increasing water temperature, and by addition of sperm extract as suggested by Loosanoff and Davis (1963). After spawning, the eggs were screened employing bolting silk of fine mesh (45 µm) and placed in fingerbowls containing sterilized sea water. Artificial fertilization was also found to be effective in this species apart from induced spawning.

Salinity was measured by argentimetric titration method of Strickland and Parsons (1972) and the experimental salinity range was obtained by diluting the sea water by adding distilled water/rainwater (Salt free, stored in fibre glass tank). The experimental lower temperature was maintained by cool water flow system and higher temperature was maintained in an air incubator.
The fingerbonds, conical flasks, flat bottom flasks and pipettes for experimental use were thoroughly cleaned, washed and chemically sterilized (using chlorine water) and rinsed with distilled water, to prevent contamination. To study the development of embryos to straight hinge stage larvae, fertilized eggs were placed in 500 ml conical flasks or flat bottom flasks containing sea water (filtered through sand filter and subsequently autoclaved at 15 lb/sq. inch for 15 minutes) and observed for 30 hours. Experiments with combined variables of temperature and salinity were conducted at temperatures ranging from 20 to 35°C at intervals of 5°C ± 1°C and salinities from 10 to 35 ppt at intervals of 5 ppt. The cultures were not aerated and the larvae were not fed.

Early development:

In the present study, the first polar lobe developed fully in 40 minutes after fertilization, and extrusion of the second polar body occurred 5 minutes after the first polar body had developed. After 1 hr and 40 minutes of fertilization a two celled stage was reached, and within 10 minutes of this stage a 4 celled stage was observed. Further, cell division was rapid, resulting in an gastrula stage after 5 hours and thereupon reaching to trochophore stage after 10-12 hours. The final stage—the veliger (straight hinge stage) was observed between 20-25 hours after fertilization.

Temperature and salinity requirements:

Average value (statistically not treated) of the triplicate experiments conducted on temperature and salinity requirements for the development of *S. cucullata* from embryo to straight hinge stage larvae are shown in Table I. Nearly 70% of the cultures were found to develop at 25 and 30°C at salinities of 20-35 and 20-25%o respectively (The figure-70% is considered ecologically significant by Davis and Calabrese 1964). Embryonic development was found to decrease at 15%o and 30%o salinities & at temperatures of 25°C and 30°C respectively. Early embryonic development was found to cease totally at 20°C and 35°C irrespective of salinity.

Based on the current observations it is inferred that the early development of *S. cucullata* occurs at optimal temperatures ranging from 25 to 30°C with salinities from 25 to 35%o. Both temperature and salinity exerted significant influence on early development. Rearing of *S. cucullata* embryos at their respective optimal temperature — salinity levels would therefore increase the efficiency of culture of this bivalve.

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Table I. Percentage development of Saccostrea cucullata embryos to straight hinge larval stage at different combinations of temperature and salinity.

<table>
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REFERENCES


