Short Paper

The Effect of Photoperiod on Growth and Egg Production of the Sea Hare *Aplysia dactylomela* Rang

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The opisthobranch mollusc *Aplysia* is utilized as a model preparation for neurophysiological and neurobehavioral studies, because of its well identified cells with known interconnections and behavioral functions.¹⁾ Certain chemicals in its body and egg mass have antimicrobial and antileukemic activities.^{2,3)} The sea hare itself is edible and its egg mass is directly utilized as food in some parts of Asia, such as the Philippines (E.A.T. Floreto: Kagoshima Univ., pers. comm., 1995). Therefore the culture of the sea hare using macroalgae that are byproducts of aquacultural biofilters⁴⁾ or collected from nature due to their abundance and apparently of low economic value, presents new exciting possibilities in the utilization of both this gastropod and macroalgae. This study describes the effects of photoperiod on culture of *Aplysia dactylomela*, a cosmopolitan species of sea hare,¹⁾ using the common green seaweed: *Ulva pertusa*. This macroalgae is the most frequently used seaweed in biofilters and their overabundance in the wild fouls fish cages and plays a significant role in the pollution of coastal waters and shrimp ponds when it decomposes.^{5,6)} *Aplysia* prefers green seaweeds over red or brown seaweed.⁷⁾ Adults (211.2 ± 6.5 g wet weight) of *A. dactylomela*, which had been acclimated for a week in indoor aquaria at ambient seawater temperature and under natural photoperiod, using *U. pertusa* as food, were stocked in six 45 l aquaria and divided into two groups. For group one, aquaria were covered with an opaque material to minimize light influence, and for the second group, the uncovered aquaria were placed near a window facing south and subjected to the natural light conditions of the Kagoshima area from the 28th of March until the 26th of April, 1994. The average duration of the dark period was 11.2 ± 0.3 h,⁸⁾ and the average light intensity at water surface of the aquaria was 6.06 ± 3.10 mol/m²·day (LI-Cor: LI-1000). Each condition was tested in triplicate using three adults for each aquarium. Seaweeds were harvested weekly from intertidal flats and maintained in the laboratory. Animals were fed a known amount of seaweed ad libitum at least twice daily. Uneaten remnants of *Ulva* were collected with a dip-net and egg masses were removed from the aquaria and weighed every day; handling lasted for about 50 s for each aquarium. The sea hares were weighed every 10 days, after being placed on a towel to re-

Table 1. Specific growth rate (SGR), food conversion efficiency (FCE) and gonado-somatic index (GSI) of the sea hare *Aplysia dactylomela* fed on green seaweed *Ulva pertusa* under a dark and natural light regime for a period of 30 days

Performance Indicators	Light regime	
	Dark (24 h)	Natural photoperiod (11.2 ± 0.3 h Dark)
Body weight (dry, g/ind)		
Initial	19.8 ± 0.6	19.6 ± 0.6
Final (after 30 days)	39.7 ± 1.7**	28.7 ± 1.9
SGR (%/day)	2.31 ± 0.10**	1.28 ± 0.03
FCE (%)	15.4 ± 1.0*	11.5 ± 0.4
GSI	0.10 ± 0.02	0.21 ± 0.02**

The values are expressed as mean ± S.D.

Differences were, *significant at $p < 0.05$; **significant at $p < 0.01$.

move excess water. All handling was done at night under a dim light which was placed far from the aquaria. Time of exposure to the dim light and handling were minimized to reduce disturbance to the *Aplysia* during the dark period. Dry weight equivalents of body weights, egg masses and seaweed were obtained by correcting for moisture content. This was obtained by drying 12, 21 and 9 separate samples of animals, egg masses and seaweeds respectively, at 110°C and averaging the results. Wet weight conversion factors were 0.093 ± 0.005 for body weight, 0.095 ± 0.011 for egg masses and 0.164 ± 0.001 for the *Ulva*. The experiment was run for 30 days (after which growth gain of the animals fed on the dark regime reached a value twice their initial body weight) and specific growth rate (SGR), food conversion efficiency (FCE) and gonado-somatic index (GSI) were calculated. Computations were as follows: $SGR = 100 [\ln(wf/wi)/(tf-ti)]$; $FCE = 100 [(wf-wi)/S]$; $GSI = E/wf$, where wf =final dry weight of the animal (g), wi =initial dry weight of the animal (g), tf =final time (day), ti =initial time (day), S =dry weight of seaweed consumed (g), E =dry weight of the eggs produced (g). All the water was exchanged daily. Water temperature during the experiment ranged from 17 to 20°C. Results are summarized in Table 1. The adults showed a greater increase in body weight under the dark regime, with higher SGR and FCE. On the other hand, adults under the natural light re-

gime showed twice the GSI; possibly due to the conversion of energy from somatic growth to egg production. *A. dactylomela* is active nocturnally and inactive to varying extents during daylight hours.^{7,9)} *Aplysia* fed in the dark regime in our experiment ate constantly and had subsequently greater growth rates. The highest egg producers (high GSI) were animals that grew under natural photoperiod-the light regime. Previous studies have shown that hormones associated with egg-laying, inhibit feeding,¹⁰⁾ and this could be an additional limiting factor to the time spent by animals feeding under the natural photoperiod. Our results showed that the consumption of the algae, the body weight increase and egg production in *A. dactylomela* were significantly affected by the light regime, and that this environmental factor can be used for the management of algae or to either increase the weight of *Aplysia* or its egg production.

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