

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 bermusim dalam panjang dan keadaan reproduktif bagi kedua-dua *Sargassum* species dianggarkan dengan pemantauan 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 pemantauan (Januari 1995, Jun 1995 dan Mac 1996) dengan nilai tertinggi direkodkan dalam Januari 1995. Tumbuh-tumbuhan *S. baccularia* menghasilkan reseptakal dua kali dalam masa pemantauan, di antara Januari-Februari 1995 dan Jun-Ogos 1995. *S. swartzii* adalah subur sepanjang masa pemantauan 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 hingga 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 bebas-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.

CONTENTS

	Page
ACKNOWLEDGMENTS	ii
ABSTRACT	iii
ABSTRAK	v
CONTENTS	vii
LIST OF FIGURES	xv
LIST OF TABLES	xviii
LIST OF PLATES	xx
LIST OF APPENDICES	xxi
 CHAPTER 1 : INTRODUCTION	 1
 CHAPTER 2 : LITERATURE REVIEW	 5
2.1 <i>Sargassum</i> C. Agradh	5
2.2 Distribution of <i>Sargassum</i>	10
2.3 Phenological Studies	12
2.3.1 Thallus Length	15
2.3.2 Size Classes	16
2.3.3 Reproduction	19
2.3.4 Growth Rate	20
2.3.5 Standing Crop	23
2.4 Environmental Parameters	25

2.4.1	Temperature	26
2.4.2	Salinity	31
2.4.3	pH	34
2.4.4	Nutrients	36
2.4.5	Wave	38
2.4.6	Desiccation	39
CHAPTER 3 :	MATERIALS AND METHODS	41
3.1	Study Site	41
3.2	Preliminary Study	42
3.2.1	Selection of Species	42
3.2.2	Selection of Quadrat Size and Quadrat Number	43
3.3	15-Month Studies	47
3.3.1	Permanent Quadrats	47
3.3.1.1	Growth Rate	49
3.3.1.2	Degenerative Rate	50
3.3.1.3	Variation in Thallus Thallus Length	50
3.3.1.4	Length Classes	50
3.3.1.5	Reproductive State	51
3.4	Quarterly Monitoring of the <i>Sargassum</i> species	51
3.4.1	Destructive Sampling	51
3.4.1.1	Biomass Processing	52

	3.4.1.2	Variation in Thallus Length	53
	3.4.1.3	Length Classes	54
	3.4.1.4	Reproductive State	54
3.5		Herbarium Specimens	54
3.6		Environmental Parameters	55
	3.6.1	Salinity	55
	3.6.2	Water Temperature	56
	3.6.3	Dissolved Oxygen	56
	3.6.4	pH	56
	3.6.5	Water Analysis	56
3.7		Statistical Analysis	57
CHAPTER 4 :		RESULTS	59
4.1		Description of the Species	59
	4.1.1	<i>Sargassum baccularia</i> (Mertens) C. Agardh	59
	4.1.2	<i>Sargassum swartzii</i> (Turner) C. Agardh	61
4.2		Preliminary Study	66
4.3		15-Month Studies	71
	4.3.1	<i>S. baccularia</i>	71
	4.3.1.1	Seasonal Variation in Mean Thallus Length	71
	4.3.1.2	Seasonal Variation in Growth Rate and Degenerative Rate	72

4.3.1.3	Correlation Between Mean Thallus Length, Growth Rate and Degenerative Rate	75
4.3.1.4	Seasonal Variation in Reproductive State	75
4.3.1.5	Seasonal Variation in Length Classes	76
4.3.2	<i>S. swartzii</i>	78
4.3.2.1	Seasonal Variation in Mean Thallus Length	78
4.3.2.2	Seasonal Variation in Growth Rate and Degenerative Rate	79
4.3.2.3	Correlation Between Mean Thallus Length, Growth Rate and Degenerative Rate	79
4.3.2.4	Seasonal Variation in Reproductive State	82
4.3.2.5	Seasonal Variation in Length Classes	84
4.4	Quarterly Monitoring of the <i>Sargassum</i> Species	85
4.4.1	<i>Sargassum baccularia</i>	85
4.4.1.1	Mean Quarterly Biomass	85
4.4.1.2	Variation in Biomass Between Line Transects	87
4.4.1.3	Variation in Biomass Between Station Levels (Quadrats)	87

4.5.4	pH	110
4.5.5	Ambient Temperature	110
4.5.6	Sunshine	111
4.5.7	Solar Radiation	111
4.5.8	Rainfall	111
4.5.9	Nutrient Levels	114
4.6	Correlation with Environmental Parameters	116
4.6.1	Permanent Quadrats	116
4.6.1.1	Growth Rate	116
4.6.1.2	Degenerative Rate	117
4.6.1.3	Mean Thallus Length	118
4.6.1.4	Reproductive State	119
4.6.2	Quarterly Destructive Sampling	122
4.6.2.1	Biomass	122
4.6.2.2	Mean Thallus Length	123
4.6.2.3	Reproductive State	124
CHAPTER 5 :	DISCUSSION	128
5.1	Growth Pattern	128
5.2	Reproduction	133
5.3	Standing Crop	139
5.4	Environmental Parameters	144
5.5	Appraisal of Project and Future Areas for Research	148

CHAPTER 6 :	CONCLUSION	151
REFERENCES		157
APPENDICES		170

LIST OF FIGURES

Figure		Page
1	Drawing of a <i>Sargassum</i> plant	6
2	Graphic representation of the <i>Sargassum</i> life cycle (Source : Vashishta 1973)	7
3	The carbonate equilibrium (Source : Lobban & Harrison 1994).	35
4	Location of the study site.	44
5	The arrangement of quadrats for determination of optimum quadrat area for sampling vegetation in order to estimate biomass using Wiegert's arrangement of Nested quadrats in January 1995.	46
6	Map of the locations for the permanent line transects and destructive sampling line transects (___ = Permanent line transects : P1, P2, P3; ----- = Destructive sampling line transects : L1 to L6; Q = Quadrat.	48
7	<i>Sargassum baccularia</i> (Mertens) C. Agardh. a. Vesicles and receptacles (i) male (ii) female. b. Leaves	62
8	<i>S. swartzii</i> (Turner) C. Agardh. a. Vesicles and receptacles. b. Leaves.	67
9	Plot of $V_r C_r$ against quadrat size for biomass (ash-free dry weight) collected using Wiegert's nested quadrat.	70
10	<i>S. baccularia</i> : Mean thallus length with standard deviation bars.	73
11	<i>S. baccularia</i> : Mean (a) growth rate (b) degenerative rate with standard deviation bars.	74
12	<i>S. baccularia</i> : Comparison between mean thallus length and percentage fertility.	77
13	Length classes of <i>S. baccularia</i> .	78

LIST OF FIGURES (CONTINUED)

Figure		Page
14	<i>S. swartzii</i> : Mean thallus length with standard deviation bars.	80
15	<i>S. swartzii</i> : Mean (a) growth rate (b) degenerative rate with standard deviation bars.	81
16	<i>S. swartzii</i> : Comparison between mean thallus length and percentage fertility.	83
17	Length classes of <i>S. swartzii</i> .	84
18	Seasonal variation in biomass of <i>S. baccularia</i> with standard deviation bars.	86
19	Biomass of <i>S. baccularia</i> for every destructive sampling from April 1995 to April 1996.	88
20	Biomass of <i>S. baccularia</i> between station levels (quadrats) from April 1995 to April 1996.	89
21	Comparison between the mean thallus length (mm) and biomass (g m^{-2}) of <i>S. baccularia</i> .	90
22	Mean length (mm) of <i>S. baccularia</i> for every destructive sampling from April 1995 to April 1996.	91
23	Length classes of <i>S. baccularia</i> .	92
24	Percentage frequency of <i>S. baccularia</i> in various length classes for every destructive sampling.	94-95
25	Comparison between percentage fertility and biomass for <i>S. baccularia</i> .	96
26	Comparison between percentage fertility and mean thallus length (mm) for <i>S. baccularia</i> .	96
27	Seasonal variation in biomass of <i>S. swartzii</i> with standard deviation bars.	99
28	Biomass of <i>S. swartzii</i> for every destructive sampling from April 1995 to April 1996.	100

LIST OF FIGURES

Figure		Page
1	Drawing of a <i>Sargassum</i> plant	6
2	Graphic representation of the <i>Sargassum</i> life cycle (Source : Vashishta 1973)	7
3	The carbonate equilibrium (Source : Lobban & Harrison 1994).	35
4	Location of the study site.	44
5	The arrangement of quadrats for determination of optimum quadrat area for sampling vegetation in order to estimate biomass using Wiegert's arrangement of Nested quadrats in January 1995.	46
6	Map of the locations for the permanent line transects and destructive sampling line transects (— = Permanent line transects : P1, P2, P3; ---- = Destructive sampling line transects : L1 to L6; Q = Quadrat.	48
7	<i>Sargassum baccularia</i> (Mertens) C. Agardh. a. Vesicles and receptacles (i) male (ii) female. b. Leaves	62
8	<i>S. swartzii</i> (Turner) C. Agardh. a. Vesicles and receptacles. b. Leaves.	67
9	Plot of $V_r C_r$ against quadrat size for biomass (ash-free dry weight) collected using Wiegert's nested quadrat.	70
10	<i>S. baccularia</i> : Mean thallus length with standard deviation bars.	73
11	<i>S. baccularia</i> : Mean (a) growth rate (b) degenerative rate with standard deviation bars.	74
12	<i>S. baccularia</i> : Comparison between mean thallus length and percentage fertility.	77
13	Length classes of <i>S. baccularia</i> .	78

LIST OF FIGURES (CONTINUED)

Figure		Page
29	Biomass of <i>S. swartzii</i> between station levels (quadrats) from April 1995 to April 1996.	101
30	Comparison between mean thallus length (mm) and biomass (g m^{-2}) of <i>S. swartzii</i> .	102
31	Mean length (mm) of <i>S. swartzii</i> for every destructive sampling from April 1995 to April 1996.	103
32	Length classes of <i>S. swartzii</i> .	104
33	Percentage frequency of <i>S. swartzii</i> in various length classes for every destructive sampling.	105-106
34	Comparison between percentage fertility and biomass for <i>S. swartzii</i> .	107
35	Comparison between percentage fertility and mean thallus length (mm) for <i>S. swartzii</i> .	108
36	Salinity (‰), water temperature ($^{\circ}\text{C}$), dissolved oxygen (mg l^{-1}) and pH for Cape Rachado, Port Dickson.	112
37	Ambient temperature (maximum and minimum air temperatures, $^{\circ}\text{C}$), sunshine hours, solar radiation (MJ m^{-2}) and rainfall (mm) for Malacca.	113
38	Nutrients (ammonia, nitrate and phosphate, $\mu\text{g L}^{-1}$) for Cape Rachado, Port Dickson.	115

LIST OF TABLES

Table		Page
1	List of Malaysian <i>Sargassum</i> (Fucales, Sargassaceae) species.	13
2	Mean maximum length ($\pm$ sd) or maximum size of <i>Sargassum</i> species.	17
3	Length classes for <i>Sargassum</i> species in Philippines reported by Ohno <i>et al.</i> (1995).	18
4	Summary of fertile periods in <i>Sargassum</i> species.	21
5	Standing crop of <i>Sargassum</i> species recorded in the literature.	25
6	Seasonality of <i>Sargassum</i> reported in literature.	28-31
7	Number of quadrats for biomass (ash-free dry weight) needed to be taken in order to get accurate samples from the study area.	70
8	Results of LSD Multiple range test (95% confidence level) to show significant differences for biomass between *line transects* of <i>S. baccularia</i> population from April 1995 to April 1996. NS = no significant difference between line transects.	87
9	Results of LSD Multiple range test (95% confidence level) to show significant differences for biomass between *quadrats* of <i>S. baccularia</i> population from April 1995 to April 1996. NS = no significant difference between quadrats.	87
10	Results of LSD Multiple range test (95% confidence level) to show significant differences for biomass between *line transects* of <i>S. swartzii</i> population from April 1995 to April 1996. NS = no significant difference between line transects.	98

LIST OF TABLES (CONTINUED)

Table		Page
11	Results of LSD Multiple range test (95% confidence level) to show significant differences for biomass between *quadrats* of <i>S. swartzii</i> population from April 1995 to April 1996. NS = no significant difference between quadrats.	98
12	Correlation between <i>Sargassum</i> growth rate, degenerative rate, mean thallus length (TL) and number of plants bearing receptacles (F) with environmental parameters ($p < 0.05$).	120
13	Cross-correlation between <i>Sargassum</i> growth rate, degenerative rate, mean thallus length (TL) and number of plants bearing receptacles (F) with environmental parameters. Correlation for each species with each factor is given with the lag period yielding the best correlation ($p < 0.05$). 1 lag period = 1 month.	121
14	Correlation between <i>Sargassum</i> biomass, TL and F with environmental parameters ($p < 0.05$).	126
15	Cross-correlation between <i>Sargassum</i> biomass, TL and F with environmental parameters. Correlation for each species with each factor is given with the lag period yielding the best correlation ($p < 0.05$). 1 lag period = 3 months.	127
14	Standing crop reported in Philippines and Cape Rachado.	140

LIST OF PLATES

Plate		Page
1	Low tide (0.1 m or less above sea level) at the reef flats of Cape Rachado.	44
2	<i>Sargassum baccularia</i> .	45
3	<i>Sargassum swartzii</i> .	45
4	The pole and tags in the field.	49
5	Whole plant of <i>S. baccularia</i> dried specimen.	63
6	<i>S. baccularia</i> : Male receptacular branch.	63
7	<i>S. baccularia</i> : Cross-section of male receptacle.	64
8	<i>S. baccularia</i> : Cross section of female receptacle.	64
9	Whole plant of <i>S. swartzii</i> dried specimen.	68
10	Morphological variations of vesicles in <i>S. swartzii</i> .	68
11	<i>S. swartzii</i> : Receptacular branch.	69
12	<i>S. swartzii</i> : Cross section of androgynous receptacle showing antheridia (a) and oogonia (o).	69

LIST OF APPENDICES

Appendix	Page
1 Observation on fertility.	170
2 Procedure for the analysis of ammonia	171
3 Procedure for the analysis of nitrate	173
4 Procedure for the analysis of phosphate	174
5 Growth rate, degenerative rate, percentage of plants bearing receptacles and mean thallus length of <i>S. baccularia</i> .	176
6 Growth rate, degenerative rate, percentage of plants bearing receptacles and mean thallus length of <i>S. swartzii</i> .	177
7 A. Length classes of <i>S. baccularia</i> . B. Length classes of <i>S. swartzii</i> .	178
8 Biomass (g m^{-2}), percentage of reproductive plants and mean thallus length (mm) of <i>S. baccularia</i> in destructive samplings.	179
9 Biomass of <i>S. baccularia</i> between line transects from April 1995 to April 1996.	180
10 Biomass of <i>S. baccularia</i> between station levels from April 1995 to April 1996.	181
11 Biomass (g m^{-2}), percentage of reproductive plants and mean thallus length (mm) of <i>S. swartzii</i> in destructive samplings.	182
12 Biomass of <i>S. swartzii</i> between line transects from April 1995 to April 1996.	183
13 Biomass of <i>S. swartzii</i> between station levels from April 1995 to April 1996.	184

LIST OF APPENDICES (CONTINUED)

Appendix		Page
14	Mean thallus length (mm) between line transects. A. <i>S. baccularia</i> . B. <i>S. swartzii</i> .	185
15	Destructive samplings. A. Length classes of <i>S. baccularia</i> . B. Length classes of <i>S. swartzii</i> .	186
16	Percentage frequency for every destructive sampling. A. <i>S. baccularia</i> . B. <i>S. swartzii</i> .	187
17	Environmental parameters	188