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Second addendum to the synoptic review of red algal genera

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Review

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Second addendum to the synoptic review of red algal genera

Abstract: A second addendum to Schneider and Wynne’s (Schneider, C.W. and M.J. Wynne. 2007. A synoptic review of the classification of red algal genera a half a century after Kylin’s “Die Gattungen der Rhodophyceen”. Bot. Mar. 50: 197–249.) “Synoptic review” of red algal genera and their classification is presented, with an updating of names of new taxa at the generic level and higher. In the past few years, the hierarchy of some genera has changed due to new subfamilies, which are cited and referenced below. There have also been the descriptions of some higher taxa in the past few years.

Keywords: classification; genera; Kylin; red algae; Rhodoplantae.

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Introduction

Gene sequencing and the resulting construction of phylogenetic trees continue to add to our knowledge of red algal genera and the classification of the Rhodophyta. Such molecular-based phylogenies often have shown the need to recognize segregate entities, at times necessitating the description of new genera or the resurrection of older generic names that had come to be treated as taxonomic synonyms using criteria based on the classical morphology and reproduction. Following the publication of Schneider and Wynne’s (2007) “Synoptic review...of red algal genera,” and our first addendum to it (Wynne and Schneider 2010), additional changes have appeared, leading us to issue this second addendum. Furthermore, we continue to find obscure valid names that we had overlooked in the synoptic review. We will periodically provide further addenda as sufficient new published information on red algal genera and classification appears.

The flood of new data coming in from the gene-sequence analyses is not only revealing the cases where some genera need to be split up and where others were cases of cryptic speciation but also where some genera and even families have been placed in orders where they clearly no longer belong. The red algal tree of life depicted by Verbruggen et al. (2010, figure 2), reconstructed using the Bayesian phylogenetic inference of DNA data mined from GenBank, reveals a contemporary view of our current understanding of the classification in the red algae at the class, subclass, order, and family levels. Their tree includes some taxa (Atractophora, Calosiphoniaceae, Inkyuleeaceae, and Peyssonneliaceae), in which their traditional assignments are not supported by the present gene-sequence data.

With regard to the current realignment and descriptions of the many red algal genera due to molecular phylogenetics, it is worthwhile to refer to the ongoing discussion of the reliability of obtaining a DNA sequence data from the “archival” red algae. On one hand, some workers have questioned how successful the DNA extraction and sequencing can be for specimens older than about a dozen years (Saunders and McDevit 2012). On the other hand, other workers claim that the protocols have been successfully devised for the sequencing of the genes from the specimens going back into the early 19th century (Hughey and Gabrielson 2012). Confirmation of the results from the archival specimens with the DNA obtained from the recent collections from the same type localities should assist in resolving these questions.

Format of the list

The same format that was employed in the previous synoptic review and the first addendum (Schneider and Wynne 2007, Wynne and Schneider 2010) is followed in this second addendum. All the genera established after Kylin (1956) and added here have the authorities who described them, as well as the year and page of the protolog printed in bold face along with the proper names.
The “References” section contains the literature cited for the protologs of the genera since Wynne and Schneider (2010), as well as that not covered by Kylin (1956) and Schneider and Wynne (2007).

Kingdom Plantae
Phylum Rhodophyta
Subphylum Rhodellophytina
Class Rhodellophyceae
Order Dixoniellales
Family Dixoniellaceae

Note: Wynne and Schneider (2010) considered this family a synonym of the Glaucosphaeraceae based upon the rule of nomenclatural priority. Since then, however, the Glaucosphaeraceae was emended by Scott et al. (2011, 2012) to include only Glaucosphaera and transferred to the new order Glaucosphaerales [below]. This realignment of the Glaucosphaeraceae excluded Dixoniella and Neorhodella from the family, allowing the resurrection of the Dixoniellaceae to accommodate them (Scott et al. 2011, 2012).


Note: Bulboplastis was considered a member of the Dixoniellaceae when described by Kushibiki et al. (2012), and it would remain there given its phylogenetic association with Dixoniella and Neorhodella despite Glaucosphaera being segregated into its own order (Scott et al. 2012).


Note: The initial proposal by Yang et al. in Scott et al. (2011) to establish this order was not valid due to the lack of the Latin diagnosis and designation of the type family. The requirement for a Latin diagnosis lapsed beginning January 1, 2012, and so Yang et al. in Scott et al. (2012), with a diagnosis in English, later validated the name of the order and designated the type family to be the Glaucosphaeraceae Skuja (1954).

Class Porphyridiophyceae
Order Porphyridiales
Family Porphyridiaceae


Subphylum Metarhodophytina
Class Compsopogonophyceae
Order Erythropeltidales

Family Erythrotrichiaceae
Erythrotrichia Aresch. 1850: 435. nom. cons.

Note: Zuccarello et al. (2011) showed that Erythrotrichia sensu lato comprised at least seven well-supported infrageneric lineages, and the authors recognized the difficulty of linking these genetic groupings with the more than two dozen species names currently associated with the genus. They observed that the morphology and, at times, overlapping geographic locations of their isolates were not useful in tying these cryptic species to the historical binomials. Two species of Erythrotrichia were transferred to Porphyrostromium.

Subphylum Eurhodophytina
Class Bangiophyceae
Order Bangiales

Porphyra C. Agardh 1824: xxxii, 190. nom. cons.

Note: Several genera have, over the years, been subsumed under the speciose Porphyra (Schneider and Wynne 2007, Wynne and Schneider 2010). With the advances of molecular genetics in taxonomy, the workers have begun to find distinctions of the species at the generic level, and two genera (see below) with a large number of taxa have been resurrected for the genetic groupings that segregate them from Porphyra (Sutherland et al. 2011).


Pyropia J. Agardh 1899: 149.

Note: Formerly considered a taxonomic synonym of Porphyra (Wynne and Schneider 2010), this genus was resurrected for more than 75 species, leaving it as the most speciose genus in the Bangiales (Sutherland et al. 2011).

Wildemania G. De Toni 1890: 144, 148.

Synonym: Diploderma Kjellm. (1893) nom. illeg. (non Link 1816)

Note: Wildemania was resurrected by Sutherland et al. (2011) from Porphyra where it was considered a taxonomic synonym (Schneider and Wynne 2007).
Class Florideophyceae
Subclass Hildenbrandiophycidae
Order Nemaliales
Family Liagoraceae


Note: Lin et al. (2011) based Macrocarpus on Liagora perennis I.A. Abbott.

Note: Zeng et al. (2005) placed their new genus in the Dermonemataceae, a family considered by most workers as a synonym of the Liagoraceae (Huisman 2006).


Order Palmariales
Family Rhodophysemataceae
Rhodophysema Batters 1900: 377.
Note: Saunders and Clayden (2010) provided a valid epithet for the species known as Halosacciocolax kjellmanii S. Lund, an invalidly published entity, after finding it grouped with the genus Rhodophysema (Clayden and Saunders 2010) in their COI-5P phylogenetic analyses.

Subclass Corallinophycidae
Order Corallinales
Family Corallinaeae
Corallina L. 1758: 805.
Synonyms: Marginosporum (Yendo) Ganesan (1968); Serraticardia (Yendo) P.C. Silva (1957); Titanephilum Nardo (1834); Yamadaia [Yamadaea] Segawa (1955).
Note: Hind and Saunders (2013) presented a molecular phylogenetic evidence to propose the merger of both Marginosporum and Serraticardia within Corallina. The spelling we used previously, “Titanephilum” (Schneider and Wynne 2007), should be Titanephilum. The genus Yamadaia was reduced to a synonym of Corallina by virtue of Martone et al. (2012) transferring the generitype species, Y. melobesioides Segawa, into Corallina. The only other species, Y. americana E.Y. Dawson et R.L. Steele, was transferred into Chiharaea (Martone et al. 2012). With regard to the spelling of the name, the original spelling was Yamadaia, and Johansen (1969) altered it to Yama daea. We notice a conflict in the International Code of Nomenclature for algae, fungi, and plants (Melbourne Code) (http://www.iapt-taxon.org/nomen/main.php) between Art. 60.1, which states that “The original spelling of a name or epithet is to be retained,” and Recommendation 60B.1(a), which states that for a generic name derived from a surname ending in a vowel, the letter “-a” is added, except for a name ending in “-a,” in which case “-ea” is added. We accede to the Article rather than the Recommendation and, thus, accept Segawa’s (1955) original spelling.

Note: This segregate genus was based on Corallina elongata J. Ellis et Solander (Hind and Saunders 2013).

Note: This segregate genus was based on Serraticardia macmillanii (Yendo) P.C. Silva following the transfer of the type species of Serraticardia, S. maxima (Yendo) P.C. Silva, to Corallina.

Pachyarthron Manza 1937: 45.
Note: Sato et al. (2009) suggested that Pachyarthron should be subsumed under Corallina on comparisons of multiple gene sequences, including those of the generitype, P. cretaceum (Postels et Rupr.) Manza. We await a more formal presentation of these results. The genus Pachyarthron has a confused nomenclatural history with Bossiella (Schneider and Wynne 2007), and at present, the two genera are considered distinct (Wynne and Schneider 2010).

Subfamily Lithophylloideae
Amphiroa J.V. Lamour. 1812: 186.
Synonym: Eurytion (Decne.) Lindl. (1846)
Note: This synonym was omitted in Schneider and Wynne (2007). The genus was first recognized as section Eurytion of Amphiroa by Decaisne (1842), before being elevated by Lindley (1846).

Subfamily Mastophoroideae
Note: Kato et al. (2011) revised this subfamily created by Setchell (1943) to include only the genera Mastophera and Metamastophera.

Note: This new subfamily was created to include Hydro lithon (Kato et al. 2011).

Note: At present, this new subfamily includes only Porolithon (Kato et al. 2011).
Note: This new subfamily was created to include Neogoniolithon (Kato et al. 2011).

Subclass Rhodymeniophycidae
Order Ceramiales
Family Delesseriaceae
Note: This new genus is based on the new species Hymenenopsis heterophylla, which had previously gone under the name of Hymenena palmata f. marginata sensu Kylin from New Zealand (Lin et al. 2012b).

Paraglossum (J. Agardh) J. Agardh 1898: 213.
Note: Using morphological and molecular studies, Lin et al. (2012a) showed that Paraglossum should be reinstated to include certain Southern Hemisphere species that had been placed in Delesseria. Earlier, Paraglossum had been relegated as a junior synonym of Delesseria (Schneider and Wynne 2007). Lin et al. (2012) showed that Paraglossum and Apoglossum were closely related genera in the newly described tribe Apoglosseae of the Delesseriaceae.

Family Rhodomelaceae
Erythrocystis J. Agardh 1876: 638.
Synonym: Ricardia Derb. et Sol. 1856: 211.
Note: The name Ricardia was inadvertently omitted by Kylin (1956) and Schneider and Wynne (2007). Silva (1952) has reviewed the nomenclatural history of the names Erythrocystis and Ricardia.

Note: On the basis of molecular data alone, this genus was segregated from Laurencia by Cassano et al. (2012) to include L. marilzae Gil-Rodríguez, Sentíes, Díaz-Larrea, Cassano et M.T. Fuji.


Note: This genus is a parasite of Symphyocoladía (Kim and Cho 2010).

Order Gelidiales
Family Gelidiaceae
Synonym: Porphyroglossum Kütz. (1847)
Note: The merger of the monotypic genus Porphyroglossum into Gelidium was proposed by Kim et al. (2011a). Their initial binomial, Gelidium zollingeri (Kütz.) comb. nov., however, was a later homonym of that by Sonder (1854), and so they proposed the nomen novum Gelidium indonesianum K.M. Kim, G.S. Gerung et S.M. Boo (Kim et al. 2011b).

Order Gigartinales
Family Caulacanthaceae
Sterrocladia F. Schmitz 1893: 77.
Note: A second species was added to this uniquely freshwater gigartinalean genus. Using the comparative gene-sequence data, Sherwood et al. (2012) showed Sterrocladia to be in a basal position relative to the Gigartinaceae and Phyllophoraceae and may well represent a new family. However, they believed that fresh collections of the gen-eritype species, S. amnica (Mont.) F. Schmitz, from northern South America, were needed for the final disposition.

Family Chondrymeniaceae Rodríguez-Prieto, G. Sartoni, S.-M. Lin et Hommersand 2013: in press.
Note: The genus Chondrymenia Zanardini had previously been included in the Sarcodiaceae of the order Plocamiales (Schneider and Wynne 2007). But on the basis of rbcL gene sequence analyses, Rodríguez-Prieto et al. (2013) demonstrated that the genus was more closely allied with the Cystocloniaceae-Solieriaceae complex and justified being separated as a distinct family in the order Gigartinales.

Family Cruoriaceae

Family Gigartinaceae
Note: Based upon the morphological and reproductive characteristics, Nelson et al. (2011) found this genus to be basal to the other genera in the family, containing unique features thus far not found in the other genera of the family.

Family Kallymeniaceae
Note: Based upon the multigene analyses, Clarkston and Saunders (2012) placed Beringia, Erythrophyllum,
Kallymeniopsis, and Hommersandia in the Kallymeniaceae rather than the Crossocarpaceae where they previously had been treated.

Ectophora 1876: 689.
Note: As pointed out by D’Archino et al. (2011), Ectophora has had a complicated taxonomic history with periods as a synonym of Callophyllis and others as a discrete generic entity. Using multiple genetic markers, D’Archino et al. (2011) demonstrated that it demanded status at the generic level.

Note: Clarkston and Saunders (2012) based their new genus on Pugetia firma Kylin.


Family Phyllophoraceae
Note: Along with a new species described from Bermuda, Schneider et al. (2011) included Leptofauchea brasiliense A.B. Joly in their new genus, a species that Dalen and Saunders (2007) had excluded from the Faucheaceae (Rhodymeniales).

Coccotylus Kütz. 1843
Synonym: Ceratocolax Rosenv. (1898)
Note: Using the rbcL gene sequences and morphological investigations, Le Gall and Saunders (2010) found that the generitype and only species of the parasitic Ceratocolax was better assigned to Coccotylus, rendering the genus synonymous.

Family Schmitziellaceae Guiry, Garbary et G.W. Saunders in Guiry, 2012: 183
Note: Guiry et al. (in Guiry, 2012) described this new family, based on the genus Schmitziella, and provisionally assigned it to the order Gigartinales.

Order Peyssonneliales
Note: When pointing out the incorrect placement of the Peyssonneliaceae as a family of the Gigartinales, Verbruggen et al. (2010) were unaware of it already having been moved into its own order (Krayesky et al. 2009, Wynne and Schneider 2010).
resurrected this genus from synonymy using reproductive and molecular data.

*Prionitis* J. Agardh 1851: 185.
Note: Wang et al. (2001) proposed the merger of this genus into *Grateloupia*. Using reproductive and molecular data, Gargiulo et al. (2013) resurrected this genus from synonymy.

*Spongophloea* Huisman, De Clerck, Prud’homme et Borowitzka 2011: 12.

Order Plocamiales
Family Plocamiaceae
*Plocamium* J.V. Lamour. 1813: 137. nom. cons.
Note: Cremades et al. (2011) investigated the type of *Plocamium cartilagineum* (L.) P.S. Dixon as well as the other original material of the European species of the genus, and they came to different conclusions than those reported by Saunders and Lehmkühl (2005). This allowed for a taxonomic revision of the generic type and a better understanding of the other early named species of *Plocamium*.

Order Sebdeniales
Family Sebdeniaceae

Order Rhodymeniales
Family Fryeellaceae
*Agardhina* De Toni 1897: 64.
Note: Based upon the tetrasporangial ontogeny and characteristics, Saunders and McDonald (2010) and Schneider et al. (2012) suggested that this genus might possibly be a member of the Fryeellaceae, rather than the Rhodymeniaceae, where it had previously been placed.

Family Rhodymeniaceae

Incertae sedis generalis

Note: Because these two genera were first described directly after the treatment of the Phyllophoraceae (Gigartinales) in Perestenko (1996), we mistakenly attributed them to this family in our synoptic treatment of red algal genera (Schneider and Wynne 2007). It is unclear, at present, where they should be phylogenetically placed.

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