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IN VIVO DISSOLUTION AND REFORMATION OF CRYSTALLINE STYLE IN CERTAIN INTERTIDAL BIVALVE MOLLUSCS

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ABSTRACT

The intertidal bivalve molluscs, *Anadara rhombea, Crassostrea madrasensis, Meretrix meretrix, M. casta, Katelysia opima* and *Donax cuneatus* were exposed to environmental stresses viz. starvation and desiccation to find out the permanence of the style. Total dissolution of crystalline style was observed except in *D. cuneatus*, where it persisted till death (192 h). The style dissolved and disappeared faster under desiccation (0.5 to 72.0 h) than under starvation (120 to 168 h). When the bivalve species without style were immersed in high tide water, a new style was reformed uniformly within a short time (2-3 h) in all species. A mechanism of style dissolution is proposed. The significance of style dissolution and reformation is also discussed.

Key-words: Crystalline style, dissolution, reformation, bivalves.

The crystalline style is a secreted rod of glycoprotein lodged in the midgut of most bivalves and in some gastropods, aiding in the extracellular digestion. *In vivo* dissolution of the crystalline styles was observed under desiccation (Nelson, 1918) and starvation (Edmondson, 1920 and Owen, 1966) for a number of marine bivalve species. The style was also observed to be dissolved and reformed in each tidal cycle in the oysters, *Crassostrea gigas* (Morton, 11977) and *C. madrasensis* and in the blood cockle, *Anadara rhombea* (Hameed, 1984). However, in species like *Siliqua, M coma* and *Mya* the styles were highly resistant to dissolution (Nelson, 1925). Information on the process of dissolution and reformation of the style under starvation and desiccation in the bivalve species of Indian coastal waters is inadequate. Hence the present investigation was taken up to understand the mechanism and significance of this process.

Specimens of *Anadara rhombea* (Born), *Crassostrea madrasensis* (Preston), *Meretrix meretrix* (Linnaeus), *M. casta* (Chemitz) and *Katelysia opima* (Gmelin) collected from the mud flats of Vellar estuary joining the Porto Novo sea shore (11° 29'N lat. and 79° 46'E long.) and *Donax cuneatus* (Linnaeus) from the marine intertidal zone were used for the present experi-

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ment. Specimens of *A. rhombea* with shell length 28-30 mm, *C. madrasensis* with shell length 58-61mm. *M. meretrix* with shell length 60-61mm *M. casta* with shell length 43-45 mm, *K. opima* with shell length 40-42 mm and *D. cuneatus* with shell length 39-41 mm were used for the experiment in the month of September, 1982. The bivalves were kept species wise in fibre glass aquaria with filtered sea water at 28°C. The water was changed once in 24 hrs. Five specimens were randomly sampled from each species and dissected to examine the presence of crystalline style thrice every day. Individuals were also kept species-wise in the wooden quadrants on the shore of Vellar estuary well above the high tide mark and five indivi duals were randomly picked out from each quadrant and the presence of crystalline style was checked by dissection. Some specimens were forced to lose their style completely by keeping them out of water in a crowded condition overnight. The complete loss of the style was checked through dissecting the randomly chosen animals. They were kept immersed in the intertidal zone during the high tide regime. The formation of a new style was observed in the specimens sampled once in 30 minutes.

The time requirement for the complete loss of the crystalline style in each species and for the reformation when normal life conditions are restored, are presented in Table I. Starvation and removal from water resulted a complete loss of crystalline style in all species except in *D. cuneatus* in which the style persisted till the animal died after 8 days of starvation and desiccation. It is obvious that the style sac in *D. cuneatus* is a blind diverticulum completely separated from the midgut whereas in all other species under study the style sac is conjoined with the midgut (Hameed, 1984) and therefore, the gut content may have a pronounced influence on the style dissolution especially under adverse conditions.

The style loss was observed to be quicker under desiccation (0.5 to 72.0 h) than under starvation (120 to 168 h). Probably, the stress load was relatively heavier in desiccation in which the bivalves had to withstand lack of food, lack of water and lack of dissolved oxygen while in starvation lack of food was the only stress. Disappearance of styles on exposure was observed at different rate in different species (Table I). This differential rate of style dissolution could be accounted by the variation in the organic content of the style (Hameed, 1984).

The earliest view of style dissolution on starvation was that of Hazay and Haseloff (Yonge, 1923). He considered the style as a reserved food, assumed to be utilised on starvation. Dakin (1909) was of opinion that the availability of food was the prime factor controlling style permanence. But this view had been disproved by Orton (1923), Berkeley (1923) and Yonge (1925). All of them showed that llamelllibranchs retain the style after a long period of starvation. Yonge (1925) reported that when the bivalves were under

Table I - Dissolution under starvation and desiccation and reformation of crystalline style in bivalve molluscs.

Species	Style dissolution time Starvation (Hours)	Desiccation (Hours)	Style Reformation (Hours)
Anadara rhombea	168	2.0	3
Crassostrea madrasensis	168	0.5	2
Meretrix meretrix	120	72.0	3
M. casta	120	72.0	3
Katelysia opima	120	24.0	3
Donax cuneatus	Persistent till death (192 h)	Persistent till death (192 h)	—

adverse conditions, they could not carry out normal metabolic processes like style secretion. Hameed (1984) stated that under normal condition the style undergoes a continuous dissolution but it is maintained through the addition of newly secreted style matrix. The evidences from present study strongly suggested that under unfavourable conditions the complete loss of style was brought out by the continuous dissolution followed by cessation of style secretion. Therefore, it may be concluded that style dissolution is a physical and continuous process while style secretion is a physiological process which is energy consuming and operative only under favourable conditions, as evidenced by the style reformation experiments (Hameed, 1984).

The loss of style during adverse conditions could also be considered as an energy conservation process. The results of the style reformation experiments indicated that these intertidal bivalves are endowed with the ability to reform a functional new style within a short time (2 to 3 h). This ability appeared to be an adaptive feature which enabled the bivalves under adverse conditions to initiate the feeding and digestion whenever normal environmental conditions were restored.

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