

Probing the Enigmatic Record of *Gracilaria disticha* (Gracilariales, Rhodophyta) Reported from Sibuyan Island, Philippines

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ABSTRACT

The marine red seaweed genus *Gracilaria* is among the most species-rich that is widely distributed throughout the Philippines. While many species are common and well characterized, there are a number of those poorly known and often based on single and overlooked reports. One such little known species is *Gracilaria disticha* (J. Agardh) J. Agardh which was first collected in 1975 from Sibuyan Island in Romblon. An exhaustive search and comparison with published descriptions and scanned images have revealed a misidentification. Results suggested that the Romblon samples are typical of the common Philippine species, *Gracilaria edulis* (Gmelin) Silva, and that the record of *G. disticha* should be removed from the Philippine seaweed flora. This report emphasizes the importance of thorough verification of records based on examination and comparison of well-preserved samples by experienced taxonomists and exhaustive literature searches.

Keywords: *agarophyte, database, herbarium, seaweed, species record, taxonomy*

INTRODUCTION

The eminent Hawaii'an marine phycologist, Dr. Isabella Aiona Abbott was regarded as the leading seaweed taxonomist recognized as a world authority on the taxonomy of marine red algal families, particularly Liagoraceae and Gracilariaceae, among other groups. She organized a taxonomy workshop held in Guam in 1985 providing a comprehensive list of Philippine Gracilariaceae that have been published by many Filipino phycologists (Abbott, 1985) incorporating the work of Trono et al. (1983) which attempted for the first time to monograph the Philippine representatives of this economically-important group of agar-yielding seaweeds. In addition, her list was primarily based on

specimen illustrations of other Philippine samples brought to the workshop by Dr. Maxwell Stanford Doty, who is credited with the development of seaweed aquaculture in the Philippines. Both Professors Abbott and Doty were affiliated with the University of Hawai'i at that time and are recognized as the most renowned phycologists and taxonomists.

Among the species listed by Abbott (1985), *Gracilaria disticha* (J. Agardh) J. Agardh [erroneously as *G. disticha* J. Agardh] was never reported from the Philippines but collected from Sibuyan Island in the province of Romblon and illustrated in her paper as Figure 56. This record was from the work of Dr. Abbott was subsequently included in the catalog of Philippine marine algae by Silva et al. (1987: 42) without any notes or queries but cited the work of Abbott (1985) as the sole basis for its inclusion. Later, Ganzon-Fortes (2012: 188) also included *G. disticha* in her survey of Philippine seaweed records, also without any supporting notes. A year after, Ang et al. (2013: 30) published a summary of all known Philippine marine macroalgal records including *G. disticha*. Their checklist was meticulously checked against the AlgaeBase, (Guiry & Guiry, 2025) and the Index Nominum Algarum [INA] maintained by the Silva Center for Phycological Documentation at the University of California at Berkeley (Silva, 1996 into date). The latest in this parade of Philippine seaweed

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lists was that of Lastimoso & Santiañez (2021: 62) who also listed *G. disticha* as a member of the Philippine marine flora. In addition, the latter authors included information obtained from the online resources available, the Macroalgal Herbarium Portal [www.macroalgae.org] and the National Museum of Natural History at the Smithsonian Institution [www.collections.nmnh.si.edu]. In the last two checklists cited above, no explanatory notes nor comments were added to the records of *G. disticha*, suggesting direct and simple citation, most likely unverified and unquestioned, carried over from the first report of Abbott (1985).

A more recent study by Clemente et al. (2017) conducted a comprehensive survey of the marine benthic algae of Romblon province. Prior to their study, only two species of marine algae have been reported from Romblon, namely *Laurencia flexilis* Setchell reported by Trono (2004: 128) and *G. disticha* by Abbott (1985). *L. flexilis* was collected from Agtiwa, San Fernando on the western tip of Sibuyan Island and currently known as *Ohelopapa flexilis* (Setchell) F. Rosseau, Martin-Lescanne, Payri & L. Le Gall. The same species was reported by Clemente et al. (2017: 995) from localities in Tablas and Romblon Islands. Unfortunately, *G. disticha* as recorded from Sibuyan Island was not found and remains an enigmatic species to this day, thus its presence in the Philippines remains doubtful until samples are examined.

Revisiting this is crucial for maintaining the accuracy of national biodiversity inventories and taxonomic databases. Additionally, erroneous species listings can mislead ecological assessments, resource management and biodiversity policymaking. Therefore, it is essential to re-examine past records using available herbarium materials, digital archives, and comparative morphological analysis to ensure the reliability of species checklists.

Most recently, the authors tracked down some samples identified as *Gracilaria disticha* that were deposited in the Herbarium Pacificum of the Bernice P. Bishop Museum in Honolulu. The samples were part of the personal collection of Dr. Doty which were donated to the Herbarium Pacificum. Among those samples found was the same material used by Abbott (1985), specifically that sample shown in her Figure 56 which remains the only photo voucher for the published Philippine record of *G. disticha*.

METHODOLOGY

Digitally scanned images of *Gracilaria disticha* examined in this study were retrieved from the Herbarium Pacificum of the Bernice Pauahi Bishop Museum in Honolulu, Hawai'i, U.S.A. Additional

scanned materials of the target species as well as supplemental information were searched in different online databases such as the Algae Herbarium Portal (<https://macroalgae.org/portal/index.php>) and AlgaeBase (Guiry & Guiry, 2025; <https://algaebase.org>) for comparison. Relevant phytogeographical and historical information were also obtained from many published and online sources.

RESULTS AND DISCUSSION

Samples of the marine red alga *Gracilaria disticha* (J. Agardh) J. Agardh were first collected off the coast of the African region formerly known as Abyssinia (likely Massawa in present-day Eritrea) in the Horn of Africa on the eastern central side of the continent (Agardh, 1837). The original materials were collected in 1831-1832 by Wilhelm Peter Eduard Simon Rüppell when he was in a collecting trip to Eritrea and the southern Red Sea region. Soon after, the seaweed samples from Eritrea were sent to Paris to the prominent Swedish algal taxonomist Jacob Georg Agardh for him to study. Several new species were described by him including *Sphaerococcus distichus* and published in the journal *Museum Senckenbergianum* (Agardh, 1837). After some years have passed and reexamining the samples, the same species was transferred to the genus *Gracilaria* (Agardh, 1852). The authors attempted to locate the original type specimens at the Senckenberg Museum (Frankfurt), the Museum National d'Histoire Naturelle (Paris) and Lund University (home institution of J.G. Agardh) where samples were reportedly deposited (Papenfuss, 1968) but could not be located. Further information on the whereabouts of the type materials and other samples examined by J.G. Agardh was also unavailable upon thorough search.

A set of representative samples identified as "*Gracilaria disticha* J.Ag." was collected from "the reef flat at Danao, Cajidiocan, Sibuyan Island, Romblon Province" on 22-25 August, 1975 by Agaton E. Manago. Another set was obtained from Silum, Magdiwang (Sibuyan Island), Romblon Province on 29 August, 1975 also by A.E. Manago. These samples have been mounted in at least six herbarium sheets deposited at the Herbarium Pacificum with each sheet assigned an MSD field number (MSD-Maxwell S. Doty) and a BISH accession number (BISH-Bernice P. Bishop Museum).

All samples were identified as "*Gracilaria disticha* J.Ag." by Mitchell D. Hoyle who at that time was a Ph.D. student under M.S. Doty studying the Hawaiian species of *Gracilaria* as his dissertation research topic. He wrote the species name into the specimen labels on 08 June 1978. In one of the sheets

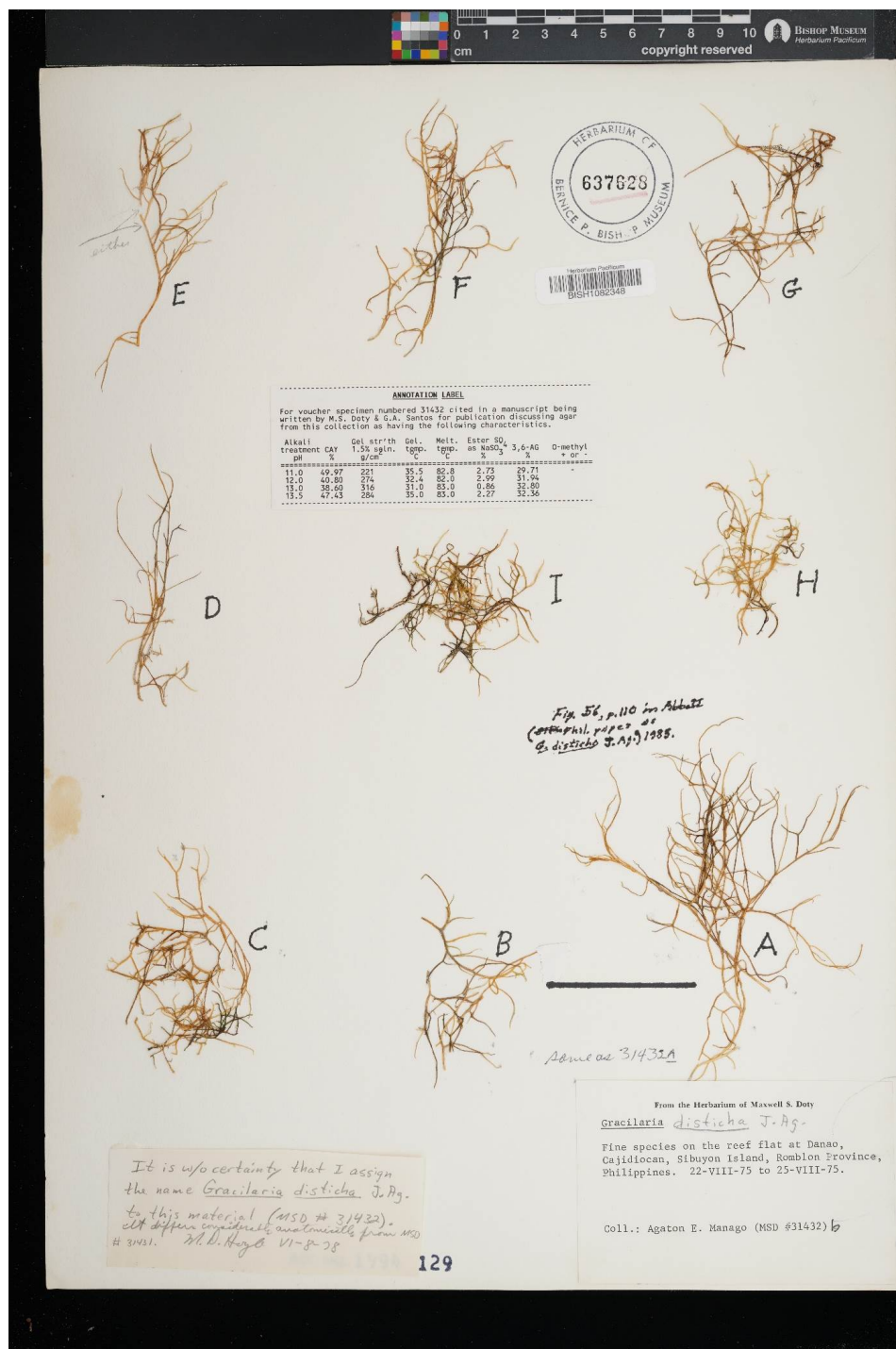


Fig. 1. Herbarium samples (BISH 637628) from Cajidiocan, Sibuyan Island, Romblon identified as *Gracilaria disticha* J. Ag. by M.D. Hoyle. Sample marked A on the lower right corner was the basis of the first Philippine report in Abbott (1985)



Figure 2. Herbarium sample (AHFH in UC 53905 = UC 1850526) from Singapore identified as *Gracilaria disticha* J.Ag. by E. Yale Dawson.



Fig. 3. Herbarium sample (MICH 665105) from Krusadai Island, southeast India identified as *Gracilaria disticha* (J.Ag.) J.Ag. by M.J. Wynne.

(BISH 637628) containing nine samples from Cajidiocan (designated by letters A to I), he added a note found at the bottom of the herbarium sheet which said “It is w/o certainty that I assign the name *Gracilaria disticha* J.Ag. to this material (MSD#31432).” The sample code (MSD#31432 A) was used by Abbott (1985: 89) as the basis for including *G. disticha* among the species from the Philippines. Dr. Abbott just copied the species name directly from the label as she said “I have not studied any of the specimens reported herein,” referring to all samples brought to the Guam taxonomy workshop. The same sample from Cajidiocan was included as Figure 56 of Abbott & Norris (1985: 110) which is illustrated as part of Fig. 1 of this present report.

Gracilaria disticha has been reported by Papenfuss (1968) and Einav et al. (2021) from throughout the western shores of the Red Sea (coasts of Egypt and Eritrea). In the Indian Ocean region, it was reported from the southeast coast of the Arabian Peninsula, Mauritius and India (Silva et al., 1996). Samples collected from southern India were examined by Umamaheswara Rao (1972) who compared them with *G. coronopifolia* J. Agardh. with which they are superficially similar. In our own online search, materials identified as *G. disticha* collected from Mauritius, India and Singapore were found, which made this species widely distributed throughout the Indian Ocean. Although Singapore is not directly located within the waters of the Indian Ocean, it was included in the marine algal catalogue of Silva et al. (1996).

Our search using the Algae Herbarium Portal (www.macroalgae.org) found an undated sample from Singapore (duplicate, AHFH 53905 in UC 1850526) originally distributed from the herbarium of the Irish phycologist William H. Harvey at Trinity College in Dublin, Ireland. This was found among the collections of the Allan Hancock Foundation herbarium at the University of Southern California, which was later transferred to the University of California Berkeley herbarium (Fig. 2). The sample was identified by Elmer Yale Dawson as *Gracilaria disticha* J.Ag. It is bushy, ca. 10 cm tall, composed of thinly cylindrical branches of ca. 2 mm diameter at the base that are gradually attenuating distally, branching sparingly at the base, dichotomously to subdichotomously, fastigiate, becoming proliferous distally by branching more frequently towards the acute tips. This general morphology and size of the Singaporean sample are reminiscent of the South Indian sample studied by Umamaheswara Rao (1972) who illustrated it in his Plate IID. The Indian sample was collected from Pamban and Krusadai Island in southeastern India facing Sri Lanka. Another sample from the same vicinity was located at the herbarium of the University

of Michigan (MICH 655105), It was collected in August 1970 by P. Dayanandan and identified as *G. disticha* (J.Ag.) J.Ag. by Michael J. Wynne. However, the sample (Fig. 3) is strikingly different from that examined by Umamaheswara Rao (1972). It is a large plant, up to 35 cm high, with its main axes 2-3 mm in diameter for the most part, branching dichotomously, more frequently so distally, ending in fine, attenuate tips. The presence of many filiform outgrowths on the branches is remarkable. These filiform branchlets are ca. 1 mm in diameter, 2-10 mm long, may branch once or twice, issued randomly every few millimeters along the length of the branchlets, sometimes appearing distichous.

Southeast Asian waters boast of many species of *Gracilaria* with cylindrical, slender branches of 1.0 mm diameter or less and any of these would be superficially similar to *G. disticha*. The authors are aware that the taxonomy of cylindrical species of *Gracilaria* is still in a state of flux and that morphological plasticity is commonly seen among them. Inasmuch as type materials of *G. disticha* could not be found, the closest resemblance to authentic samples would likely be the specimens from southeastern India deposited at the University of Michigan cited above (Fig. 3) owing to the fact that the cylindrical branches are clothed with distichous, filiform branchlets that may have inspired the naming of this species as *G. disticha* (originally as *Sphaerococcus distichus*). However, the samples from Romblon have smooth branches that are definitely devoid of such distichous branchlets (see Fig. 1).

A thorough comparison of samples superficially similar to the materials from Romblon has pointed to two possible names: *Polycavernosa fastigiata* Chang & Xia [later *Gracilaria fastigiata* (Chang & Xia) Chang & Xia] and *G. edulis* (Gmelin) Silva.

Xia and Abbott (1987, figs. 1 and 2) illustrated samples of *Polycavernosa fastigiata* from Malaysia which bore striking similarities with the samples from Romblon. The younger plants in Fig. 1 appear bushy and smooth, closely similar to Romblon materials while the older one in their Fig. 2 had few distichous branchlets. Initially designated as the type of the genus *Polycavernosa*, *P. fastigiata* and similar species were segregated into their own genus because of the presence of multicavitated spermatangial conceptacles in male plants. Later, all species of *Polycavernosa* were transferred to the genus *Hydropuntia* by Wynne (1989) as the latter is a valid, available and earlier name of the former. Much later, Lyra et al. (2015, 2021) provided molecular and evolutionary evidence to recognize a broader circumscription of *Gracilaria* subsuming all *Hydropuntia* species including *H. fastigiata* (Chang & Xia) Wynne. In addition, *H. fastigiata* was also recognized as one of the many synonyms of *G. edulis* (Abbott et al., 1991; Lyra et al.,

2021). Another sample collected from Sorsogon and illustrated by Trono (2004, fig. 135) is almost identical in external morphology to the Romblon materials. This was identified as *G. fastigiata* (Chang & Xia) Chang & Xia by Trono (2004) which is a superfluous and latter heterotypic homonym of *G. fastigiata* J. Agardh (1901) first described from Mauritius and Sri Lanka, which is also a latter homonym of *G. fastigiata* J. Agardh (1852) from the cold waters off the Falkland Islands (Silva et al., 1996). This Antarctic species was later recognized as belonging to another genus, *Callophyllis fastigiata* (J. Agardh) J. Agardh (1876).

Perhaps the most compelling proof pointing to the identity of the Romblon samples was provided by Trono (2017). His Fig. 69 described and identified as *G. edulis* seemed to match every external feature of branch morphology and arrangement. Without any doubt, the materials from Romblon can be identified with much certainty as *G. edulis*. This identification therefore effectively removes *G. disticha* from the list of Philippine marine algae.

CONCLUSION

Thorough archival search and comparing in different online databases are useful approaches providing updated checklists and to re-examine current marine algal lists in the Philippines to maintain accuracy. Among the many species of economically-important seaweed, *Gracilaria disticha* was documented from Romblon in 1985.

Based on the examination and comparison of searched images obtained from online databases and phytogeographic considerations, the samples from Romblon were deemed to have been misidentified. Descriptions and images of specimens were identified to be *G. edulis*, a common and widely distributed species based on external morphology. Therefore, the sole record remained unscrutinized for the past decades, and since then, there have been no other reports of *G. disticha* with the Philippine archipelago, particularly the most recent study by Clemente et al. (2017) in Romblon.

In the future, molecular-assisted alpha taxonomy (MAAT) can be used to help resolve this taxonomic question. For now, samples are limited and any effort to perform MAAT will need destructive sampling of rare samples which institutions are not likely to allow. This study underscored the importance of correctly identified and properly preserved samples such as those deposited in herbaria and natural history collections. In addition, due to the dwindling of Filipino taxonomists and phycologists, these problems are bound to happen. The maintenance of biodiversity repositories consisting of well curated, preserved samples and staffed by

trained and dedicated taxonomists should be encouraged and supported.

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AUTHORS' CONTRIBUTIONS

JBG: field work, material verification, writing, editing and approval of manuscript

LML: archival and data-mining, writing, editing and approval of manuscript

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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