# PHILIPPINE ALGAL TAXONOMY: PAST, PRESENT, AND FUTURE

**Paciente A. Cordero, Jr.**
Phycology Section, Botany Division
National Museum, Manila, Philippines

## ABSTRACT

This paper presents a historical account of the development of algal taxonomy in the Philippines, from its early beginnings in 1800 to the present, with emphasis on marine forms.

Marine algal taxonomists in the country are urged to shift emphasis from the classical morphologic approach to the chemotaxonomic and cytologic method in attempts at resolving the classification and phylogeny of important marine groups such as the polymorphic and economically important *Caulerpa, Ulva, Codium, Sargassum,* and *Gracilaria.* Chemotaxonomy has close affinity with the morphological approach, hence is given priority over cytology with the use of the scanning electron microscope.

## INTRODUCTION

This paper attempts to present an overview of the status and future direction of algal taxonomy in the Philippines, with emphasis on marine algae. This is in recognition of the significant role the taxonomists play in providing baseline data that link them with other scientists.

A developing country such as the Philippines expects to benefit from this symposium on the culture and utilization of algae. The information to be gained will constitute a significant addendum to the rather anemic algal literature of the country.

## HISTORICAL ACCOUNT OF ALGAL TAXONOMY

Available literature and actual explorations show that the Philippines is rich in algal materials for biological laboratory studies as well as for

commercial utilization. Most of the early studies were taxonomic works by foreign or visiting scientists.

**1800-1900**

During the early nineteenth century, various foreign expeditions as well as individuals undertook botanical collecting in the Philippines.

A. von Chamisso, botanist of the Romanzoff Expedition (1817-1818), collected the first *Corallopsis* specimen in Manila. The Philippines was not in the itinerary of this Russian exploration, but the ship *Rurik* was forced to take shelter in Manila following a heavy storm in the Pacific.

C.A. Agardh (1820) described and illustrated the type species under the name *Sphaerococcus salicornia* which was later assigned to *Corallopsis* and more recently to *Gracilaria.* R. Greville (1830) monographed *Corallopsis* based on the morphology of Chamisso's Manila material.

The Prussian East Asia Expedition headed by F.J.E. Meyen visited the Philippines in 1831. From among the materials collected in Rizal and Laguna, Georg von Martens found two new *Cladophora* species, the freshwater *Cladophora diluta* and C. *luzoniensis.*

The year 1837 might be considered the birth of algology as a science in the Philippines. It was then that the earliest mention of the algae of the country was made by Blanco (1837) in his book *Flora de Filipinos.* Two more editions of the book followed, one in 1845 by Blanco himself, and a posthumous edition in 1877-1883, completed by Fr. Ignacio Mercado and Fr. Antonio Llanos. Blanco revised a number of algal identifications he himself had made. The scarcity of botanical literature at the time and the limited academic contact with foreign algal taxonomists caused some misidentifications and duplications of scientific names.

A Manila-based Londoner, Hugh Cumings, made some valuable collections of algae that were believed worked on by Montagne (1844-1846). A great number of the Cumings collections are deposited in the Kew Herbarium in England.

An American expedition in 1854 collected mostly flowering plants and a few algae; there was no algologist in the group. The algal specimens were turned over to Bailey and Harvey who reported new records like *Dictyota dichotoma* and a host of new species, among them *Amphitetras favosa, Campylodiscus kutzingii, Lagena williamsonii* and *Triceratium orientale.* The collecting site, as reported by Charles Wilkes, head of the exploration, was confined to Marongas Island, northeast of Jolo in southern Philippines.

Georg von Martens (1866), in his compilation of algae described or

reported from tropical Asia and the Pacific, made some revisions of the nomenclature in Blanco's *Flora de Filipinos,* e.g., *Fucus gulaman* Blanco, renamed *Fucus edulis,* to *Sphaerococcus gelatinus* Agardh.

After the British Challenger Expedition (1874-1875), Dickie (1876, 1877) cited in his enumeration *Polyphysa spicata* Kutz. from Mactan Island in the Visayas.

In 1919-1921, Shaw published his exceptional study of new volvocine genera: *Campbellosphaeria, Janetosphaeria, Merrillosphaeria,* and *Copelandosphaeria.* Shaw (1923) also reported *M. africana* from Manila.

The last recorded exploration that reached the Philippines in 1800-1900 was that of the Italian *Vettor Pisani.* The collection yielded new species as described by Piccone (1886).

**1900-1941**

The year 1900 saw the coming of the Dutch Siboga Expedition which undertook intensive dredging in the Sulu Sea. The specimens were studied by different investigators. Van Bosse & Foslie worked on the corallinaceous group; Barton on *Halimeda*; A. & E.S. Gepp (1911) on Codiaceae. Weber van Bosse (1913-1928) published in two parts her annotated listing of blue-green, green, brown, and red algae. She made special mention of the abundance of *Bornetella sphaerica* (Zanard) Solms-Lauback. The bulk of the collection was preserved supposedly in Holland and elsewhere in Europe. Unlike previous expeditions, the Italian group failed to turn over duplicate materials to the Philippine Government.

Between 1907 and 1910, the United States Fish Commission boat *Albatross* visited the Philippines and some collecting was done. The Chlorophyceae was partly worked out by Gilbert(1941, 1942a,b, 1946, 1947). Velasquez (1963) cited most of the blue-greens years later.

In 1913, Merill and Shaw sent to the United States some marine algae now deposited in the New York Botanical Garden. Most of the green algae were loaned to and studied by Gilbert who described a new species, *Acetabularia philippinensis.*

Collection trips that followed were rather small-scale joint ventures with the Philippine Government. Outstanding were those by Barlett on two occasions. In 1935, Bartlett, who at that time was with the University of the Philippines as exchange professor, undertook extensive algal collecting from Batanes down to Sulu. His collections were sent to the University of Michigan.

Manza (1937a-c), a Filipino marine botanist, worked on articulated

corallinaceous algae and described such new genera as *Bossea* and *Joculator* as well as some new species.

Bartlett made his second visit to the Philippines in 1940-41 as a full-time agronomist. Nevertheless, he included seaweeds in his collections, with the assistance of J.S. Domantay, then with the Bureau of Fisheries, and a Filipino Muslim diver. The second batch of marine algal specimens was also sent to the University of Michigan and identified and distributed under the supervision of W.R. Taylor. The chlorophyceans appeared in the papers of Gilbert (1941, 1942a,b, 1946, 1947); phaeophyceans in Taylor's (1961, 1962, 1963, 1966); myxophyceans in Velasquez's (1940, 1941a,b, 1962).

**1942-1945**

The outbreak of World War II set back algological study in the Philippines. The country, scene of some of the world's fiercely fought battles, saw its herbarium, then under the Bureau of Science, reduced to ashes during the liberation of Manila. Nothing could be salvaged from the debris; algal and flowering plant materials and valuable references disappeared in the flames.

A reported study during the period was that of Dawson (1954) who collected *Corrallopsis salicornia* along the sea wall of the Manila Harbor. His material later became the topotype of the present *Gracilaria salicornia* (C. Agardh) Dawson and, therefore, confirmed the real type locality of Chamisso's erstwhile *Corallopsis* material which was doubted by Ruprecht in 1851.

**1956 to the present**

Rebuilding Philippine phycology was a very challenging task. The initial step was taken by Velasquez who, under a grant-in-aid program from the American Philosophical Society, continued his research on the myxophyceae. A number of his masteral students assisted in the rebirth of research and accumulation of references on algae.

The next step was the organization of the Phycological Society of the Philippines under the initiative of Dr. Velasquez. The aim was to build a "bank" of well-duplicated numbered specimens, only roughly identified as to family or genus, from which specialists might receive materials for use in monographic or regional studies.

In November 1964, one of the biggest post-war expeditions arrived in the Philippines. This was the joint exploration-collection of the Kagoshima University of Japan and the National Museum of the Philippines. The places of collection were the islands of Batan, Batanes, and Camiguin, and the provinces of Cagayan and La Union (San Fernando), all in the northern part of the country. The expedition lasted for one month and yielded a very

substantia] number of algal materials including freshwater forms. Tanaka (1967) described some new species out of the collected materials, like *Avrainvillea capituliformis* and *Dictyopteris camiguensis* from San Pioquinto, Camiguin Island, Cagayan Province, and *Claudea batanensis* from Basco, Batan Island, Batanes Province.

No notable expedition has been undertaken after the 1964 joint exploration. However, the University of the Philippines, through Dr. Velasquez and his students, has organized collection trips aboard the university training ship *Pampano.* The Philippine National Herbarium has had its share of algal collection trips through the initiative of the author and his co-workers in the Division of Botany.

The Philippine National Herbarium shortly after the war was transferred to the National Museum. The algal section was left with no one to restore the precious specimens that formed part of one of the richest herbaria in the world. Except for few duplicates recovered from foreign herbaria, very few materials were added. Numerous marine forms from various rich and previously unrepresented collecting grounds have been accumulated since 1963. The Philippine National Herbarium today boasts of algal specimens from different parts of the country as well as of foreign duplicates kept as exchange materials.

The 60s witnessed the turning point in algal taxonomy in the Philippines. It marked the initial active participation of Filipino phycologists in taxonomic studies especially those dealing with marine algae.

## CURRENT STATUS

The algae of the Philippines are probably the best known taxonomically in the tropical Pacific. Earlier works have already been mentioned above. Cordero (1977) studied the red algae, while the freshwater plankton became the subject of research by Pantastico (1977) and Martinez & Eakle (1977). The brown algae group is being studied by R. Modelo, Jr. at Kyoto University. Contribution by Dr. G. Trono, Jr. and his students at the University of the Philippines and by Dr. E. Menez of the Smithsonian Institution (including his students at Siliman University and University of San Carlos) also advanced significantly marine biology research in the country.

Velasquez et al. (1975) listed 229 genera and 824 species for the Philippines based on 88 publications, the earliest by Rumphius (1750) and the latest by Cordero (1977).

No less than 20 genera contain several species considered as potentially of economic importance. Some of these are the green *Enteromorpha, Ulva,*

*Caulerpa, Codium, Monostroma,* and *Chaetomorpha;* the brown *Hydroclathru8* and *Sargassum;* and the red *Asparagopsis, Acanthophora, Eucheuma, Gelidiella, Gracilaria, Hypnea, Laurencia,* and *Porphyra.*

*Caulerpa, Sargassum, Eucheuma, Gracilaria,* and *Porphyra* promise to yield economic benefit once maricultured intensively. Except for the Philippine species of *Sargassum,* the taxonomy of species in these genera has been worked out substantially by both foreign and Filipino phycologists.

To date, only *Caulerpa racemosa, Eucheuma striatum, E. spinosum,* and *Gracilaria verrucosa* have been farmed vegetatively using cuttings. There were previous attempts in 1980 to mariculture *Porphyra* by the Bureau of Fisheries and Aquatic Resources (BFAR), but with little success due to unsustained funding. *Porphyra* in the country is expensive, its supply being dependent only on natural growth in the coastal waters of northern Luzon. It promises to be a dollar-earning marine commodity. Three species occur in the country (Cordero 1974, 1976), namely, *P. crispata* Kjellman, *P. suborbiculata* Kjellman, and *P. marcosii* Cordero. The latter two are recommended for sea farming.

## FUTURE DIRECTION

The paucity of algal taxonomists in the Philippines is very pronounced. This becomes even more apparent when we consider that the phycologists in the country are based in Luzon. The Philippine Archipelago, with its 7,100 islands and a coastal line more extensive than that of continental U.S.A., is a virtual paradise for phycologists. It is, however, a difficult place to work in. Distance between islands has to be reckoned, logistic support is often entirely self-borne, and the security in some areas is unstable.

It was only in the late 70s when phycology graduates started to proliferate. Before, taxonomy and most biological sciences were taboo to Filipino students. As one writer puts it, taxonomy is not a "fashionable" science; even in terms of funding it plays second fiddle to its sister sciences like physiology and ecology. There was also the misinformed notion that taxonomy is highly specialized, and the dim chance of getting a good-paying job was most feared by students. There is some truth to this because taxonomy contends with the difficult problem of classifying biological organisms. Still, the problem involving shortage of manpower adept in algal taxonomy and absence of a well-defined national algal research program must somehow be alleviated soon.

For the present, the Philippines needs a redirection of its approach to algal taxonomy from the present classical method. This is not to say that we do away with the latter. Rather, we recognize the classical method as

integral part of the taxonomic scheme, but we must gradually shift to the cytological approach using the scanning electron microscope (SEM). However, considering the prohibitive cost of the SEM it is advisable for Filipino algal taxonomists to give more emphasis on chemotaxonomy as a tool toward improving taxonomic output. Chemotaxonomy has a close affinity with the classical morphological method. It requires team effort - a histochemist, someone to do immuno-electrophoresis, and another to do spectroscopic analysis of polysaccharides, proteins, and other pigments in the cytoplasm and cell wall of algae.

We are now doing the chemotaxonomy of brown algae in one area in Luzon. Later, we hope to resolve with the same approach some fundamental problems in the taxonomy of such economically important genera like *Ulva, Caulerpa, Gracilaria* and *Sargassum*. For these genera, life-history studies are also needed. *Sargassum* needs utmost attention. Velasquez etal.(1975) list 27 species for the country, but the veracity of this record is difficult to ascertain in the absence of a more intensive taxonomic study of the genus, itself highly polymorphic. *Sargassum* is the country's answer to the algin-rich kelp *(Macrocystis)* of temperate waters.

The issue, therefore, is how fast the Filipino algal taxonomists can accept and shift to chemotaxonomy and cytology as fundamental tools toward improvement of our research output.

## LITERATURE CITED

Agardh, C.A. 1820. Icones Algarum Ineditae. Fasciculus Primus 2, 10 pls. Lundae.

Blanco, M. 1837-1845. *Flora de Filipinos* segun el systema sexual de Linneo. p. i-ixxvii, 1-887 (1837); Segunda impresion corregida y aumentada p. i-11x, 1-619 (1845).

Blanco, M. 1877-1883. *Flora de Filipinas* adicionada con el manuscrito inedito del P. Fr. Ignacio Mercado, las obras del P. Fr. Antonio Llanos y de un apendice con todas las nuevas investigaciones botanicas referentes al archipelago Filipino. Gran edition hecha a expensa de la Pronvicia de Agustinos Calzado de Filipinas bajo la direccion cientifica y literaria de los P.P. Agustinos Calzados, P. Fr. Andres Naves y Celestino Fernandez-Villar. 1, p. i-xxx, 1-350, index I-VII(1877); 2. p. 1-419, index I-VIII (1878-1879); 3. p. 1-271, index I-VI (1879); 4-1, p. i-xviii, 1-108 (1880); 4-2, p. i-vi, 1-63 (1880); 4-3, p. i-ix, 1-368, t. 1-478 (1880-1883).

Cordero, P.A., Jr. 1974. Phycological observations - I: Genus *Porphyra* of the Philippines, its species and their occurrence. Bull. Jap. Soc. Phycol. 22(4): 134-142.

Cordero, P.A., Jr. 1976. Phycological observations - II: *Porphyra marcosii* Cordero,

a new species from the Philippines. Acta Manilana, Ser. A, 24(15):14-24.

Cordero, P.A., Jr. 1977. Systematic studies on Philippine marine red algae. Spl. Publ. Seto Mar. Biol. Lab., Kyoto Univ., Ser. IV 251 pp., 268 text-figs., 28 pls., 1 map.

Dawson, E.Y. 1954. Notes on tropical and Pacific marine algae. Bull. Southern Calif. Acad. Sci., Part I 53:1-7.

Dickie, G. 1876. Contributions to the botany of the expedition of H.M. "CHALLENGER" - chiefly Polynesian. Journ. Linn. Soc. Bot. 15:235-246.

Dickie, G. 1877. Supplementary notes on algae collected by H.M. Mosley, M.A. of H.M.S. "CHALLENGER" from various localities. Journ. Linn. Sco. Bot. 15:486-489.

Gepp, A. and E.S. Gepp. 1911. The Codiaceae of the Siboga Expedition. Siboga Expeditie Monographic 62. 150 pp., 22 pls.

Gilbert, W.J. 1941. Notes on *Caulerpa* from Java and the Philippines. Pap. Mich. Acad. Sci. Arts & Lett. 22:17-18.

Gilbert, W.J. 1942a. Studies on the marine Chlorophyceae of the Philippines. Unpublished doctorate thesis. 217 pp., 17 pls., 45 figs., 1 map.

Gilbert, W.J. 1942b. Studies on the Philippine Chlorophyceae, I. The Dasycladaceae. Pap. Mich. Acad. Sci. Arts & Lett. 28:15-35.

Gilbert, W.J. 1946. Studies on Philippine Chlorophyceae, II. Survey of literature and list of recorded species prior to 1940. Bull. Tor. Bot. Club 73:73-79.

Gilbert, W.J. 1947. Studies on Philippine Chlorophyceae. III. The Codiaceae. Bull. Torrey Bot. Club 74:121-132.

Greville, R. 1830. Algae Britannicae. 218 pp., 99 pls. Edinburg.

Manza, A.V. 1937a. The genera of the articulated corallines. Proc. Nat. Acad. Sci. 23:44-48.

Manza, A.V. 1937b. Some North Pacific species of articulated corallines from South Africa. Proc. Nat. Acad. Sci. 23:561-567.

Manza, A.V. 1937c. New species of articulated corallines from South Africa. Proc. Nat. Acad. Sci. 23:568-572.

Martenz. G. 1866. Die Preussische Expedition nach Ost-Asien. Bot. Teil, die Tange, p. 1-152, 4 phos., 3 pls.

Martinez, M.R. and T.W. Eakle. 1977. Fluctuations in algal population densities in fishponds and fishpens, Laguna de Bay, Philippines. National Research Council of the Philippines. 11 pp., 3 text-figs.

Montagne, C. 1844-1846. Crytogamae Cellulares. Gaudichaud, Bot. Voy. Bonite 1, p. 1-163 (1844); p. 205-314 (1846).

Pantastico, J.B. 1977. Taxonomy of the Freshwater Algae of Laguna de Bay and Vicinity. National Research Council of the Philippines. Bull. 261 pp., 27 pls.

Piccone, A. 1886. Algae del viaggio de circumnavigzione della Vettor Pisani. Genova, p. 80-97, t. 1-2.

Rumphius, G.E. 1750. Herbarium Amboinense. Amst. (1741-1755), 6 vols.

Shaw, W.T. 1919-1922. Papers on Volvocaceae of the Philippines, four genera in separate articles. Philipp. Jour. Sci., respectively *Campbellasphaeria,* 15(6):493-520; *Janetosphaeria,* 20(5):477-508; *Merrillosphaeria,* 21(1):87-129; *Copelandosphaeria,* 21(2):207.

Shaw, W.T. 1923. *Merrillosphaeria africana* at Manila. Philipp. Jour. Sci. 22:185-218.

Tanaka, T. 1967. Some marine algae from Batan and Camiguin Islands, northern Philippines. I. Mem. Fac. Fish., Kagoshima Univ. (6):13-27.

Taylor, W.M., R. 1961. *Cladophoropsis philippinensis,* a new species from the western Pacific Ocean. Bot. Mar. 3:56-59.

Taylor, WM., R. 1962. Two undescribed species of *Halimeda.* Bull. Torrey Bot. Club 89(3):172-177.

Taylor, WM., R. 1963. The genus *Turbinaria* in eastern seas. J.Linn. Soc. (Bot.) 58:475-487.

Taylor, WM., R. 1966. Records of Asian and western Pacific marine algae particularly algae from Indonesia and the Philippines. Pac. Sci. 20:

Velasquez, G.T. 1940. Myxophyceae of the Philippines, I. Nat. App. Sci. Bull. 7:269-271.

Velasquez, G.T. 1941a. Myxophyceae of the Philippines, II. Family Oscillatoriaceae. Nat. App. Sci. Bull. 8:189-200.

Velasquez, G.T. 1941b. Myxophyceae of the Philippines, III. Nostocaceae, Scytonemataceae, Stigonemataceae, and Rivulariaceae. Nat. App. Sci. 8:203-210.

Velasquez, G.T. 1962. On the state of Phycological knowledge in the Philippines. Proc. 9th Pac. Sci Congress, Bangkok (Bot.)4:234-238.

Velasquez, G.T., G.C. Trono, Jr., and M.S. Doty. 1975. Algal species reported from the Philippines. Philipp. Jour. Sci. 101(3-4):115-169.

Weber van Bosse. 1913-1928. Liste des algues du Siboga Exped. 59a-d, p. 1-533, fig. 71, t. 1-17.