Embryonic, larval and juvenile development of tropical sea urchin, Diadema setosum

ABSTRACT

Diadema setosum (Leske, 1778), is one of the common echinoids widely distributed in the Indo-West Pacific Ocean, where it occurs from the Red Sea, Persian Gulf and the east coast of Africa to Japan, Australia and Malaysia. To investigate the developmental basis of morphological changes in embryos and larvae, we documented the ontogeny of D. setosum in a controlled laboratory condition at the Institute of Bioscience, Universiti Putra Malaysia, during July–September, 2012. Matured gametes were obtained from the adult individuals and the eggs fertilized at limited sperm concentration (10-5 dilution). The obtained embryos were then reared at 24-25oC. First cleavage (2-cell), 4-cell, 8-cell, 16-cell, 32-cell and multi-cell (Morulla) stages were attained at 01.20, 02.14, 02.44, 03.09, 03.32 and 03.54 h after fertilization, respectively. Blastulae with a mean length of 111.47±1.88 µm (mean±SD) hatched 08.45 h after sperm entry. Gastrula formed 16.36 h post-fertilization and the archenteron extended constantly, while the ectodermal red-pigmented cells migrated synchronously to the apical plate. The pluteus larva started to feed unicellular algae (Chaetoceros calcitrans) in 2 d, grew continuously, and finally attained metamorphic competence within 35 d after fertilization. Induction of metamorphosis took approximately 1 h 30 min from attachment on the substratum to the complete resorption of larval tissues and the development of complete juvenile structure with adult spines, extended tubefeet and well developed pedicellaria, the whole event usually took place within 1 d post-settlement. The newly formed juvenile (473.16 ± 6.96 µm, n=30) with a complete adult structure then grew on coralline algae to 3-month old juvenile, which represents the “sea urchin seed” for stocking in grow-out culture. This study represents the first successful investigation on embryonic, larval and early juvenile development of D. setosum. The findings would greatly be helpful towards the development of breeding and seed production techniques for aquaculture of sea urchins.

Keyword: Sea urchin; Diadema setosum; Embryo; Larva; Juvenile; Development; Pulau Pangkor