STUDIES ON THE CEPHALOCHORDATES OF THE MADRAS COAST
XIII. SALINITY TOLERANCE OF AMPHIOXUS, *BRANCHIOSTOMA LANCEOLATUM*

ABSTRACT

The present work is a report on the salinity tolerance of the lancelet *Branchiostoma lanceolatum* of the Madras waters. Lancelets were maintained in glass troughs (30.5 × 15.0 cm) under about 5 cm of sea-water of salinity 34‰. Samples of 10 lancelets of the same size were transferred to media of low salinity after an acclimation period of 15 days in sea-water of 34‰. It was noted that on direct and sudden transfer there was one hundred per cent mortality of lancelets in sea-water of 10‰ and 17‰; 50% mortality in 26‰ and nil morality in 29‰. Further, survival is possible upto 14‰ only, when the lancelets are taken through a graded series of sea-water of above mentioned salinity with about 48 hrs of acclimation in each medium. Results are discussed with reference to the ability of amphioxus to invade estuarine waters, and the general flexibility of osmoregulation in marine lancelets is stressed.

THE degree of tolerance to changes in salinity is an important factor in the distribution of marine organisms. The information available regarding the salinity tolerance of amphioxus is meagre. However, some work has been done on *Branchiostoma nigeriense* by Webb and Hill (1958) who have reported that the lower threshold salinity for adult *B. nigeriense* is 13‰. Further, Chin (1941) working with *B. belcheri* found the lower limit to be 19.2‰. These results indicate that different species may show different degrees of tolerance to salinity changes.

B. lanceolatum of the Madras coast has been recorded both from marine and estuarine habitats (Azariah, 1965 ; Sanjeeva Raj and Azariah, 1967). In order to survive, lancelets may show some degree of tolerance to changes in salinity and also some powers of osmoregulation. It is of interest, therefore, to study the salinity tolerance of amphioxus.

Lancelets of the species *B. lanceolatum* were dredged from the inshore waters of Madras. They were maintained in the Laboratory in glass troughs (30·5 × 15.0 cm) under about 5.0 cm of sea-water of salinity 34‰. Lower salinity (29‰, 26‰, 17‰, 14‰ and 10‰) were made up by adding distilled water to sea-water. Samples of ten lancelets of the same size group were transferred to glass containers holding about 200 ml of the test solution. The experimental set up was placed in a cool and dark chamber. Fresh sea-water of appropriate salinity was changed on alternate days. In assessing the death of lancelets the method of Webb and Hill (1958) was followed in which the loss of muscular movements and distinct signs of opacity of the body were taken into consideration.

A series of experiments on *B. lanceolatum* was carried out to find out the lower limits of salinity tolerance when the changes in salinities are sudden and drastic. Lancelets that were acclimatized in sea-water of 34‰ for a period of 15 days were transferred in batches of 10 to sea-water of varying salinity. On such direct transfer it was noted that within a period of one hour all the lancelets in sea-water with salinity 10‰ and 17‰ were incapable of movement and showed distinct signs of opacity. However, lancelets in sea-water of 26‰ and 29‰ salinity were all healthy and showed normal signs of activity. On the subsequent day (second day) there was a 10% mortality of lancelets in sea-water of 26‰ while on the third day the mortality rate rose to 50%. The remaining 50% of lancelets in sea-water of 26‰ and the lancelets in 29‰ were all healthy and actively feeding. From the foregoing observations it may be inferred that the lancelets are incapable of survival in sea-water of salinity below 17‰ and the tolerance is limited in sea-water of salinity 26‰.

The lancelets, acclimatized in sea-water of 26‰ and 29‰ were taken through a graded series of sea-water to study whether the lancelets are able to adjust their osmotic behaviour when the changes in salinity are gradual. On the fourth day i.e. after three days of acclimatization in 26‰ and 29‰, the lancelets were transferred to 22‰ and 26‰ respectively. It was observed that the lancelets were all healthy. After a period of 48 hours of acclimatization in sea-water of 22‰ and 26‰, these lancelets were transferred to 17‰ and 22‰ respectively (on the sixth day of the experiment) from the former media. On such transfer it was found that the lancelets were able to swim actively suggesting their good health. With 48 hours of acclimatization in 17‰ the lancelets were transferred to sea-water of salinity 14‰ and it was noted that all the lancelets were inactive and the body became opaque within a period of 6 hrs. Similarly the lancelets acclimatized in 22‰ for 48 hours when transferred to 17‰ (on the 8th day) were normal and healthy. They were again acclimatized in 17‰ for 48 hours and then transferred to sea-water of 14‰ in which medium the lancelets lost their muscular movements and the body became opaque within 6 hrs. Thus it would appear that the lancelets of the Madras coast may be able to tolerate salinity as low as about 14‰ when they are taken through a graded series of sea-water with an acclimation period of about 48 hours at each stage.

In many marine invertebrates, tolerance of hypotonic conditions has helped to invade estuarine areas. *B. lanceolatum* is mostly marine in its distribution and is stenohaline in its behaviour. Nevertheless, the limits of its tolerance of dilution as well as its endurance under unfavourable osmotic conditions seems to be an adaptation for the lancelets to invade estuarine waters where a salinity gradient is to be expected from the mouth of the estuary to the interior. However, its limited tolerance in sea-water of 26‰ may explain the limited number of their occurrence in estuarine waters.

From a study on the salinity tolerance of *B. nigeriense* Webb and Hill (1958) suggested that the osmoregulatory powers of different species of lancelets are not the same. In the present study the observation that 50% of *B. lanceolatum* are able to survive in sea-water of 26‰ and the possible extension of lower limit upto 14‰ when the salinity changes are gradual seems to confirm the general flexibility of osmoregulation in marine lancelets.

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