Journal of Applied Phycology
https://doi.org/10.1007/s10811-021-02474-4

Influence of light, water motion, and stocking density on the growth and pigment content of *Halymenia durvillei* (Rhodophyceae) under laboratory conditions

Najeen Arabelle M. Rula[1,2,3] · Edna T. Ganzon-Fortes[1] · Ma. Josefa R. Pante[1] · Gavino C. Trono Jr.[1]

Received: 6 August 2020 / Revised and accepted: 14 April 2021

Abstract
The tropical red seaweed *Halymenia durvillei* Bory de Saint Vincent is a potential source of the high-value pigments, r-phycoerythrin (RPE) and r-phycocyanin (RPC). The unique properties of these pigments find many applications—from food to cosmetics, pharmaceuticals, and biomedical research. This study aimed to improve the land-based culture technology of *H. durvillei* by determining the appropriate combination of light, water motion, and stocking density that would result in high growth performance and high RPE and RPC content. Combinations of two light levels (full light, 100% and reduced light, 67%), two water motion levels (low and moderate), and three stocking densities (50, 100, and 200 g) were studied using 64.5-L glass tanks with flow-through seawater and aeration systems at the outdoor land-based seaweed nursery in Bolinao, Pangasinan, Philippines. After 6 weeks of culture, growth performance (growth rate and productivity) of *H. durvillei* and phycobiliprotein content were best under a combination of full light (100%), moderate water motion, and 50-g stocking density. The generally low light regime during the experimental period, which coincided with the cold, dry season characterized by shorter days and overcast skies, may have influenced *H. durvillei* to maximize the use of available resources such as light and possible increased nutrient availability from water motion to promote growth and phycobiliprotein synthesis. Treatments with low stocking densities generally showed satisfactory growth and phycobiliprotein content. This study provides groundwork for future research into mechanisms by which these and other factors affect the growth and physiology of *H. durvillei* in culture.

Keywords Aquaculture · *Halymenia durvillei* · Phycobiliproteins · Phycocyanin · Phycoerythrin · Rhodophyta · Seaweed cultivation

Introduction

Traditionally collected for food consumption, seaweeds are also harvested and cultured for a diverse range of products. Various phycocolloids have been developed for a wide range of food and non-food applications, such as agar, alginates, and carrageenan. The phycocolloid industry is currently estimated to be worth more than US$ 1 billion per annum (Porse and Rudolph 2017). However, the potential of seaweeds in biotechnology has been barely realized, given that the seaweed industry has largely focused on food application (Mazarrasa et al. 2014).

The red seaweed, *Halymenia durvillei* Bory de Saint Vincent, is mucilaginous, large, bushy, and found attached to rocks at the lower intertidal to the upper subtidal areas moderately exposed to wave action (Trono Jr 1997). This species has been reported to occur in Asia, Africa, Indian Ocean, Australia, New Zealand, and the Pacific Islands (Guiry and Guiry 2016) and is widely distributed throughout the Philippines (Silva et al. 1987; Trono Jr 1997).

Halymenia durvillei is traditionally harvested and prepared as salad or cooked as part of soups and other local dishes (Trono Jr and Ganzon-Fortes 1988; Montaño 2002). Recent interest on this edible red seaweed stems from its potential as a source of lambda-like carrageenan (Briones et al. 2000; Fenoradosoa et al. 2009) and, more importantly, as a source

✉ Najeen Arabelle M. Rula
narula@msi.upd.edu.ph

[1] The Marine Science Institute, College of Science, P. Velasquez St., University of the Philippines Diliman, 1101 Quezon City, Philippines

[2] Verde Island Passage Center for Oceanographic Research and Aquatic Life Sciences and College of Agriculture and Forestry, Batangas State University, 4229 Lobo, Batangas, Philippines

[3] College of Arts and Sciences, Batangas State University, Rizal Avenue, 4200 Batangas City, Batangas, Philippines

Published online: 17 May 2021