

THE DISTRIBUTION OF *Grasshopper* SPECIES IN SELECTED
AREAS IN DIVISIONS KUCHING AND SAMARAHAN,
SARAWAK AND THEIR FEED YIELD AND PROPERTIES

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**THE DISTRIBUTION OF *Gracilaria* SPECIES IN SELECTED AREAS IN
DIVISIONS KUCHING AND SAMARAHAN, SARAWAK AND
THEIR AGAR YIELD AND PROPERTIES**

By

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**PENGAKUAN DAN PENGESAHAN LAPORAN
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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

The Distribution of *Gracilaria* species (Rhodophyta) in Selected Areas in Divisions Kuching and Samarahan, Sarawak and their Agar Yield and Properties.

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LIST OF CONTENTS

Title	Page
TITLE PAGE	i
APPROVAL FORM	ii
ACKNOWLEDGEMENT	iii
LIST OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF APPENDICES	x
LIST OF ABBREVIATIONS	xi
ABSTRAK	xiii
ABSTRACT	xv
CHAPTER 1 INTRODUCTION	1
CHAPTER 2 LITERATURE REVIEW	5
2.1 Seaweed in General	5
2.2 Identification of <i>Gracilaria</i>	6
2.3 Life cycle of <i>Gracilaria</i>	8
2.4 The Distribution and Habitat of <i>Gracilaria</i> species in Malaysia	9
2.5 <i>Gracilaria</i> as a world major source of agar	10
2.6 Definition of Agar and The Application of Alkali Treatment	11
2.7 Seaweeds For Direct Human Consumption	13
CHAPTER 3 MATERIALS AND METHODS	15
3.1 Experimental Design	15
3.2 Study Areas	17
3.3 Sampling Methods	19
3.3.1 Seaweed Sample collection	19

3.4	Preparation of Voucher Specimens and Storage	20
	3.4.1 Preserved Specimens	20
	3.4.2 Herbarium Specimens	20
3.5	Identification and Taxonomy of <i>Gracilaria</i> Species	21
3.6	Agar Extraction and Analysis	22
	3.6.1 Alkali Pretreatment	23
	3.6.2 Extraction and Yield of Agar	23
	3.6.3 Agar Quality Analysis	24
	3.6.3.1 Preparation of Standard 1.5% Agar and Agar Solution	24
	3.6.3.2 Color Comparison	25
	3.6.3.3 Gel Strength Test	25
	3.6.3.4 Gelling Temperature Measurement	25
	3.6.3.5 Melting Temperature Measurement	26
3.7	Data Analysis	26
 CHAPTER 4 RESULTS		 27
4.1	Distribution of <i>Gracilaria</i> species in the study Areas	27
4.2	Taxonomic notes on <i>Gracilaria</i>	30
	4.2.1 <i>Gracilaria</i> species	30
	4.2.1.1 Dichotomous key to Three Species of <i>Gracilaria</i> (Order: Gracilariales)	30
	4.2.1.2 Description of <i>Gracilaria</i> Species	31
4.3	Other seaweed found in the study area	38
4.4	Composition of <i>Gracilaria</i> Sample and Its Agar Evaluation	39
	4.4.1 Composition of <i>Gracilaria</i> Sample	39
	4.4.2 Agar Yield and Physical Characteristic of Agar	40
	4.4.3 Color Comparison of Agar	43
4.5	Local name and Use by the Local Inhabitants	45
 CHAPTER 5 DISCUSSION		 47
5.1	Taxonomy and Identification of <i>Gracilaria</i>	47
5.2	Distribution of <i>Gracilaria</i> Species	48

5.3	Agar Yield and Its Evaluation	49
5.3.1	Agar Yield and Gel Strength at Different Season and Study Area	50
5.3.2	Alkali Treated Agar Yield and Gel Strength at Various Temperatures	52
5.3.3	Agar Yield and Gel Strength at different Reproductive stages	53
CHAPTER 6 CONCLUSION		54
LITERATURE CITED		56
APPENDICES		60

LIST OF TABLES

Table No.	Title	Page
1.1	The distribution of 13 species of genus <i>Gracilaria</i> in Malaysia. (summarized by Gan, 2003)	2
3.1	The location of sampling sites in study areas.	17
4.1	Composition of <i>Gracilaria</i> species collected from different locations.	39
4.2	The yield and properties of agar obtained from different stations, experimental temperatures and life stages of <i>Gracilaria changii</i> , and some commercial agars. 1.5% (w/w) agar solutions or gels were used or all measurements of physical properties.	41
4.3	A recipe of sambal belacan with “janggut duyong” (<i>Gracilaria</i> sp.)	46

LIST OF FIGURES

Figure No.	Title	Page
2.1	Life history of <i>Gracilaria</i> source from Zhanjiang Fisheries College, 1990)	8
3.1	The scheme of sampling and analysis for the <i>Gracilaria</i> samples collected	16
3.2	Map showing the locations of the first three seaweed sampling stations in Kuching Area; Kuala Salak and Santubong: S1–Tnj. Batu, Kuala Salak; S2 – Galingan, Kuala Salak; and S3 – Sg. Buah, Santubong.	18
3.3	Map showing the locations of the last two seaweed sampling stations in Samarahan Area: S4 and S5 – Sg. Moyan shoal, Samarahan.	18
4.1	Tjg. Batu, Kuala Salak. S1(i)	27
4.2	Galingan, Kuala Salak. S1(ii)	28
4.3	Floating Fish Cages, Sg. Buah, Santubong. S2	28
4.4	Sg. Moyan Shoal, Samarahan (S3)	29
4.5	<i>G. changii</i> collected from Galingan, Kuala Salak Kuching.	32
4.6	<i>G. changii</i> non-cystocarpic plant collected from Sg. Buah, Santubong.	32
4.7	<i>G. changii</i> cystocarpic plant collected from Sg. Buah, Santubong in Kuching.	33
4.8	<i>G. changii</i> non-cystocarpic plant collected from Sg. Moyan shoal, Samarahan.	33
4.9	<i>G. changii</i> cystocarpic plant collected from Sg. Moyan shoal, Samarahan.	33
4.10	<i>G. salicornia</i> plant collected from Tanjung Batu, Kuala Salak (Kuching)	35

4.11	<i>G.edulis</i> collected from floating fish cages, Sg. Buah, Santubong.	37
4.12	Branches with short and spine like or with tendrils.	37
4.13	<i>Catenella nipae</i> attached on mangrove roots	38
4.14	<i>C. nipae</i> found in Sg. Moyan shoal, Samarahan.	38
4.15	The agar yield (%) obtained from native agar (NA) and alkali treated agar at various temperatures.	42
4.16	The gel strength value obtained from native agar (NA) and alkali treated agar at various temperatures.	42
4.17	Melting and gelling point (°C) obtained from native agar (NA) and alkali treated agar at various temperatures.	42
4.18	Left to right: Agar made from agar strips (China), agar powder (Thailand) and agar powder (Japan).	43
4.19	Agars extracted from non-cystocarpic thalli of <i>G. changii</i> collected from Sg. Buah, Santubong (floating fish cages) - 1 st Collection	43
4.20	Agars extracted from cystocarpic thalli of <i>G. changii</i> collected from Sg. Buah, Santubong (floating fish cages) - 1 st Collection	43
4.21	Agars extracted from non-cystocarpic thalli of <i>G. changii</i> collected from Sg. Buah, Santubong (floating fish cages) - 2 nd Collection	44
4.22	Agars extracted from cystocarpic thalli of <i>G. changii</i> collected from Sg. Buah, Santubong (floating fish cages) - 2 nd Collection	44
4.23	Agars extracted from non-cystocarpic thalli of <i>G. changii</i> collected from Sg. Moyan shoal, Samarahan.	44
4.24	Agars extracted from non-cystocarpic thalli of <i>G. changii</i> collected from Sg. Moyan shoal, Samarahan.	44
5.1	Cross section of of <i>G. changii</i> normal thallus from floating fish cages, Sg. Buah, Santubong.	51
5.2	Cross section of <i>G. changii</i> senescent thallus from Sg. Moyan shoal, Samarahan.	51

LIST OF APPENDICES

Appendix No.	Title	Page
Appendix I.	A Three-Factor ANOVA without Replication, where the variable is agar yield (%) of <i>G.changii</i> to determine whether there are significant differences within five treatments, reproductive stages, and sampling period and stations.	60
Appendix II.	A Three-Factor ANOVA without Replication, where the variable is gel strength (g.cm ⁻²) <i>G. changii</i> to determine whether there are significant differences within five treatments, reproductive stages, and sampling period and stations.	62
Appendix III	A Three-Factor ANOVA without Replication, where the variable is agar melting temperature (°C) of <i>G. changii</i> to determine whether there are significant differences within five treatments, reproductive stages, and sampling period and stations.	64
Appendix IV	A Three-Factor ANOVA without Replication, where the variable is agar gelling temperature (°C) of <i>G. changii</i> to determine whether there are significant differences within five treatments, reproductive stages, and sampling period and stations.	66

LIST OF ABBREVIATIONS

Symbols		Meaning
NaOH	-	Sodium hydroxide
H ₂ SO ₄	-	Sulfuric acid
sp.	-	Species
w/w	-	weight per weight
mL	-	milliliter
L	-	Liter
Temp.	-	Temperature
cm	-	Centimeter
%	-	Percentage
°	-	Degree
°C	-	Degree Centigrade
NA	-	Native agar
AT	-	Alkali-treated
°E	-	Degree East
°N	-	Degree North
Fig.	-	Figure
g	-	Gram
g.cm ⁻²	-	Gram per centimeter square
g.10g ⁻¹	-	Gram per 10 gram
kg	-	Kilogram

kg.cm ⁻²	-	Kilogram per centimeter square
ha	-	Hectare
°C.min ⁻¹	-	Degree centigrade per minute
min	-	minute
Kpg.	-	Kampung
Sg.	-	Sungai
Tjg.	-	Tanjung
En.	-	Encik
>	-	More than
<	-	Less than
Pn.	-	Puan
RM	-	Ringgit Malaysia
‰	-	Salinity
IPP Sarawak	-	Institut Penyelidikan Perikanan Cawangan Sarawak (Sarawak Fishery Research Intitute)

ABSTRAK

Rumpai laut merah (Rhodophyta) dari genus *Gracilaria* (Greville, 1830) ialah sumber utama agar dunia pada masa kini. Pelbagai kajian telah dijalankan untuk mengkaji taksonomi, ekologi dan komposisi agar genus ini. Telah diketahui bahawa kuantiti atau hasil dan kualiti agar yang dihasilkan dari *Gracilaria* adalah berbeza mengikut spesis, musim, peringkat pertumbuhan alga dan suhu yang digunakan untuk rawatan alkali. Di Sarawak, rumpai laut ini dikenali sebagai “janggut” atau “janggut duyong” di kalangan penduduk tempatan dan dikutip untuk dimakan (sayur laut). Tinjauan telah dijalankan di bahagian Kuching dan Samarahan, Sarawak bagi mengkaji taburan genus ini, dan sampel yang mencukupi dikutip dan dianalisis untuk menentukan samada ianya berpotensi sebagai sumber agar komersial. Tiga kawasan kajian telah dipilih. Kawasan Kuala Salak dan Santubong, Kuching telah ditinjau pada bulan Mei dan Julai 2003, sementara tinjauan di muara Sg. Moyan, Samarahan dijalankan pada Oktober 2003. Terdapat tiga spesis telah dijumpai iaitu *Gracilaria changii*, *G. salicornia* dan *G. edulis*. *G. salicornia* hanya dijumpai di Tanjung Batu, Kuala Salak. Manakala *G. changii* ditemui di Galingan, Kuala Salak; Sg. Buah, Santubong (Kuching) dan juga muara Sg. Moyan, (Samarahan). Pemerhatian menunjukkan bahawa *G. changii* adalah spesis yang paling banyak dari segi kelimpahan diikuti oleh *G. salicornia* dan *G. edulis*. *G. changii* telah dikutip dari Sg. Buah, Santubong (Kuching) dan muara Sg. Moyan (Samarahan) untuk menentukan kuantiti dan kualiti agar. Rawatan alkali (5% NaOH, 60 min) pada suhu yang berbeza (60, 70, 80 dan 90°C) telah dijalankan ke atas sampel berbeza pada peringkat pembiakan (sistokarp dan bukan sistokarp). Keputusan bagi ujian makmal dibandingkan dengan tiga jenis agar kormesil dari China, Thailand dan Jepun. Hasil agar asli (tanpa rawatan alkali) yang diperolehi didapati lebih tinggi pada julat 20.4%–44.7%. Walaubagaimanapun, kekuatan gel, takat suhu cair dan takat suhu beku agar ini adalah lebih rendah berbanding agar sampel yang telah dirawat.

Hasil agar yang melalui rawatan alkali berjulat antara 24.6–34.0% dan berkurang dengan pertambahan suhu rawatan alkali. Kualiti agar yang terbaik diperolehi daripada sampel yang telah dirawat pada suhu 90°C. Selain daripada kekuatan gel, tiada perbezaan signifikan pada hasil agar, takat suhu cair dan beku di antara tumbuhan sistokarpik dan bukan sistokarpik. Keputusan juga menunjukkan bahawa rawatan alkali adalah penting untuk meningkatkan kualiti dan bukan kuantiti agar. Secara keseluruhan, *G. changii* dari kedua-dua kawasan Kuching dan Samarahan menunjukkan potensi sebagai sumber agar komersial.

ABSTRACT

The red seaweed (Rhodophyta) genus *Gracilaria* (Greville, 1830) is currently the world's major source of agar. Various studies have been done on their taxonomy, ecology, biology and agar composition. Nevertheless, it is well known that the agar yield and quality of *Gracilaria* varies within species, season, growth stages and alkali treatment temperature of the algae. In Sarawak, this seaweed is called "janggut" or "janggut duyong" by the local people and it was collected as sea vegetable. Surveys on this genus in divisions Kuching and Samarahan, Sarawak were done for the study of their distribution and enough samples were collected to determine their potential as agar resources. Three selected areas in Kuala Salak and Santubong, Kuching were surveyed in May and July 2003 while Sg. Moyan shoal, Samarahan was surveyed in October 2003. *Gracilaria salicornia*, *G.changii* and *G. edulis* were found during sampling. *G.salicornia* was found only in Tanjung Batu, Kuala Salak While *G. changii* was found in Galingan, Kuala Salak; Sg. Buah, Santubong (Kuching) and also Sg. Moyan shoal (Samarahan). *G.edulis* was found only in Sg. Buah, Santubong (Kuching). Field observations showed that *Gracilaria changii* was the most abundant species followed by *G. salicornia* and *G. edulis*. *G. changii* from Sg. Buah, Santubong and Sg. Moyan shoal were collected for agar yield and its quality studies. Experiment on alkali pretreatment (5% NaOH, 60 min) at different temperatures (60, 70, 80 and 90°C) was tested on cystocarpic and non-cystocarpic plants. Agars obtained from laboratory were compared to three commercial agars from China, Thailand and Japan. The agar yield was higher in the native agars range from 20.4%–4.7%. However native agars gel strength, melting and gelling temperatures was lower than alkali-treated agar. Yield for alkali-treated agar ranged from 24.6%–4.0% and decreased gradually with the increasing of alkali treatment temperature. Agar with the best quality in cystocarpic and non-cystocarpic thalli was obtained from alkali treatment at 90°C. Except for gel strength, there were no significant differences between cystocarpic and non-cystocarpic plants in terms agar yield, melting and gelling temperatures. Results also showed that alkali treatment was useful to improve the quality but not the quantity of agar. Finally, there is a potential for both *G. changii* from Kuching and Samarahan areas as good sources for food grade agar.