

Short Communication

Macrobenthic Algae of the Southern Coasts of Catanduanes Island, Philippines: Historical Account and Critical Review of Records

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ABSTRACT:- The Philippines occupies the northern apex of the Coral Triangle, a vast area straddling the Indian and Pacific Oceans renowned for its extremely rich marine biodiversity. A brief historical account and species list of the known marine benthic algae from the southern coast of Catanduanes Island, northeastern Philippines were compiled from the published literature and the scientific names were updated accordingly to conform to conventional, accepted nomenclature. Some 147 taxa of marine algae were accounted for which can further be grouped into 68 green algae (Chlorophyta), 25 brown algae (Phaeophyceae), 52 red algae (Rhodophyta) and two blue-green algae (Cyanobacteria). The information is useful for providing baseline data for effective marine resource management. Among the species listed are some with untapped economic potentials that may prove useful for livelihood generation and poverty alleviation among island inhabitants.

KEY WORDS: Macrobenthic Algae, Catanduanes Island, Philippines.

INTRODUCTION

The Bicol region in southeastern Luzon Island is among the most typhoon prone areas in the Philippines owing to its location facing the western Pacific Ocean. One such consequence is the dearth of marine surveys of the coastal ecosystems there where unpredictable weather and sea conditions can pose serious risks to life and limb. On the other hand, the frequent stormy conditions cause greater water exchange recharging the seas with nutrients that support a rich marine benthic biodiversity on the rugged volcanic coastlines. One of the richest assemblages of

benthic marine algae in the Philippines has been documented in the southernmost tip of Bicol region in the province of Sorsogon (Trono, 1975, 1976; Kraft *et al.*, 1999). The shores of Bulusan municipality in Sorsogon have yielded several new species, genera and even families of marine algae (e.g., Kraft, 1972, 1976; Kraft *et al.*, 1999).

Catanduanes is an island province on the northeastern side of Bicol region that has attracted botanists to its shores for almost a century despite its remoteness. The prolific Filipino collectors Maximo Ramos and Gregorio E. Edaño of the former Bureau of

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Science of the American colonial period were the first to collect samples of marine algae in July to September 1928. The bulk of their collections as well as those of others was apparently destroyed during the Battle of Manila in 1944 which razed the entire Bureau of Science herbarium. Fortunately, some duplicates were distributed and preserved in a number of foreign herbaria and were studied by Taylor (1966) and Modelo and Umezaki (1984). The next botanical collecting activity on the shores of Catanduanes would take place thirty years later in May 1958 when Maxwell Stanford Doty and Gregorio Tiongson Velasquez, professors at the University of Hawaii and the University of the Philippines, respectively, visited Benticayan Bay on the southeastern side of the island. Velasquez would later return in February 1962 to collect in Cabugao Bay and Egang Cove in the vicinity of the provincial capital town of Virac. In November 1968, Gavino Cajulao Trono, Jr., at the time newly returned from his graduate studies under M.S. Doty collected from southeastern Catanduanes for the first time in November 1968. He would return again to collect on December 1971. Subsequently, many Filipino and foreign botanists would also collect and publish on their collections.

The earliest report of Catanduanes marine algae was made by Taylor (1966) who listed three species among a large collection of seaweeds he examined from the western Pacific Ocean. He recorded one species of brown alga, *Padina boryana* Thivy ex Taylor and two species of green algae, *Dasycladus australasicus* (Sonder) De Toni (as "australicus" and attributed to Cramer) and *Halimeda opuntia* (Linn.) Lamouroux, all collected by the tandem of Ramos and Edaño in 1928. The first species was described as a new species in the same publication with a sample from Tonga designated as type specimen. Later, the Philippine record of *D. australasicus* was recognized as *Chlorocladus australasicus*

Sonder by Silva *et al.* (1987). A rare, minute species, *Lophosiphonia cristata* Falkenberg was the first red marine alga from Catanduanes which was reported by Hollenberg (1968). The following year Saito (1969) studied the genus *Laurencia* (Ceramiales, Rhodomelaceae) from the western Pacific Ocean and reported two species based on materials collected from Catanduanes by Doty and Velasquez in 1958 namely, *Laurencia papillosa* (C. Agardh) Greville and *L. subsimplex* Tseng. The former is currently recognized as *Palisada perforata* (Bory de Saint Vincent) K.W. Nam. The latter is represented by a single collection from Catanduanes and has since then never been reported elsewhere in the Philippines.

Gilbert and Doty (1969) studied several noteworthy species of marine Chlorophyceae from Catanduanes including representatives of the Udoteaceae and Dasycladaceae. In the same paper, they reported an unidentified species of *Trichosolen* (Bryopsidales, Bryopsidaceae) which was also a genus recorded for the first time from Philippine waters. Many species of *Trichosolen* have been transferred to the genus *Pseudobryopsis* and vice versa due to various and divergent nomenclatural interpretations. Henne and Schnetter (1999) maintained these two genera as distinct. The identity of the Catanduanes samples have not been ascertained but it could possibly be one of the species reported from around the region, either *Pseudobryopsis hainanensis* Tseng (type locality: Hainan Island), *P. oahuensis* Egerod (type locality: Hawaii) or *Trichosolen parvus* (Dawson) Taylor (type locality: Pacific Mexico, and recently reported from Vietnam; basionym - *Pseudobryopsis parva* Dawson).

The island of Catanduanes is the type locality of at least two new species of marine algae: *Acetabularia velasquezii* Trono, Santiago & Ganzon-Fortes (1978) and *Sargassum yoshidae* Trono (1994).

One of the most comprehensive surveys of the seaweeds of Catanduanes was conducted in the early 1980s by Eden E. Vela-Evangelista who was a graduate student at the University of Santo Tomas in Manila at that time. Her collection is largely unpublished and forms the major basis of this report. Her samples have been deposited at the National Museum of the Philippines (PNH). This species checklist is therefore primarily culled from her unpublished report (submitted in 1982) as well as from every available previous report on Catanduanes marine algae. The aim of this present report is to produce a comprehensive species list using updated nomenclature within a contemporary classification system such as that of Dawes and Mathieson (2010).

MATERIALS AND METHODS

The island of Catanduanes is located off the southeastern coast of the main Philippine island of Luzon (Fig. 1) from which it is separated by Lagonoy Gulf to its southwest. Its eastern shore faces the vast Pacific Ocean. The mountainous island province has a land area of approximately 1,500 km² with a population of about 250,000. Much of the botanical collecting activity has been limited to the southern half of the island owing to better transportation access there and relatively safer and protected coastal away from the strong winds blowing from the Pacific.

The species list was generated from all known sources of published literature. A significant portion of the list was also taken from the unpublished report of the first author (Vela, 1982). Species names from the original literature were reviewed and updated. Where necessary, some annotations and remarks have been included under selected individual species. Sources of individual reports are indicated in brackets following each species name.

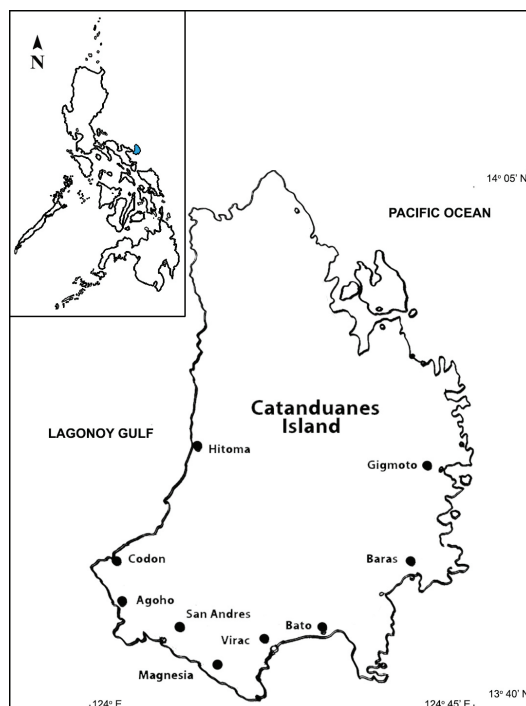


Figure. 1. Map of the island province of Catanduanes, showing the different collecting stations Vela (1982).

RESULTS AND DISCUSSION

The present comprehensive survey of marine benthic algae covered published reports from different localities (i.e., towns, villages) on the southern fringes of Catanduanes island province. The names of collecting localities are indicated in Fig. 1. A total of 147 species is listed, broken down into 68 species of green algae (Chlorophyta), 25 species of brown algae (Phaeophyceae), 52 species of red algae (Rhodophyta) and two species of blue-green algae (Cyanobacteria). The species have been classified following the system of Dawes and Mathieson (2010). Synonyms, if any, are indicated below each currently accepted name.

Phylum **CHLOROPHYTA**
 Class **ULVOPHYCEAE**
ULVALES

Ulvaceae

Ulva clathrata (Roth) C. Agardh [Mendoza and Soliman, 2013]

=*Enteromorpha clathrata* (Roth) Greville [Vela, 1982]

Remarks: Species of the genus *Enteromorpha* Link have been transferred to *Ulva* Linnaeus recently on the basis of molecular evidence (Hayden *et al.*, 2003).

Ulva compressa Linnaeus

=*Enteromorpha compressa* (Linnaeus) Nees [Vela, 1982]

Ulva intestinalis Linnaeus

=*Enteromorpha intestinalis* (Linnaeus) Nees [Vela, 1982; Trono, 1997]

Ulva lactuca Linnaeus [Vela, 1982; Trono, 1997]

Remarks: This name has been applied conveniently to broadly foliose species of *Ulva* over the years. However, records of this species from the Philippines as well as from around the Indo-Pacific are to be treated cautiously as this species name appears to be applicable to entities inhabiting cooler waters.

Ulva sp. [Mendoza and Solima, 2013]

CLADOPHORALES

Anadyomenaceae

Anadyomene wrightii Harvey ex J. Gray [Vela, 1982]

Microdictyon japonicum Setchell [Vela, 1982]

Boodleaceae

Boodlea composita (Harvey) Brand [Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

Cladophoraceae

Chaetomorpha vieillardii (Kützinger) Wynne

=*Chaetomorpha crassa* (C. Agardh) Kützinger [Vela, 1982; Trono, 1997]

Remarks: This coarse, large-celled species commonly encountered in tropical waters

has been erroneously given a name currently applied to a European species; a new substitute name has been proposed for the Philippine species.

Chaetomorpha spiralis Okamura [Vela, 1982]

Chaetomorpha sp. [Mendoza and Soliman, 2013]

Cladophora rupestris (Linnaeus) Kützinger [Vela, 1982]

Cladophora trichotoma (C. Agardh) Kützinger [Trono and Young, 1977]

Remarks: This species is usually regarded as one of the many synonyms of *Cladophora pellucida* (Hudson) Kützinger, a species restricted to European waters. A careful examination of the materials will be needed to assign them to one of the species commonly encountered in the tropics like *C. sibogae* Reinbold and *C. socialis* Kützinger with which it shares similar characteristics.

Siphonocladaceae

Boergesenia forbesii Harvey [Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]

Dictyosphaeria cavernosa (Forsskål) Børgesen [Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

Dictyosphaeria versluysii Weber-van Bosse [Trono, 1997]

Dictyopshaeria sp. [Mendoza and Soliman, 2013]

Valoniaceae

Valonia aegagropila C. Agardh [Mendoza and Soliman, 2013]

Valonia ventricosa J. Agardh [Mendoza and Soliman, 2013]

BRYOPSIDALES

Bryopsidaceae

Bryopsis plumosa (Hudson) C. Agardh [Vela, 1982]

Trichosolen sp. [Gilbert and Doty, 1969]

Remarks: The identity of this species as

well as its correct generic placement is still uncertain as explained above.

Caulerpaceae

- Caulerpa cupressoides* (Vahl) C. Agardh [Taylor, 1977; Vela, 1982; Trono, 1997]
Caulerpa lentillifera J. Agardh [Taylor, 1977; Trono and Tuason, 1978; Trono, 1997; Mendoza and Soliman, 2013]
Caulerpa prolifera Forsskål [Trono, 2004]
 Remarks: The occurrence of this species in the Philippines and around Southeast Asia should be carefully studied. Most of the records of this species pointed to a very similar species, *C. brachypus* Harvey as noted by Belleza and Liao (2007). This particular record very likely points to the Indo-West Pacific species, *C. brachypus*.
Caulerpa racemosa (Forsskål) J. Agardh [Taylor, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Caulerpa racemosa var. *laetevirens* (Montagne) Weber-van Bosse [Vela, 1982]
Caulerpa racemosa var. *uvifera* (C. Agardh) J. Agardh [Vela, 1982]
Caulerpa serrulata (Forsskål) J. Agardh [Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Caulerpa serrulata var. *spiralis* Weber-van Bosse [Taylor, 1977]
Caulerpa sertularioides (Gmelin) Howe [Taylor 1977; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Caulepa taxifolia (Vahl) C. Agardh [Vela, 1982]

Codiaceae

- Codium edule* Silva [Vela, 1982]
Codium geppii Schmidt [Trono, 2004]
Codium repens [Vela, 1982]
 Remarks: This record probably represents *Codium arabicum* Kützinger as this amorphous species is widely distributed throughout the Indo-Pacific region and should form part of

the marine flora of Catanduanes.
Codium sp. [Mendoza and Soliman, 2013]

Halimedaceae

- Halimeda discoidea* Decaisne [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997]
 Remarks: *Halimeda cuneata* Hering as reported by Vela (1982) may be referred to this species. Many previous records of *H. cuneata* in the Philippines are referable to *H. discoidea* because the former is usually restricted to the coasts of East Africa eastward to India. The present collection looks superficially similar to *H. discoidea* as well.
Halimeda fragilis W.R. Taylor [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997]
Halimeda incrassata (Ellis) Lamouroux [Trono, 1997; Mendoza and Soliman, 2013]
Halimeda macroloba Decaisne [Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Halimeda macrophysa Askenasy [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997]
Halimeda opuntia (Linnaeus) Lamouroux [Taylor, 1966; Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Halimeda taenicola W.R. Taylor [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997; Mendoza and Soliman, 2013]
Halimeda tuna (Ellis & Solander) Lamouroux [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997; Mendoza and Soliman, 2013]
Halimeda sp. [Trono and Young, 1977; Mendoza and Soliman, 2013]

Udoteaceae

- Avrainvillea erecta* (Berkeley) A. & E.S. Gepp [Gilbert and Doty, 1969; Vela, 1982; Trono, 1997]

- Avrainvillea lacerata* Harvey ex J. Agardh [Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Avrainvillea longicaulis (Kützting) Murray & Boodle [Trono, 1997]
Avrainvillea obscura (C. Agardh) J. Agardh [Gilbert and Doty, 1969; Trono, 1997]
Avrainvillea sordida Murray & Boodle [Gilbert and Doty, 1969]
Chlorodesmis fastigiata (C. Agardh) Ducker [Trono, 1997]
 = *Chlorodesmis comosa* Harvey & Bailey [Gilbert and Doty, 1969; Trono and Tuason, 1978; Vela, 1982; Mendoza and Soliman, 2013]
Tydemania expeditionis Weber-van Bosse [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997]
Udotea argentea Zanardini var. *argentea*
 Remarks: This typical variety was reported by Vela (1982) as var. *typica* A. & E.S. Gepp (1911) to contrast it from var. *spumosa* A. & E.S. Gepp (1911) which has also been reported from the Philippines.
Udotea glaucescens Harvey ex J. Agardh [Gilbert and Doty, 1969]
Udotea occidentalis A. & E.S. Gepp [Mendoza and Soliman, 2013]
Udotea orientalis A. & E.S. Gepp [Gilbert and Doty 1969; Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

DASYCLADALES

Dasycladaceae

- Bornetella nitida* Sonder [Trono and Tuason, 1978; Vela, 1982; Trono, 1997]
Bornetella oligospora Solms-Laubach [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997; Mendoza and Soliman, 2013]
Bornetella sphaerica (Zanardini) Solms-Laubach [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997; Mendoza and Soliman, 2013]
 Remarks: The report of *Bornetella ovalis*

Yamada by Vela (1982) is most likely referable to *B. sphaerica*, a common element of the Indo-Pacific marine flora and which is fairly easy to recognize in the field when present.

- Chlorocladus australasicus* Sonder
 = *Chlorocladus philippinensis* Gilbert [Vela, 1982; Calumpong and Meñez, 1997; Mendoza and Soliman, 2013]
 = *Dasycladus australicus* (Sonder) Cramer [Taylor, 1966]
Cymopolia van-bosseae Solms-Laubach [Gilbert and Doty, 1969; Vela, 1982; Trono, 1997]
Neomeris annulata Dickie [Vela, 1982; Trono, 1997]
Neomeris vanbosseae Howe [Trono and Tuason, 1978; Calumpong and Meñez, 1997; Mendoza and Soliman, 2013]

Polyphysaceae

- Acetabularia dentata* Solms-Laubach [Trono, 1997]
Acetabularia major Martens [Gilbert and Doty, 1969; Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]
Acetabularia ryukyuensis Okamura & Yamada
 Remarks: *Acetabularia philippinensis* Gilbert is a large species originally described from Taytay, Palawan and reported to occur in Catanduanes by Trono and Tuason (1978). Most taxonomists concurred that the species name is antedated by the Japanese species from the Ryukyu Islands in southwestern Japan.
Halicoryne wrightii Harvey [Trono and Young 1977; Trono and Tuason, 1978; Cordero, 1980; Vela, 1982; Calumpong and Meñez, 1997; Trono, 1997; Mendoza and Soliman, 2013]
Parvocaulis clavatus (Yamada) Berger, Fettweiss, Gleissberg, Liddle, Richter, Sawitzky & Zuccarello
 Remarks: *Acetabularia clavata* Yamada as reported by Trono (1997) is now recognized as belonging to the segregate genus

Parvocaulis based on molecular and morphological evidence.

Parvocaulis parvulus (Solms-Laubach) Berger, Fettweiss, Gleissberg, Liddle, Richter, Sawitzky & Zuccarello

Remarks: This minute species identified as *Acetabularia moebii* Solms-Laubach by Trono (1997) has now been synonymized and transferred to this currently accepted species name. Another species, *Acetabularia velasquezii* Trono, Santiago & Ganzon-Fortes, originally described from Catanduanes and reported recently by Trono (1997) has also been synonymized under this species.

Phylum **HETEROKONTOPHYTA**

Class **PHAEOPHYCEAE**

DICTYOTALES

Dictyotaceae

Canistrocarpus cervicornis (Kützinger) De Paula & De Clerck

Remarks: This species has been reported under its old name within the genus *Dictyota* by Mendoza and Soliman (2013) and has since been removed into its segregate genus.

Dictyota dichotoma (Hudson) Lamouroux [Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

Remarks: Records of this species from the Philippines and other parts of the Indo-Pacific need to be re-examined more critically as recent studies have pointed to its seemingly restricted distribution in the North Atlantic.

Dictyota friabilis Setchell [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1997]

Dictyota linearis (C. Agardh) Greville [Vela, 1982; Mendoza and Soliman, 2013]

Dictyota patens J. Agardh [Vela, 1982]

Remarks: This species is usually regarded as a synonym of *Dictyota bartayresiana* Lamouroux, a species also commonly reported from the Philippines.

Lobophora variegata (Lamouroux) Womersley ex Oliveira

=*Pocockiella variegata* (Lamouroux)

Papenfuss [Vela, 1982]

Padina australis Hauck [Vela, 1982]

Padina boryana Thivy ex W.R. Taylor [Taylor, 1966; Modelo and Umezaki, 1984; Trono, 2004]

=*Padina commersonii* Bory de Saint-Vincent [Vela, 1982]

Padina japonica Yamada [Trono and Young, 1977; Trono, 1997; Vela, 1982; Mendoza and Soliman, 2013]

Padina minor Yamada [Trono and Tuason, 1978; Modelo and Umezaki, 1984; Trono, 1997]

Padina pavonica (Linnaeus) Thivy ex W.R. Taylor [Modelo and Umezaki, 1984]

Padina sp. [Mendoza and Soliman, 2013]

ECTOCARPALES

Scytosiphonaceae

Colpomenia sinuosa (Mertens ex Roth) Derbès & Solier [Vela, 1982]

Hydroclathrus clathratus (C. Agardh) Howe [Vela, 1982; Trono, 1997]

Chnoosporaceae

Chnoospora implexa J. Agardh [Trono, 1997]

FUCALES

Sargassaceae

Hormophysa cuneiformis (Gmelin) Silva [Liao *et al.*, 1997]

=*Hormophysa triquetra* (C. Agardh) Kützinger [Vela, 1982]

Sargassum carpophyllum J. Agardh [Modelo and Umezaki, 1995]

Sargassum cristaeifolium C. Agardh

=*Sargassum duplicatum* Bory de Saint-Vincent [Vela, 1982]

Sargassum oligocystum Montagne [Trono, 1992; Trono, 1997]

Sargassum polycystum C. Agardh [Trono and Tuason, 1978; Trono, 1997]

Sargassum yoshidae Trono [Trono, 2004]

Sargassum sp. [Trono and Young, 1977; Trono and Tuason, 1978; Trono, 1992; Mendoza and Soliman, 2013]

Turbinaria decurrens Bory de Saint-Vincent [Trono and Young, 1977; Trono, 1997]
Remarks: *Turbinaria turbinata* (Linnaeus) Kuntze as reported by Vela (1982) is likely an erroneous record. Her material probably refers to one of the two Indo-Pacific species with distinctly obpyramidal foliar parts namely, *T. decurrens* or *T. murrayana* Barton, as *T. turbinata* is a species restricted to the Atlantic and the Caribbean (Taylor, 1964). The distinction between these two species however needs to be further studied.

Turbinaria ornata (Turner) J. Agardh [Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

Turbinaria sp. [Mendoza and Soliman, 2013]

Phylum **RHODOPHYTA**
Class **FLORIDEOPHYCEAE**
Subclass **NEMALIOPHYCIDAE**
CORALLINALES
Corallinaceae
Mastophoroideae

Mastophora rosea (C. Agardh) Setchell [Cordero 1977; Vela, 1982; Trono, 1997] Lithophylloideae

Amphiroa ephedraea (Lamarck) Decaisne [Vela, 1982]

Amphiroa foliacea Lamouroux [Trono and Young, 1977; Vela, 1982]

Amphiroa fragilissima (Linnaeus) Lamouroux [Vela, 1982; Trono, 1997]

Jania adhaerens Lamouroux [Vela, 1982]

Jania cultrata (Harvey) Kim, Guiry & Choi
Remarks: *Cheilosporum cultratum* (Harvey) Areschoug as reported by Trono (1997) is now recognized as a species of *Jania* based on molecular evidence presented by Kim *et al.* (2007).

Jania unguolata forma *brevior* (Yendo) Yendo [Vela, 1982]

Jania sp. [Mendoza and Soliman, 2013]

NEMALIALES

Liagoraceae

Ganonema farinosum (Lamouroux) K.C. Fan & Y.C. Wang

=*Liagora farinosa* Lamouroux [Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

Izziella orientalis (J. Agardh) Huisman & Schils
Remarks: The report of *Liagora orientalis* J. Agardh reported by Cordero (1977) and Trono (2004) may be referred to this segregate genus.

Liagora boergesenii Yamada [Cordero, 1977; Vela, 1982]

Liagora ceranoides Lamouroux [Vela, 1982]

Liagora sp. [Mendoza and Soliman, 2013]

Liagoropsis schrammii (Crouan & Crouan) Doty & Abbott

Remarks: This species is relatively common in this part of the Philippines and is most likely similar to what was reported as *Helminthocladia australis* Harvey by Vela, (1982).

Yamadaella cenomyce (Decaisne) Abbott [Cordero, 1977; Vela, 1982; Trono, 1997]

Galaxauraceae

Actinotrichia fragilis (Forsskål) Børgesen [Trono and Young, 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]

Dichotomaria apiculata (Kjellman) Kurihara & Masuda

Remarks: The species *Galaxaura apiculata* Kjellman as reported by Trono, (1997) may now be referred to this genus based on molecular evidence.

Dichotomaria arborea (Kjellman) Kurihara & Huisman

Remarks: This distinctly flattened species formerly known as *Galaxaura arborea* Kjellman and reported by Vela, (1982) is now more correctly known under this name based on detailed morphological and molecular studies.

Dichotomaria obtusata Lamarck

Remarks: The report of *Galaxaura obtusata* (Ellis & Solander) Lamouroux by Trono, (2004) may be referred to its currently accepted name based on molecular evidence.

Galaxaura divaricata (Linnaeus) Huisman & Townsend

Remarks: The reports of *Galaxaura fasciculata* Kjellman by Trono and Tuason, (1978) and Trono, (1997) may be referred to this earlier valid name.

Galaxaura rugosa (Ellis & Solander) Lamouroux
= *Galaxaura elongata* J. Agardh [Vela, 1982]
= *Galaxaura subfruticulosa* Chou [Vela, 1982]
= *Galaxaura subverticillata* Kjellman [Trono, 1997]

Tricleocarpa cylindrica (Ellis & Solander) Huisman & Borowitzka [Wiriyadamrikul *et al.*, 2013]

Tricleocarpa fragilis (Linnaeus) Huisman & Townsend [Wiriyadamrikul *et al.*, 2013]
= *Galaxaura oblongata* (Ellis & Solander) Lamouroux [Cordero, 1977; Trono and Young 1977; Trono and Tuason, 1978; Vela, 1982; Trono, 1997; Mendoza and Soliman, 2013]

Subclass **RHODYMENIOPHYCIDAE**

BONNEMAISONIALES

Bonnemaisoniaceae

Asparagopsis taxiformis (Delile) Trevisan [Vela, 1982]

CERAMIALES

Ceramiaceae

Herpochondria elegans (Okamura) Itono
= *Microcladia elegans* Okamura [Cordero, 1977]

Rhodomelaceae

Acanthophora spicifera (Vahl) Børgesen [Cordero, 1977; Vela, 1982; Trono, 1997]

Acrocystis nana Zanardini [Vela, 1982]

Amansia glomerata C. Agardh [Cordero, 1977;

Trono and Tuason, 1978; Vela, 1982; Trono, 1997]

Bostrychia tenella (Lamouroux) J. Agardh [Vela, 1982]

Laurencia subsimplex Tseng [Saito 1969]

Leveillea jungermannioides (Hering & Martens) Harvey [Trono and Tuason, 1978; Trono, 1997]

Lophosiphonia cristata Falkenberg [Hollenberg, 1968]

Palisada perforata (Bory de Saint-Vincent) K.W. Nam

= *Laurencia papillosa* (C. Agardh) Greville [Saito, 1969; Vela, 1982; Trono, 1997]

GELIDIALES

Gelidiaceae

Gelidium kintaroi Yamada

Remarks: A report was made under the homonymous *Gelidium clavatum* Okamura by Cordero (1977) [non *Gelidium clavatum* (Lamouroux) Lamouroux] which should be correctly identified under its replacement name.

Gelidiellaceae

Gelidiella acerosa (Forsskål) Feldmann & Hamel [Cordero, 1977; Vela, 1982; Trono, 1997]

Gelidiella sp. [Mendoza and Soliman, 2013]

GIGARTINALES

Cystocloniaceae

Hypnea boergesenii Tanaka [Mendoza and Soliman, 2013]

Hypnea cervicornis J. Agardh [Vela, 1982]

Hypnea charoides Lamouroux [Cordero, 1977; Vela, 1982; Trono, 1997]

Schizymeniaceae

Titanophora weberae Børgesen [Vela, 1982]

Solieriaceae

Betaphycus gelatinum (Esper) Doty ex Silva
= *Eucheuma gelatinae* (Esper) J. Agardh
[Vela, 1982]

Eucheuma denticulatum (Burman) Collins &
Hervey [Trono, 1997]
= *Eucheuma muricatum* (Gmelin) Weber-van
Bosse [Vela, 1982]

Eucheuma sp. [Mendoza and Soliman, 2013]

GRACILARIALES**Gracilariaceae**

Gracilaria arcuata Zanardini [Vela, 1982]

Gracilaria canaliculata Sonder
= *Gracilaria crassa* Harvey ex J. Agardh
[Vela, 1982]

Gracilaria salicornia (C. Agardh) Dawson
[Trono, 1997]

Gracilaria sp. [Mendoza and Soliman, 2013]

Hydropuntia edulis (Gmelin) Gurgel & Fredericq
= *Gracilaria edulis* (Gmelin) Silva [Trono,
1997]

Remarks: The report of *Gracilaria verrucosa*
(Hudson) Papenfuss by Vela, (1982) and
previous workers probably refers to this
species.

Hydropuntia eucheumatoides (Harvey) Gurgel
& Fredericq
= *Gracilaria eucheumatoides* Harvey [Vela,
1982]

HALYMENIALES**Halymeniaceae**

Halymenia durvillaei Bory de Saint-Vincent
[Trono and Young, 1977; Vela, 1982; Trono,
1997; De Smedt *et al.*, 2001]

Halymenia sp. [Cordero, 1977; Mendoza and
Soliman, 2013]

Rhizophyllidaceae

Portieria hornemannii (Lyngbye) Silva [Trono,
1997]

= *Chondrococcus hornemannii* (Lyngbye)
Schmitz [Vela, 1982]

= *Desmia hornemannii* Lyngbye [Trono and
Tuason, 1978]

CYANOPHYCEAE**OSCILLATORIALES****Oscillatoriaceae**

Lyngbya majuscula (Dillwyn) Harvey [Vela,
1982]

STIGONEMATALES**Mastigocladaceae**

Brachytrichia quoyi (C. Agardh) Bornet &
Flahault [Vela, 1982]

Doubtful species

These species cannot be convincingly verified
through examination of photos and descriptions,
or no vouchers can be located for further
examination. Their identity remains doubtful
and hence excluded from the marine flora of
Catanduanes on these and phytogeographical
grounds.

Codium intricatum Okamura [Vela, 1982]

Kallymenia callophylloides Okamura & Segawa
[Vela, 1982]

Peyssonnelia distenta (Harvey) Yamada [Vela,
1982]

Phyllophora intricata Okamura [Vela, 1982]

Sargassum crispifolium Yamada [Vela, 1982]

Sargassum nigrifolium Yendo [Vela, 1982]

Sargassum piluliferum (Turner) C. Agardh
[Vela, 1982]

The long and rugged Pacific coasts of the
Philippines represent one of the potentially
richest habitats in terms of marine
biodiversity. The exposed nature of the coasts
that are largely affected by the dynamics of
the Kuroshio Current flowing westward from
the Pacific Ocean plays an important role in

maintaining the rich biodiversity in these regions. The Kuroshio Current is responsible for the dispersal of many marine organisms which in turn affects fisheries of these and other species in the adjacent regions (Hwang *et al.* 2007; Itoh and Kimura 2007). It most likely carries propagules and spores of seaweeds in its nutrient rich waters to the eastern shores and to the inland waters of the Philippines contributing to the rich marine biodiversity seen there.

Along the Pacific coasts of the Philippines, the knowledge of the diversity of seaweeds is at best sporadic. The northernmost group of islands comprising the Batanes and Babuyan islets has been surveyed by a joint Philippine National Museum-Kagoshima University expedition in 1964 and its seaweed flora has been published by Tanaka (1967), Cordero (1976, 1977a, 1978) and Cordero and Tanaka (1972). The only other region of notable interest along the Pacific coast is the extreme southeastern portion of Luzon Island (Bicol region). Points to the south of the Bicol region all the way down to the Visayan islands and the large island of Mindanao are poorly known except for occasional reports from individual collections (e.g., Gilbert and Doty, 1969; Modelo and Umezaki, 1995).

Within the Bicol region, the area around Bulusan in the province of Sorsogon is among the most diverse and best documented in terms of seaweed diversity. Its rich flora has been documented mainly by Kraft (1972, 1976), Trono (1975, 1976) and Kraft *et al.* (1999). For a particular group like the red seaweeds (Rhodophyceae), 130 species have been recorded from two sites that were surveyed comprehensively on two occasions in 1968 as well as a two-day survey in 1998 involving a team of specialists (Kraft *et al.* 1999). The marine red algae in these sites constitute about one-third of the entire Philippine marine red algal flora (Silva *et al.*

1987). About 60 km to the northwest is the economically important Lagonoy Bay where another study of the seaweed flora, although mainly ecological in nature, was conducted by Mendoza and Soliman (2013). From 12 sites around Lagonoy Gulf, 55 species of seaweeds have been documented.

The island province of Catanduanes, specifically its southern coasts is the subject of the present report. The 147 species of marine algae accounted for in this study indicate a richness that is only starting to be appreciated. Another survey in the future that will include the less accessible coastal areas of the northern half of Catanduanes will surely and significantly add to the already extensive list of species presented here. Proof to this is the richness revealed by one-day and single-locality collections such as that done in tiny Minabalay Island off the southeastern coast of Catanduanes by Trono and Young (1977) that accounted for 25 species including six new provincial records.

Being under the direct influence of the warm waters of the Kuroshio Current, the island province of Catanduanes is likely to host a number of species from the waters of central tropical Pacific Ocean traversed by the Kuroshio Current. Also because of the influence of the different monsoon seasons that prevail in this region similar to the phenomena reported by Mendoza and Soliman (2013), the seaweed diversity in Catanduanes exhibits marked seasonal changes. Clearly, any meaningful seaweed survey must take into consideration the changing seasons that bring about changing water conditions that affect different species. In Catanduanes, for example, taxonomic surveys of seaweeds must account for this temporal variability across the entire length and breadth of the island province and not just the more easily accessible southern coasts in order to get a clearer and more accurate floristic

overview. The development of human resource and expertise in seaweed taxonomy is also crucial towards fulfilling this goal. Unfortunately, however, the dearth of seaweed taxonomic expertise continues to present obstacles in fully understanding this apparently rich but inadequately known marine flora of Catanduanes as well as in other localities throughout the Philippines.

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