

Establishment of MMSU Algal Herbarium

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ABSTRACT

Marine macro-algae were collected from northwest Philippines for the establishment of MMSU Algal Herbarium. Collection of algal specimen was undertaken along with the gathering of carrageenophytes for the MMSU-DA-BAR project entitled "Characterization of carrageenan from selected Philippine red algae and its interaction with food systems". The specimen were gathered on different dates from April 2001 to November 2002 from various collection sites. A total of 101 algal species were identified in 56 genera, 33 families, 16 orders, and 3 classes. Sixteen species were reported as sources of carrageenan (carrageenophytes). However, extraction analysis showed that only eight species contain considerable amount of carrageenan with *Betaphycus philippinensis* having the highest percentage.

Key words: Marine macro-algae, algal herbarium, carrageenophytes, carrageenan-producing algae

INTRODUCTION

"The best plant description leaves much unsaid about the plant; the botanical specimen will complete all that is desired (Mendoza, 1967)". This statement clearly indicates the importance of an herbarium. An herbarium is a collection of dried and pressed plant specimen properly mounted, classified and arranged according to an accepted system of classification and which is available for reference purposes or other study. Thus, the purpose of this study is to collect, preserve and maintain algal specimen for the establishment

of MMSU herbarium. Hence, this is an answer to the numerous inquiries and the expressed needs of students as well as biology teachers interested in the study of algal flora.

The collected algal species are kept in the Museum of Natural History (MNH), MMSU Algal Herbarium. It has initially one wooden cabinet measuring 4' x 8' with glass cover and provided with shelves. Each species is placed in a labeled small brown envelope. Different species under one genus are placed in a labeled expanded envelope.

METHODOLOGY

Collection

Five areas were designated as collection stations. These areas were selected based on the presence and abundance of any of the

target carrageenophytes. Thus, the sampling stations that were identified are found along northwestern Luzon, i.e., Caparispisan, Pagudpud, Ilocos Norte; Paayas, Burgos, Ilocos Norte; Dardarat, Cabugao, Ilocos

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Sur; Bacnotan, La Union; and Bolinao, Pangasinan.

Sampling of algal specimens from the five collection stations was done through haphazard samplings. Thus, collection was carried out using 20 throws of a 45 cm (0.159 m²) diameter iron ring sampler within a 500 m² area of each study station. All the carrageenophytes and their associated algal species within the sampler were collected by hand-picking and were placed in properly labeled net bags. Those species which could not be identified *in situ* were identified in the work station.

Preservation

Preservation of collected algal specimens in this project was done by drying in an oven or under the sun. A flier entitled, "Starting an algal herbarium: An illustrated guide" by ZM Agngarayngay et al (2007) presents detailed discussion on mounting, pressing and drying algal samples.

Identification

Preliminary identification of the algal species based on gross morphological characteristics was carried out through familiarity of the algae and through the use

of some reference materials such as Abbott and Hohenberg (1976), Cordero (1977), Trono and Ganzon-Fortes (1980), Meñez (1982), Agngarayngay (1983), Hurtado-Ponce (1983) and Trono (1997).

Some duplicate copies were given to the Phycology Division of the Philippine National Museum, Manila and University of San Carlos, Cebu City.

Storage and Maintenance

Each species was placed in a small brown envelope with the scientific name on the upper left corner. The herbarium label was placed on the lower left corner of the envelope with the following information: herbarium no.; scientific name; family; common name; collector(s); date of collection; locality; habitat; description of the species; det. by (the one who identified the specimen); and the date the specimen was identified. An expanding envelop served as genus folder where the family and the genus of the specimen were placed on the upper left corner. Labeled expanding envelopes that serve as genus folders were stored in the herbarium cabinet.

Stored algal specimens in the herbarium cabinet were kept safe from insect attacks by using moth balls.

RESULTS AND DISCUSSION

This paper treats only benthic marine algae of macroscopic size that were collected along with the gathering of carrageenophytes for the project entitled "Characterization of carrageenan from selected Philippine red algae and its interaction with food systems" (MMSU-DA-BAR Project). All the carrageenophytes and their associated algal species within the sampler were collected by hand-picking and were placed in properly labeled net bags. Those

species which could not be identified *in situ* were identified in the work station.

A total of 101 marine macro-algae were identified. These belong to the three major taxa: class chlorophyceae with 30 species; class phaeophyceae with 17 species; and class rhodophyceae with 54 species. Based on published literature, 16 species from the red algal collection contain carrageenan. However, the result of extraction analysis shows that

seven species have a considerable amount of carrageenan, namely: *Euclidean arnoldii*; *E. denticulatum*; *Kappaphycus cottonii*; *K. striatum*; *Betaphycus philippinensis* (= *Euclidean geletinae*); *Hypnea charoides*; and *H. pannosa*. Among the seven mentioned carrageenophytes, *Betaphycus philippinensis* has the highest percentage of carrageenan, hence, this species should be cultured to ensure sustainable material for a large scale extraction.

List of Species

A total of 101 algal species were identified in 56 genera, 33 families, 16 orders, and 3 classes. A list of species under chlorophyceae (Table 1), phaeophyceae (Table 2) and rhodophyceae (Table 3) are arranged following the method used by Trono (1997).

Table 1. List of species under chlorophyceae.

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
Ulvales	Ulveaceae	<i>Ulva lactuca</i> Linnaeus	Lab-labig	MNH 207; Caparispisan, Pagudpud, Ilocos Norte
		<i>Enteromorpha intestinalis</i> (Linnaeus) Nees	Bag-bagis	MNH 207; Caparispisan, Pagudpud, Ilocos Norte
Cladophorales	Anadyomenaceae	<i>Anadyomene wrightii</i> Harvey ex Gray	Ab-abaniko	MNH 62; Paayas, Burgos Ilocos Norte
	Cladophoraceae	<i>Chaetomorpha crassa</i> (C. Agardh) Kuetzing	Rip-rippiis	MNH 80; Paayas, Burgos Ilocos Norte
		<i>Cladophora rugulosa</i> Martens	Lumot	MNH 120; Caparispisan, Pagudpud Ilocos Norte
		<i>C. rupestris</i> Kuetzing	Lumot	MNH 321; Paayas, Burgos Ilocos Norte
Siphonocladales	Siphonocladaceae	<i>Boergensia forbesii</i> (Harvey) J. Feldman	Rup-ruppuuk	MNH 08; Pangil, Currimao Ilocos Norte
		<i>Boodlea composita</i> (Harvey) Brand	Lumot	MNH 30; Pangil, Currimao Ilocos Norte
	Valoniaceae	<i>Dicytyosphaeria cavernosa</i> (Forsskal) Boergesen	Rup-ruppuuk	MNH 69; Paayas, Burgos Ilocos Norte
		<i>D. versluisii</i> Weber-van Bosse	Rup-ruppuuk	MNH 69; Paayas, Burgos Ilocos Norte
		<i>Valonia aegagropila</i> C. Agardh	Rup-ruppuok	MNH 270; Dardarat, Cabugao Ilocos Norte

Table 1. (continued)

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
Bryopsidales	Caulerpaceae	<i>Caulerpa brachypus</i> Harvey	Ar-arusip	MNH 277; Dardarat, Cabugao Ilocos Sur
		<i>C. cupressoides</i> (West in Vahl) C. Agardh	Ar-arusip	MNH 06; Pangil, Currimaos Ilocos Norte
		<i>C. lentillifera</i> J. Agardh	Ar-arusip	MNH 320; Dardarat, Cabugao Ilocos Sur
		<i>C. racemosa</i> (Forsskal) J. Agardh	Ar-arusip	MNH 05; Pangil, Currimaos Ilocos Norte
		<i>C. racemosa var. pellata</i> (Lamouroux) Eubank	Payong-payong	MNH 318; Dardarat, Cabugao Ilocos Sur
		<i>C. racemosa var. uvifera</i> (Turner) J. Agardh	Ar-arusip	MNH 319; Dardarat, Cabugao Ilocos Sur
		<i>C. serrulata</i> (Forsskal) J. Agardh	Gal-galagkak	MNH 07; Pangil, Currimaos Ilocos Norte
		<i>C. sertularioides</i> (S.G. Gmelin) Howe	Sal-salamagui	MNH 06; Pangil, Currimaos Ilocos Norte
		<i>C. webbiana</i> Montagne	Sap-saplid	MNH204; Caparispisan, Pagudpud Ilocos Norte
	Codiaceae	<i>Codium repens</i> P.C. Silva	pok-poklo	MNH 280; Dardarat, Cabugao Ilocos Sur
		<i>C. edule</i> Silva	Pok-poklo	MNH 301; Paayas, Burgos Ilocos Norte
	Halimedaceae	<i>Halimeda cuneata</i> Hering	Tuon-tuon	MNH 152; Pangil, Currimaos Ilocos Norte
		<i>H. macroloba</i> Decaisne	Tuon-tuon	MNH 24; Pangil, Currimaos Ilocos Norte
		<i>H. tuna</i> Lamouroux	Tuon-tuon	MNH 56; Paayas, Burgos, Ilocos Norte
		<i>H. opuntia</i> Lamouroux	Tuon-tuon	MNH 202; Caparispisan, Pagudpud Ilocos Norte
		<i>H. velasquezii</i> W.R. Taylor	Tuon-tuon	MNH 23; Pangil, Currimaos Ilocos Norte
	Udoteaceae	<i>Udotea orientalis</i> A. Gepp and E.S. Gepp	Ab-abaniko	MNH 205; Caparispisan, Pagudpud Ilocos Norte
<i>Chlorodesmis comosa</i> Harvey and Bailey		Lumot		
Dasycladales	Dasycladaceae	<i>Bornetella nitida</i> Munier-Chalmas ex Sonder	Malo-malo	MNH 67; Paayas, Burgos Ilocos Norte
		<i>Neomeris annulata</i> Dickie	Ig-igges	MNH 46; Paayas, Burgos Ilocos Norte

Table 2. List of species under phaeophyceae.

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
Dictyotales	Dictyotaceae	<i>Dictyota dentata</i> Lamouroux	Sang-sanga	MNH 226; Dardarat, Cabugao Ilocos Sur
		<i>D. dichotoma</i> (Hudson) Lamouroux	Sang-sanga	MNH 24; Pangil, Currimaos Ilocos Norte
		<i>D. linearis</i> (C. Agardh) G. Agardh	Sang-sanga	MNH 27; Pangil, Currimaos Ilocos Norte
		<i>Padina australis</i> Hauck	Lap-lapayag	MNH 10; Pangil, Currimaos Ilocos Norte
		<i>Padina</i> sp.	Lap-lapayag	MNH 328; Paayas, Burgos Ilocos Norte
Scytosiphonales	Scytosiphonaceae	<i>Colpomenia sinuosa</i> (Mertens ex Roth) Derbes and Solier	Tab-taba ti baybay	MNH 253; Pagsanahan, Badoc Ilocos Norte
		<i>Hydroclathrus clathratus</i> (C. Agardh) Howe	Bal-balulang	MNH 268; Gabut , Badoc Ilocos Norte
		<i>Rosenvingea intricata</i> (J. Agardh) Boergesen	Sam-sam-it	MNH209; Caparispisan, Pagudpud Ilocos Norte
Scytosiphonales	Cystoseiraceae	<i>Hormophysa triquetra</i> (L.) Kuetzing	Aragan	MNH 144; Pangil, Currimaos Ilocos Norte
	Sargassaceae	<i>Sargassum cinctum</i> J.G Agardh	Aragan	MNH 292; Paayas, Burgos Ilocos Norte
		<i>S. confusum</i> Agardh	Aragan	MNH 293; Paayas, Burgos Ilocos Norte
		<i>S. cristaeifolium</i> C.A. Agardh	Aragan	MNH 290; Paayas, Burgos Ilocos Norte
		<i>S. gracillimum</i> Reinbold	Aragan	MNH 295; Paayas, Burgos Ilocos Norte
		<i>S. hemiphyllum</i> C.A. Agardh	Aragan	MNH 294; Paayas, Burgos Ilocos Norte
		<i>S. kushimotoense</i> Yendo	Aragan	MNH 296; Paayas, Burgos Ilocos Norte
		<i>Sargassum</i> sp	Aragan	MNH 289; Paayas, Burgos Ilocos Norte
		<i>Turbinaria ornata</i> (Turner) J. Agardh	Aragan	MNH 16; Pangil, Currimaos Ilocos Norte
		<i>Hydroclathrus clathratus</i> (C. Agardh) Howe	Bal-balulang	MNH 268; Gabut , Badoc Ilocos Norte
		<i>Rosenvingea intricate</i> (J. Agardh) Boergesen	Sam-sam-it	MNH209; Caparispisan, Pagudpud Ilocos Norte

Table 2. (continued)

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
Scytosiphonales	Cystoseiraceae	<i>Hormophysa triquetra</i> (L.) Kuetzing	Aragan	MNH 144; Pangil, Currimao Ilocos Norte
	Sargassaceae	<i>Sargassum cinctum</i> J.G Agardh	Aragan	MNH 292; Paayas, Burgos Ilocos Norte
		<i>S. confusum</i> Agardh	Aragan	MNH 293; Paayas, Burgos Ilocos Norte
		<i>S. cristaeifolium</i> C.A. Agardh	Aragan	MNH 290; Paayas, Burgos Ilocos Norte
		<i>S. gracillimum</i> Reinbold	Aragan	MNH 295; Paayas, Burgos Ilocos Norte
		<i>S. hemiphyllum</i> C.A. Agardh	Aragan	MNH 294; Paayas, Burgos Ilocos Norte
		<i>S. kushimotoense</i> Yendo	Aragan	MNH 296; Paayas, Burgos Ilocos Norte
		<i>Sargassum</i> sp.	Aragan	MNH 289; Paayas, Burgos Ilocos Norte
		<i>Turbinaria ornata</i> (Turner) J. Agardh	Aragan	MNH 16; Pangil, Currimao Ilocos Norte

Table 3. List of species under rhodophyceae.

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
Scytosiphonales	Erythropeltidaceae	<i>Bangia fuscopurpurea</i> (Dillwyn) Lyngbye	Bu-buok	MNH222; Caparispisan, Pagudpud Ilocos Norte
Nemaliales	Nemaliaceae	<i>Liagoropsis schrammii</i> (Boergesen) Doty and Abbott	Baris-baris	MNH 273; Dardarat, Cabugao Ilocos Sur
		<i>Yamadaella caenomyce</i> (Decaisne) Abbott	Baris-baris	MNH 151; Pangil, Currimao Ilocos Norte
Bonnemaisoniales	Galaxauraceae	<i>Actinotrichia fragilis</i> (Forsskal) Borgesen	Ruot ti baybay	MNH 147; Pangil, Currimao Ilocos Norte
		<i>G. elongata</i> J. Agardh	Ruot ti baybay	MNH 142; Pangil, Currimao Ilocos Norte
		<i>G. oblongata</i> (Ellis and Solander) Lamouroux	Ruot ti baybay	MNH 77; Paayas, Burgos Ilocos Norte
		<i>G. subfruticulosa</i> Chou	Ruot ti baybay	MNH 322; Dardarat, Cabugao Ilocos Sur

Table 3. (continued)

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
		<i>Galaxaura</i> sp.	Ruot ti baybay	MNH 121; Caparispisan, Pagudpud Ilocos Norte
		<i>Scinia bormoides</i> Setchell	Gar-garnatis	MNH 267; Paayas, Burgos Ilocos Norte
Gelidiales	Gelidiaceae	<i>Gelidiella acerosa</i> (Forsskal) Feldmann and Hamel	Kulot	MNH 78; Paayas, Burgos Ilocos Norte
Cryptonemiales	Peyssonneliaceae	<i>Peyssonnelia rubra</i> (Greville) J. Agardh	Lap-lapayag	MNH Paayas, Burgos Ilocos Norte
	Hildenbrandiaceae	* <i>Hildenbrandia</i> sp.	Ruot ti baybay	MNH 256; Balaoan La Union
		<i>Halymenia dilatata</i> Zanardini	Gayong-gayong	MNH 231; Pug-os, Cabugao Ilocos Sur
		<i>H. durvillaei</i> Bory de Saint-Vincent	Gayong gayong	MNH 82; Paayas, Burgos Ilocos Norte
		<i>H. harveyana</i>	Gayong gayong	MNH 225; Dardarat, Cabugao Ilocos Sur
		<i>H. maculata</i> J. Agardh	Gayong gayong	MNH 240; Pagsanahan, Badoc Ilocos Norte
		<i>Cryptonemia</i> sp.	Ruot ti baybay	MNH 236; Paayas, Burgos Ilocos Norte
	Callymeniaceae	<i>Callophyllis</i> sp.	Lab-labig	MNH 283; Dardarat, Cabugao Ilocos Sur
Corralinales	Corallionaceae	<i>Amphiroa foliaceae</i> Lamouroux	Tul-tulang	MNH 265; Balaoan, La Union
		<i>A. fragilissima</i> (Linnaeus) Lamouroux	Ruot ti baybay	MNH 150; Pangil, Currimaos Ilocos Norte
		<i>Cheilosporum jungermannoides</i> Ruprecht	Ruot ti baybay	MNH 251; Pagsanahan, Badoc Ilocos Norte
		<i>Mastophora rosea</i> (C. Agardh) Setchell	Ruot ti baybay	MNH 251; Pagsanahan, Badoc Ilocos Norte
Gigartinales	Rhizophyllidaceae	<i>Portiera bornemannii</i> (Lyngbye) P.C. Silva	Ruot ti baybay	MNH 39; Paayas, Burgos Ilocos Norte
	Polyisaceae	<i>Rhodopeltis borealis</i> Yamada	Ruot ti baybay	MNH 33; Pangil, Currimaos Ilocos Norte
	Nemastomataceae	<i>Titanophora weberae</i> Borgesen		MNH 133; Pug-os, Cabugao Ilocos Sur

*This alga is temporarily assigned under this genus for want of reference material

Table 3. (Continued)

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
	Gracilariaceae	<i>Ceratodictyon spongiosum</i> Zanardini	Ruot ti baybay	MNH 89; Pangil, Currimao Ilocos Norte
		<i>Gracilaria arcuata</i> Zanardini	Kanot-kanot	MNH 41; Paayas, Burgos Ilocos Norte
		<i>G. coronopifolia</i> J. Agardh	Kao-kaoyan	MNH 12; Pangil, Currimao Ilocos Norte
		<i>G. firma</i> Zhang et Xia	Kao-kaoyan	MNH 41; Paayas, Burgos Ilocos Norte
		<i>G. eucheumoides</i> Harvey	Ang-gapang	MNH 40; Paayas, Burgos Ilocos Norte
		<i>Gracilaria salicornia</i> (C. Agradh) Dawson	Lung-lungangan	MNH 238; Dardarat, Cabugao Ilocos Sur
		<i>G. textorii</i> (Suringar) De Toni	Lab-labig	MNH 288; Paayas, Burgos Ilocos Norte
	Phylloporaceae	<i>Abnfeltia</i> sp.	Kao-kaoyan	MNH 288; Paayas, Burgos Ilocos Norte
	Plocamiaceae	<i>Plocamium telfairae</i> (W.Hooker and Harvey) Harvey ex Kutzing	Ruot ti baybay	327; Paayas, Burgos Ilocos Norte
	Solieriaceae	<i>Eucheuma arnoldii</i> Weber-van Bosse	Kanot-kanot	MNH 86; Paayas, Burgos Ilocos Norte
		<i>E. denticulatum</i> (N.L. Burnam) Collins and Harvey	Kanot-kanot	MNH 87; Paayas, Burgos Ilocos Norte
		<i>Kappaphycus cottonii</i> (Weber-van Bosse) Doty	Kanot-kanot	MNH 266; Balaoan, La Union
		<i>K. philippinensis</i> Doty	Kanot-kanot	MNH 88; Paayas, Burgos Ilocos Norte
		<i>K. striatum</i> (Schmitz) Doty	Kanot-kanot	MNH 84; Paayas, Burgos Ilocos Norte
	Hypneaceae	<i>Hypnea charoides</i> Sonder	Kulot ti pusa	MNH 47; Paayas, Burgos Ilocos Norte
		<i>H. pannosa</i> J. Agradh	Kulot	MNH 186; Pangil, Currimao Ilocos Norte
		<i>H. saidana</i> Holmes	Kulot	MNH 282; Dardarat, Cabugao Ilocos Sur
		<i>H. valentia</i> (Turner) Montagne	Kulot	MNH 255; Pagsanahan, Badoc Ilocos Norte
Ceramiales	Ceremiaceae	<i>Ceramium</i> sp	Ruot ti baybay	MNH220; Caparispisan, Pagudpud Ilocos Norte

Table 3. (Continued)

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	ACCESSION NO.; LOCALITY
		<i>Spyridia</i> sp.	Kao-kaoyan	MNH 201; Pangil, Currimao Ilocos Norte
	Delesseriaceae	<i>Claudea multifida</i> Harvey	Pak-pako ti baybay	MNH 246; Pagsanahan, Badoc Ilocos Norte
	Rhodomelaceae	<i>Acanthophora spicifera</i> (Vahl) Borgesen	Kulot	MNH 15; Pangil, Currimao Ilocos Norte
		<i>Amansia glomerata</i> C. Agardh	Ruot ti baybay	MNH 258; Balaoan, La Union
		<i>Bostrychia tenella</i> (Lamouroux) J. Agardh	Lumot	MNH 278; Dardarat, Cabugao Ilocos Sur
		<i>Laurencia composita</i> Yamada	Kulot	MNH 323; Paayas, Burgos Ilocos Norte
		<i>L. intermedia</i> Yamada	Kulot	MNH 260; Balaoan, La Union
		<i>L. pinnata</i> Yamada	Kulot	MNH 276; Dardarat, Cabugao Ilocos Sur
		<i>L. papillosa</i> (C. Agardh) Greville	Kulot	MNH 14; Pangil, Currimao Ilocos Norte

CONCLUSION AND RECOMMENDATION

The establishment of MMSU algal herbarium is an initial step in putting up a collection of voucher algal specimens found in northwest Philippines. The ultimate goal of the MMSU seaweed project is to publish a comprehensive algal flora of Ilocos Norte hence, an herbarium is necessary to produce an identification database of collected and pressed specimens of algae.

As part of an academic institution its primary function is to aid in the teaching and research of the diversity of the algal flora, particularly that of the region. Research

associated with the herbarium focuses mainly on taxonomy, systematics, biogeography and endemism. The herbarium will provide an inventory of all local specimens and will preserve specimens with complete database for future users for purposes of research, instruction, and identification.

It is therefore recommended that students, teachers or researchers undergoing algal researches or algal collection should give duplicate copies of their collections to the MMSU algal herbarium for permanent record.

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