PHENOLOGICAL STUDIES OF TWO SPECIES OF *Sargassum* (SARGASSACEAE, PHAEOPHYTA) ON THE CORAL REEF FLATS AT CAPE RACHADO, PENINSULAR MALAYSIA

BY

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DEDICATION

This thesis is dedicated to my father, Wong Geok Chuan. In memory of my mother, Seow Lee Hong, whose love, warmth, encouragement and kindness I shall never forget.

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ABSTRACT

Phenological studies on two species of *Sargassum, S. baccularia* (Mertens) C. Agardh and *S. swartzii* (Turner) C. Agardh, growing on the coral reef flats at Cape Rachado, Port Dickson, Peninsular Malaysia, were conducted from January 1995 to March 1996. Plant growth rate, seasonal variation in length and reproductive state of both *Sargassum* species were estimated by monitoring tagged plants in quadrats along three permanent line transects. Growth rate analysis was based on total plant length increase per day. *S. baccularia* exhibited two periods of high growth rate; June 1995 (3.01±3.36 mm day^{-1}) and February 1996 (1.48±1.40 mm day^{-1}). *S. swartzii* exhibited high growth rate in June 1995 (3.31±3.12 mm day^{-1}) and between February-March 1996 (3.52±3.44 mm day^{-1}). Plant length for both species peaked three times during the monitoring period (January 1995, June 1995 and March 1996) with the highest values recorded in January 1995. *S. baccularia* plants produced receptacles twice during the monitoring period between January-February 1995 and between June-August 1995. *S. swartzii* plants were fertile throughout the monitoring period except in April 1995 and November 1995-February 1996.

Sesonality in biomass production of *S. baccularia* and *S. swartzii* was analyzed based on quarterly destructive sampling using a line transect-quadrat method. Destructive sampling was performed on the two species from January 1995 to April 1996. Biomass for both *Sargassum* species showed an unimodal pattern. *S. baccularia* attained high biomass during January 1995 (520.23 g wet weight m^{-2}, 47.88 g dry weight m^{-2}, 13.35 g ash-free dry weight m^{-2}) and July 1995 (501.98 g wet weight m^{-2}, 64.92 g dry weight m^{-2}, 14.00 g ash-free dry weight m^{-2}). *S. swartzii* attained the highest biomass in April 1996 (656.13 g wet weight m^{-2}, 80.81 g dry weight m^{-2}, 15.25 g ash-free dry weight m^{-2}) with another high value recorded in July 1995 (429.28 g wet weight m^{-2}, 54.30 g dry weight m^{-2}, 11.20 g ash-free dry weight m^{-2}). Both *Sargassum* species recorded the lowest biomass in January 1996 (*S. baccularia* : 76.14 g wet weight m^{-2}, 9.97 g dry weight m^{-2}, 1.97 g ash-free dry weight m^{-2}; *S. swartzii* : 68.21 g wet weight m^{-2}, 8.36 g dry weight m^{-2}, 1.68 g ash-free dry weight m^{-2}).

The population of both *Sargassum* species (permanent quadrats and destructive sampling) consisted mainly of young plants with about 96% of the *S. baccularia* population and 90% of the *S. swartzii* population shorter than 199 mm. Environmental factors were shown to affect the growth, reproduction and biomass for both *Sargassum* species especially rainfall.

ABSTRAK

Kajian fenologi terhadap dua species *Sargassum*, *S. baccularia* (Mertens) C. Agardh dan *S. swartzii* (Turner) C. Agardh, yang tumbuh di atas dataran terumbu karang di Cape Rachado, Port Dickson telah dilaksanakan dari Januari 1995 hingga Mac 1996. Kadar pertumbuhan tumbuhan, variasi bermusin dalam panjang dan keadaan reproduktif bagi kedua-dua *Sargassum* species dianggarkan dengan pemonitoran tumbuh-tumbuhan yang telah dilabel dalam quadrat-quadrat di sepanjang tiga garis transek kekal. Analisis kadar pertumbuhan berdasarkan tambahan jumlah panjang tumbuhan setiap hari. *S. baccularia* menunjukkan dua masa kadar pertumbuhan yang tinggi, iaitu Jun 1995 (3.01±3.36 mm $hari^{-1}$) dan Februari 1996 (1.48±1.40 mm $hari^{-1}$). *S. swartzii* menunjukkan kadar pertumbuhan tinggi pada Jun 1995 (3.31±3.12 mm $hari^{-1}$) dan di antara Februari-Mac 1996 (3.52±3.44 mm $hari^{-1}$). Panjang tumbuhan bagi kedua-dua species memuncak sebanyak tiga kali sepanjang masa pemonitoran (Januari 1995, Jun 1995 dan Mac 1996) dengan nilai tertinggi direkodkan dalam Januari 1995. Tumbuh-tumbuhan *S. baccularia* menghasilkan reseptakal dua kali dalam masa pemonitoran, di antara Januari-Februari 1995 dan Jun-Ogos 1995. *S. swartzii* adalah subur sepanjang masa pemonitoran kecuali dalam April 1995 dan November 1995-Februari 1996.

Produksi biomas yang bermusim bagi *S. baccularia* dan *S. swartzii* dianalisa berdasarkan pensampelan destruktif setiap tiga bulan dengan kaedah garis transek-kuadrat. Pensampelan destruktif telah dilakukan pada kedua-dua species ini dari Januari 1995 higga April 1996. Biomas bagi kedua-dua *Sargassum* species menunjukkan corak unimodal. *S. baccularia* mencapai biomas tinggi dalam Januari 1995 (520.23 g berat basah m^{-2}, 47.88 g berat kering m^{-2}, 13.35 g berat kering bebas-abu m^{-2}) dan Julai 1995 (501.98 g berat basah m^{-2}, 64.92 g berat kering m^{-2}, 14.00 g berat kering bebas-abu m^{-2}). *S. swartzii* mencapai biomas tertinggi dalam April 1996 (656.13 g berat basah m^{-2}, 80.81 g berat kering m^{-2}, 15.25 g berat kering bebas-abu m^{-2}) dengan satu lagi nilai tinggi direkodkan dalam Julai 1995 (429.28 g berat basah m^{-2}, 54.30 g berat kering m^{-2}, 11.20 g berat kering babas-abu m^{-2}). Kedua-dua *Sargassum* species merekodkan biomas yang terendah dalam Januari 1996 (*S. baccularia* : 76.14 g berat basah m^{-2}, 9.97 g berat kering m^{-2}, 1.97 g berat kering bebas-abu m^{-2}; *S. swartzii* : 68.21 g berat basah m^{-2}, 8.36 g berat kering m^{-2}, 1.68 g berat kering bebas-abu m^{-2}).

Kedua-dua *Sargassum* species (kuadrat kekal dan pensampelan destruktif) terdiri daripada tumbuh-tumbuhan muda dengan lebih kurang 96% daripada populasi *S. baccularia* dan 90% populasi *S. swartzii* kurang daripada 199 mm. Faktor-faktor persekitaran telah ditunjukkan

mempengaruhi pertumbuhan, reproduksi dan biomas bagi kedua-dua *Sargassum* species terutamanya hujan.

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