Seaweeds of the Greek coasts. II. Ulvophyceae

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Seaweeds of the Greek coasts. II. Ulvophyceae

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Abstract

An updated checklist of the green seaweeds (Ulvophyceae) of the Greek coasts is provided, based on both literature records and new collections. The total number of species and infraspecific taxa currently accepted is 96. The occurrence of each taxon in the North Aegean, South Aegean and Ionian Seas is given. In addition, 11 taxa pending confirmation of their presence, 9 excludenda and 15 inquirenda are briefly discussed.

Keywords: Aegean Sea, green algae, checklist, Ionian Sea.

Introduction

Phycological studies on marine macroalgae have been carried out along the Greek coasts since the early 19th century (Greville, 1826), resulting in numerous records of green, brown and red seaweeds until today. However, the major part of these studies provided checklists from the areas surveyed as well as scattered records, without any morphological descriptions or illustrations of the reported taxa, frequently resulting in taxonomic confusion (Tsiamis et al., 2013a).

A first attempt to produce a checklist of Greek marine seaweeds was made by Diannelidis (1950), followed by the work of Gerloff & Geissler (1974). Later on, Athanasiadis (1987) compiled a critically reviewed catalogue of marine seaweeds, but concerning only the Aegean Sea. In addition, the annotated checklists of the Mediterranean seaweed flora by Ribera et al. (1992), Gallardo et al. (1993) and Gómez Garreta et al. (2001) included seaweeds occurring in Greece.

Aiming to update the knowledge regarding the Greek seaweed marine flora, the present work focuses exclusively on green seaweeds (Ulvophyceae). This work corresponds to the second part of a checklist intended to be a seaweed catalogue of the Greek coasts. The brown seaweeds (Phaeophyceae) were treated in the first part of the series (Tsiamis et al., 2013a) while separate works on the red seaweeds (Rhodophyceae, parts III and IV) will follow.

Materials and Methods

From the early 19th century until the present day 13 PhD theses and about 130 research papers have been published on seaweeds from Greece. Master and Bachelor Degree dissertations as well as conference contributions have not been taken into account for this study. Green algal taxa reported in all other publications have been critically reviewed from present-day taxonomic and nomenclatural aspects, taking also into account the on-line data provided by Silva (2013) and Guiry & Guiry (2013).

The checklist has been compiled following the scheme used in the first part of this series (Tsiamis et al., 2013a). Taxa have been grouped in four categories: accepted, pending confirmation of their presence, excludenda and inquirenda. Taxa are listed alphabetically, in order to make their detection easier, but when infraspecific taxa are listed, the autonym, if present, is cited first. The distribution of each accepted taxon is given for the three major biogeographic regions: North Aegean, South Aegean and Ionian Sea (Fig. 1). Due to space limitation, only one reference is given for each region, giving priority to publications that include descriptions and/or illustrations (if existing). Additional references are available from the authors on request. New records are based on the collections of one of the authors (K.T.). Material regarding the new records is deposited in the herbarium database of Athens University (Faculty of Biology, Department of Botany).

Results

The present checklist recognizes at least 96 green algal taxa (at species and infraspecies level) occurring in Greece (Table 1). New regional records include Blastophysea rhizopus Reinke (in the Ionian Sea), Codium effusum (Rafinesque)
Delle Chiaje (in the Ionian Sea) and *Microdictyon tenuius* J.E. Gray (in the N. Aegean Sea). Information of these three new records follows:

**Blastophysa rhizopus** Reinke (Bryopsidales, Chaetosiphoniaceae ?)

= *Blastophysa polymorpha* Kjellman

**Description:** Microscopic endophytic alga, greenish, composed of rounded to irregular vesicular cells (Fig. 2A), 40-80 μm in diameter, with occasionally 1-2 colorless hairs arising from the upper part; chloroplasts divided into rounded to angular plate-like chloroplasts, with or without pyrenoids observed; vesicular cells scattered or joined through slender colorless interconnecting filaments, 5-10 μm in diameter; reproduction by vegetative division of cells through “constriction” observed.

**Habitat:** Endophyte, growing in the tissue of the red seaweed *Schmitzia neapolitana* (Berthold) P.C. Silva, which was collected from rocky substratum at 0.3 m depth.

**Locality:** Gerolimenas, Messiniakos Gulf, Ionian Sea, July 2008, collector K. Tsiamis.

**Distribution:** Algeria, France, Corsica, Italy and Adriatic (Gallardo et al., 1993). In Greece, it was previously reported from the N. Aegean (Chrysssovregis, 1995, as *Blastophysa polymorpha*) and S. Aegean Sea (Diapoulis, 1983, as *B. polymorpha*).

**Note:** Although it has been reported as an endophyte from various algae, this is the first time for the red seaweed *Schmitzia neapolitana*.

**Codium effusum** (Rafinesque) Delle Chiaje

= *Codium difforme* Kützing

**Description:** Saxicolous thalli, dark green, crustose, compact, irregular in shape, with spongy texture, to 8 cm in extent and 1 cm high, closely adhering to the substratum (Fig. 2B); siphonous anatomy; utricles clavate to cylindrical, 700-1100 μm long and 80-200 μm broad, occasionally with scars below the apex; no reproductive structures observed. All measurements were taken from dried specimen.

**Habitat:** A single thallus was found at 5 m depth, on rocky substratum of a semi-enclosed bay.

**Locality:** Antikyra Bay, Korinthiakos Gulf, Ionian Sea, February 2007, coll. E. Voutsina.

**Distribution:** Commonly encountered in the Mediterranean Sea (Gallardo et al., 1993). Reported also from the N. Aegean (Anagnostidis, 1968, as *Codium difforme*; Athanasiadis, 1987) and S. Aegean Sea (Coppejans, 1974; Sartoni & De Biasi, 1999).

**Microdictyon tenuius** J.E. Gray (Cladophorales, Anadyomenaceae)

= *Microdictyon tenuius* (C. Agardh) Decaisne nom. illeg.

**Description:** Thalli membranous, flat, greenish, reaching 12 cm in extent, without evident base, crisp in texture, composed of monosiphonous filaments 120-150 μm in diameter, with branching pattern in one plane; branches anastomosed, forming an irregular angular network, thin and delicate (Figs. 2C-D); no reproductive structures observed. All measurements were taken from dried specimens.
Table 1. Accepted green algal taxa in the North and South Aegean, and the Ionian Seas. For each taxon a basic reference is provided together with previously applied synonyms. Superscript numbers in brackets refer to the Notes.

| Taxa                                                                 | North Aegean | South Aegean | Ionian Sea       |
|----------------------------------------------------------------------|--------------|--------------|------------------|
| Acetabularia acetabulum (Linnaeus) P.C. Silva                        | Athenasiadis, 1987 | Lazaridou, 1994 | Nicolaidou et al., 2005 |
| = Acetabularia mediterranea J.V. Lamouroux nom. illeg.               |              |              |                  |
| Anadyomene stellata (Wulfen) C. Agardh                               | Athenasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988      |
| = Anadyomene flabellata J.V. Lamouroux                               |              |              |                  |
| Blastophyta rhizopus Reinke                                         | Chrysovergis, 1995 | Diapoulis, 1983 | present study    |
| = Blastophyta polymorpha Kjellman                                    |              |              |                  |
| Bidingia marginita (J. Agardh) P.J.L. Danceard ex Biding              | Diannelidis, 1950 | -            | Bitis, 1988      |
| = Enteromorpha marginita J. Agardh                                    |              |              |                  |
| Bidingia minima (Nägeli ex Kützing) Kylin                            | Diapoulis et al., 1998 | -            | -                |
| = Borysida neglecta (Berthold) Rietema                                |              |              |                  |
| = Borysia baltisiana Lamouroux                                       | Nikolaidis, 1985 | Athenasiadis, 1987 | Bitis, 1988      |
| = Borysia baltisiana var. disticha J. Agardh                         |              |              |                  |
| = Borysia disticha (J. Agardh) Kützing                               |              |              |                  |
| = Borysia feldmanni Gallardo & G. Furnari                             | Chrysovergis, 1995 | Diapoulis, 1983 | -                |
| = Borysia hypnoides J.V. Lamouroux                                   | Athenasiadis, 1987 | Diapoulis & Haritonidis, 1987b |                  |
| = Borysia monoica Berthold                                            |              |              |                  |
| = Borysia muscosa J.V. Lamouroux                                      | Athenasiadis, 1987 | Anagnostidis, 1968 | Schnetter & Schnetter, 1981 |
| = Borysia pennata J.V. Lamouroux                                     | Chrysovergis, 1995 | Tsiamis et al., 2013b | -                |
| = Borysia plumosa (Hudson) C. Agardh                                 | Anagnostidis, 1968 | Diannelidis et al., 1977 | Bitis, 1988      |
| = Borysia arbuscula J.V. Lamouroux                                   |              |              |                  |
| Caulerpa prolifera (Forsskål) J.V. Lamouroux                         | Anagnostidis, 1968 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| Caulerpa racemosa var. cylindracea (Sonder) Verlaque, Huisman & Boudouresque | Tsiamis et al., 2010a | Tsiamis et al., 2010a | Tsiamis et al., 2010a |
| Caulerpa racemosa var. lamourouxic f. requieniai (Montagne) Weber-van Bosse | - | Tsiamis et al., 2010a | Tsiamis et al., 2010a |
| Chaetomorpha aerea (Dillwyn) Kützing (3)                             | Athenasiadis, 1987 | Lazaridou, 1994 | Tsirika & Haritonidis, 2005 |
| = Chaetomorpha vasta (Kützing) Kützing                               |              |              |                  |
| Chaetomorpha crassa (C. Agardh) Kützing                              | Haritonidis, 1978 | Diannelidis et al., 1977 | Schnetter & Schnetter, 1981 |
| Chaetomorpha frigida (Kützing) Kützing (2)                           | Orfanidis et al., 2001 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| = Chaetomorpha capillaris (Kützing) Borgesen                         |              |              |                  |
| = Chaetomorpha mediterranea (Kützing) Kützing                        |              |              |                  |
| = Chaetomorpha tortuosa Kützing nom. illeg.                           |              |              |                  |
| Chaetomorpha linum (O.F. Müller) Kützing (3,4)                        | Nikolaidou et al., 2005 | Lazaridou, 1994 | Bitis, 1988      |
| = Chaetomorpha chlorotica (Montagne) Kützing                         |              |              |                  |
| = Chaetomorpha linum var. longiarticulata (Ardissone & Strafforello) Ardissone |              |              |                  |
| = Converva lunum O.F. Müller                                         |              |              |                  |
| Cladophora albida (Nees) Kützing                                     |              |              |                  |
| = Cladophora hamosa (Kützing) Kützing                                | Anagnostidis, 1968 | Coppejans, 1974 | Schnetter & Schnetter, 1981 |
| = Cladophora neesiorum (C. Agardh) Kützing                          |              |              |                  |
| = Cladophora pumila Kützing                                          |              |              |                  |
| Cladophora coelothrix Kützing                                        | Athenasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988      |
| = Cladophora repens (J. Agardh) Harvey                              |              |              |                  |
| = Aegagropila coelothrix (Kützing) Kützing                           |              |              |                  |
| = Aegagropila repens (J. Agardh) Kützing                            | Athenasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988      |
| = Aegagropila conglobata (Kützing) Kützing                          |              |              |                  |
| (continued)
| Taxa | North Aegean | South Aegean | Ionian Sea |
|------|-------------|-------------|-----------|
| Cladophora echinus (Biasoletto) Kützing = Cladophora cornea (Kützing) Kützing = Aegagropila cornea Kützing | Athanasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988 |
| Cladophora feredayi Harvey = Cladophora pellucida f. nana Hauck | Diannelidis, 1950 | Diannelidis, 1950 | - |
| Cladophora flexuosa (O.F. Müller) Kützing (5) = Cladophora gracilis (Griffiths ex Harvey) Kützing | Diannelidis, 1950 | - | - |
| Cladophora fracta (O.F. Müller ex Vahl) Kützing | Anagnostidis, 1968 | Politis, 1932 | Bitis, 1988 |
| Cladophora glomerata (Linnaeus) Kützing = Conferva capillaris Linnaeus | Anagnostidis, 1968 | Giacone, 1968a | Bitis, 1988 |
| Cladophora hutchinsiae (Dillwyn) Kützing = Cladophora rissoana Montagne ex Kützing | | | |
| Cladophora laetevirens (Dillwyn) Kützing = Cladophora affinis Schiffner = Cladophora falcata Harvey = Cladophora meneghiniana (Kützing) Kützing = Cladophora repens f. meneghiniana (Kützing) Hauck = Aegagropila meneghiniana Kützing = Siphonocladus rhodensis Reinbold | | | |
| Cladophora lehmanniana (Lindenberg) Kützing = Cladophora ramulosa Meneghini = Cladophora urticulosa Kützing = Cladophora urticulosa var. laetevirens Hauck = Aegagropila meneghiniana Kützing = Siphonocladus rhodensis Reinbold | | | |
| Cladophora liebetruthii Grunow | Orfanidis et al., 2001 | - | Schnetter & Schnetter, 1981 |
| Cladophora liniformis Kützing | A. | A. | van den Hoek, 1963 |
| Cladophora nigrescens Zanardini ex Frauenfeld | | Tsiamis et al., 2010b | - |
| Cladophora pellucida (Hudson) Kützing = Cladophora trichotoma (C. Agardh) Kützing = Conerva trichotoma C. Agardh | Athanasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988 |
| Cladophora prolifera (Roth) Kützing = Cladophora prolifera var. scoparia (Kützing) Schiffner = Cladophora scoparia Kützing = Conerva prolifera Roth | Athanasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988 |
| Cladophora retroflexa (Bonnemaison ex P.L. Crouan & H.M. Crouan) G. Hamel | | | |
| Cladophora sericea (Hudson) Kützing = Cladophora nitida Kützing = Cladophora pecticinicornis Kützing = Cladophora rudolphiana (C. Agardh) Kützing | Anagnostidis, 1968 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| Cladophora socialis Kützing | Chryssovergis, 1995 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| Cladophora vadorum (Areschoug) Kützing = Cladophora corynantha Kützing | Anagnostidis, 1968 | Anagnostidis, 1968 | Bitis, 1988 |
| Cladophora vagabunda (Linnaeus) van den Hoek = Cladophora flavo-virens Kützing = Cladophora fracta f. marina Hauck = Cladophora penicillata Kützing | Athanasiadis, 1987 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| Cladophoropsis sundanensis Reinbold | | Leliart & Coppejans, 2006 | - |

(continued)
| Taxa                                                                 | North Aegean | South Aegean | Ionian Sea |
|----------------------------------------------------------------------|--------------|--------------|------------|
| *Codium effusum* (Rafinesque) Delle Chiaje                           | Athanasiadis, 1987 | Coppejans, 1974 | present study |
| = *Codium difforme* Kützing                                          |              |              |            |
| *Codium fragile* (Suringar) Hariot subsp. *fragile*                  | Tsiamis & Panayotidis, 2007 | Tsiamis & Panayotidis, 2007 | -          |
| = *Codium fragile* subsp. *tomentosoides* (van Goor) P.C. Silva      |              |              |            |
| *Codium vermiculara* (Olivier) Delle Chiaje (*f*.)                   | Athanasiadis, 1987 | Tsiamis & al., 2013b | -          |
| *Dasycladus vernicularis* (Scopoli) F. Krasser                      | Athanasiadis, 1987 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| = *Dasycladus clavaeformis* (Roth) C. Agradh                         |              |              |            |
| = *Myrsidium bertoloni* Bory                                        |              |              |            |
| *Derbesia tenassima* (Moris & De Notaris) P.L. Crouan & H.M. Crouan  | Diapoulis & Haritonidis, 1984 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| = *Halicystis parvula* F. Schmitz *ex* Murray                       |              |              |            |
| *Didymosporangium repens* F.D. Lambert                               |              |              |            |
| = *Flabellia petiolata* (Turra) Nizamuddin                          | Athanasiadis, 1987 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| = *Flabellia minima* (Ernst) Nizamuddin (*f*.)                       |              |              |            |
| = *Udotea desfontainii* (J.V. Lamouroux) Decaisne                   | Athanasiadis, 1987 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| = *Udotea petiolata* (Turra) Borgesen                              |              |              |            |
| *Gomontia polyrhiza* (Lagerheim) Bornet & Flahault                   | Anagnostidis, 1968 | -            | -          |
| = *Halimeda tenuissima* (J. Ellis & Solander) J.V. Lamouroux         | Athanasiadis, 1987 | Lazaridou, 1994 | Bitis, 1988 |
| = *Halimeda platyzonisa* Decaisne                                    |              |              |            |
| *Microdictyon tenuissima* Decaisne *ex* J.E. Gray                    | present study | Diapoulis, 1983 | Tsirika & Haritonidis, 2005 |
| *Ostreobium quokettii* Bornet & Flahault (*f*.)                     |              |              |            |
| *Palnomophyllum crisisum* (Nacciari) Rabenhorst                      | Athanasiadis, 1987 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| *Porvocladia parvulus* (Solms-Laubach) S. Berger, U. Fettweiss, S. Gleissberg, L.B. Liddle, U. Richter, H. Sawitzky & G.C. Zuccarello | - | - | - |
| = *Acetabularia parvula* Solms-Laubbach                              |              |              |            |
| *Pedobesia simplex* (Meneghini ex Kützing) M.J. Wynne & F. Leliaert   | Athanasiadis, 1987 | Diapoulis, 1983 | Schnetter & Schnetter, 1981 |
| = *Pedobesia lamarouxi* (J. Agardh) Feldmann, Loreau, Codomier & Couté |              |              |            |
| = *Bryopsis dalmatica* Kützing                                      |              |              |            |
| = *Derbesia lamarouxi* (J. Agardh) Solier                            |              |              |            |
| *Penicillus capitatus* Lamarck                                       | Athanasiadis, 1987 | Lazaridou, 1994 | Tsirika & Haritonidis, 2005 |
| = *Espera mediterranea* Decaisne                                    |              |              |            |
| *Phaeophila dendroides* (P.L. Crouan. & H.M. Crouan) Batters         | Athanasiadis, 1987 | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| *Phaeophila hirsuta* (Erecgovíc) R. Nielsen                         | -            | Catría & Giardina, 2009 | -          |
| = *Pseudobryopsis* myura* (J. Agardh) Berthold                      | -            | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| = *Trichosolen myurus* (J.Agardh) W.R. Taylor                       | -            | Lazaridou, 1994 | Schnetter & Schnetter, 1981 |
| *Pseudochlorodesmis furcellata* (Zanardini) Börjesen var. *furcellata* | Athanasiadis, 1987 | Panayotidis _et al._, 2004 | Bitis, 1988 |
| = *Bryopsis furcellata* Zanardini                                    |              |              |            |
| *Pseudochlorodesmis furcellata var. canariensis* Börjesen            | -            | Catría & Giardina, 2009 | -          |
| *Rhizoclonium riparium* (Roth) Harvey (*f*)                          | Anagnostidis, 1968 | Diapoulis, 1983 | Schnetter & Schnetter, 1981 |
| = *Rhizoclonium implexum* (Dillwyn) Kützing (*f*)                   |              |              |            |
| = *Rhizoclonium salinarium* Kützing                                  |              |              |            |
| = *Lola impexa* (Dillwyn) G. Hamel                                   |              |              |            |
| *Rhizoclonium tortuosum* (Dillwyn) Kützing (*f*)                    | Chryssovergis, 1995 | Tsiamis _et al._, 2013b | Christia _et al._, 2011 (*f*) |
| *Siphonoclados pusillus* (C. Agardh ex Kützing) Hauck                | -            | Diapoulis, 1983 | Schnetter & Schnetter, 1981 |
| = *Siphonoclados wilbergii* Schmitz                                 | -            | Diapoulis, 1983 | Diapoulis & Haritonidis, 1987b |
| *Ulothrix flacca* (Dillwyn) Thuret                                  | Anagnostidis, 1968 | Diapoulis, 1983 | Schnetter & Schnetter, 1981 |
| = *Ulothrix pseudoflaccia* Wille                                    |              |              |            |
| *Ulothrix impexa* (Kützing) Kützing                                  | Diannelidis, 1950 | -            |            |
| *Ulva clathrata* (Roth) C. Agardh                                   | Chryssovergis, 1995 | -            |            |
| = *Enteromorpha clathrata* (Roth) Greville                         |              | Diapoulis, 1983 | Bitis, 1988 |
| = *Enteromorpha muscoides* (Clemente) J. Cremades                   |              |              |            |
| = *Enteromorpha ramulososa* (J.E. Smith) Carnemichael               |              |              |            |
| = *Enteromorpha ramulososa* var. *tenerrima* Schiffner             |              |              |            |
| = *Enteromorpha complanata* var. *crinita* (Nees) Kützing            |              |              |            |
| Taxa                                      | North Aegean | South Aegean | Ionian Sea |
|-------------------------------------------|--------------|--------------|------------|
| Ulva compressa Linnaeus = Enteromorpha compressa (Linnaeus) Nees Bliding | Athenasiadis, 1987 | Nizamuddin & Lehnberg, 1970 | Bitis, 1988 |
| Ulva fasciata Delile (19) = Ulva lactuca var. fasciata (Delile) Schiffner | Haritondis, 1978 | Schiffler & Schussnig, 1943 | Bitis, 1988 |
| Ulva flexuosa subsp. flexuosa = Enteromorpha flexuosa (Wulfen) J. Agardh = Enteromorpha lingulata J. Agardh = Enteromorpha compressa var. lingulata (J. Agardh) Hauck | Anagnostidis, 1968 | Lazaridou, 1994 | Bitis, 1988 |
| Ulva intestinalis Linnaeus var. intestinalis = Enteromorpha intestinalis (Linnaeus) Nees | Athenasiadis, 1987 | Nizamuddin & Lehnberg, 1970 | Bitis, 1988 |
| Ulva intestinalis f. cornucopiae (Lyngbye) A. Sfriso & D. Curiel | - | Nizamuddin & Lehnberg, 1970 | - |
| Ulva laetevirens Areschoug (14) | - | Catra & Giardina, 2009 | Christia et al., 2011 (12) |
| Ulva linza Linnaeus = Enteromorpha linza (Linnaeus) J. Agardh = Enteromorpha dhieriana Bliding nom. illeg. = Phycoseris crispata (Bertoloni) Kützing | Athenasiadis, 1987 | Diannelidis et al., 1977 | Bitis, 1988 |
| Ulva multiramosa E. Taskin = Enteromorpha multiramosa Bliding nom. inv. | Athenasiadis, 1987 | Tsiarnis et al., 2013b | Schnetter & Schnetter, 1981 |
| Ulva prolifera O.F. Müller = Enteromorpha prolifera (O.F. Müller) J. Agardh | Anagnostidis, 1968 | Coppejans, 1974 | Bitis, 1988 |
| Ulva rigida C. Agardh (14) = Ulva lactuca var. rigida (C. Agardh) Le Jolis | Athenasiadis, 1987 | Nizamuddin & Lehnberg, 1970 | Schnetter & Schnetter, 1981 |
| Ulva rotundata Bliding | - | Bliding, 1968 | - |
| Ulvella inflata (Ercegović) R. Nielsen, C.J.O ‘Kelly & B. Wyso | Chryssovergis, 1995 | - | - |
| Ulvella leptocheae (Huber) R. Nielsen, C.J.O Kelly & B. Wyso | - | Nielsen, 1983 | - |
| Ulvella scutata (Reinke) R. Nielsen, C.J. O’Kelly & B. Wyso = Pringsheimia scutata Reinke = Pringsheimiella scutata (Reinke) Marchewianka | Chryssovergis, 1995 | Diapoulis, 1983 | Tsirika & Haritonidis, 2005 |
| Ulvella setchellii P. Dangeard | - | Catra & Giardina, 2009 | - |
| Ulvella viridis (Reinke) R. Nielsen, C.J.O ‘Kelly & B.Wyso = Acrochaete viridis (Reinke) R. Nielsen = Endodermia viridis (Reinke) Lagerheim = Entocladia viridis Reinke = Phaeophila viridis (Reinke) Burrows | Chryssovergis, 1995 | Diapoulis, 1983 | Diapoulis & Haritonidis, 1987b |
| Valonia aegagropila C. Agardh | - | - | Christia et al., 2011 (12) |
| Valonia macrophysa Kützing = Haritonidis, 1978 | Lazarioud, 1994 | Tsirika & Haritonidis, 2005 |
| Valonia utricularis (Roth) C. Agardh = Athenasiadis, 1987 | Lazarioud, 1994 | Schnetter & Schnetter, 1981 |
| Valonia ventricosa J. Agardh = Giaccone, 1968a | Giaccone, 1968b | Giaccone, 1968b |
Habitat: Several plants were met in the sublittoral zone, at 12 m depth, on rocky substratum.

Locality: Porto Coufo, Sithonia, N. Aegean Sea, May 2012, coll. K. Tsiamis.

Distribution: Commonly encountered in both the Western and Eastern Mediterranean Sea (Gallardo et al., 1993). In Greece, frequently reported from the S. Aegean (e.g. Diapoulis, 1983; Sartoni & De Biasi, 1999; Catra & Giardina, 2009) and Ionian Sea (Giaccone, 1968; Tsirika & Haritonidis, 2005).

Notes
1. We follow the treatment of Sfriso (2010a) citing Chaetomorpha aerea and C. linum as distinct taxa. However, John et al. (2003) consider these two taxa as synonyms and we note that the genus requires taxonomic re-investigation.
2. We follow John et al. (2003) and Furnari et al. (2010) considering Chaetomorpha capillaris and C. mediterranea as synonyms of C. ligustica.
3. Gerloff & Geissler (1974) cite Grunow’s (1861) records of Chaetomorpha rigida (C. Agardh) Kützing, C. dalmatica (Kützing) Kützing, C. setacea (C. Agardh) Kützing and C. mazzianiana Grunow as synonyms of C. linum.
4. According to the study of Leliaert & Coppejans (2006) Cladophora modonensis and Siphonoclados consperses are probably referable to Cladophora coelothrix.
5. We follow Gallardo et al. (1993) and Furnari et al. (2010), citing Cladophora flexuosa as a distinct species, and not a synonym of C. sericea (Burrows, 1991).
6. Commonly cited as Codium bursa (Linnaeus) C. Agardh, based on Alcyonium bursa Linnaeus. However, according to Spencer et al. (2009), A. bursa is the basionym for the sponge Weberella bursa (Linnaeus).
7. Probably with a wider distribution in the Greek seas. The scarcity of Greek records is probably due to misidentifications of this species as Codium tomentosum (Athanasiadis, 1987).
8. We follow Gallardo et al. (1993) considering Flabellia minima as a synonym of F. petiolata, based on Meinesz (1980) study.
9. According to Mayhoub (1974), this species is a synonym of Pseudobryopsis myura.
10. Although Burrows (1991) considers Rhizoclonium riparium and R. tortuosum as conspecific, we follow Hardy & Guiry (2003) and John et al. (2004), considering them as distinct taxa. We note that the genus requires taxonomic re-investigation as in the case of the genus Chaetomorpha.
11. Sfriso (2010a) considers Rhizoclonium riparium and R. implexum as distinct taxa.
12. Found only in brackish water.
13. Although O’Kelly et al. (2010) note that Ulva fasciata could be considered as a synonym of U. lactuca Linnaeus, we follow Sfriso (2010a) who cites them as distinct taxa based on morphological and ecological evidence.

Fig. 2: Green algae new to the North Aegean and/or Ionian Seas. A. Blastophysa rhizopus, detail of vesicular cell including several chromatophores. B. Codium effusum (herbarium habit). C-D. Microdictyon tenuius (C. herbarium habit; D. detail of the angular network). Scale bars: Fig A = 20 μm; Figs B, C = 1 cm; Fig D = 2 mm.
14. It remains unclear whether *Ulva laetevirens* and *U. rigida* are distinct or conspecific species, pending molecular examination of their type specimens (Wolf et al., 2012).

**Taxa pending confirmation of their presence**

**Acrosiphonia arcta (Dillwyn) Gain**
- = *Cladophora arcta* (Dillwyn) Kützing
- = *Cladophora lanosa* (Roth) Kützing

The N. Aegean Sea records by Haritonidis (1978, as *Cladophora arcta* and *C. lanosa*), Haritonidis & Tsekos (1974, as *C. arcta* and *C. lanosa*) and Panagiotopoulos-Karatagli et al. (1974, as *C. arcta*) lack documentation and should be confirmed since this taxon occurs mainly in northern Europe.

**Cladophora ruchingeri (C. Agardh) Kützing**

The single record by Gerloff & Geissler (1974) from Aegina Island (Aegean Sea) was cited with reservations. Pending confirmation, *Cladophora ruchingeri* should be referred as debatable for the Greek flora.

**Codium adhaerens C. Agardh**

Although numerous records of this species do exist for the Mediterranean Sea, including Greece (see Athanasiadis, 1987), we agree with Gallardo et al. (1993) that these records might refer to *Codium effusum*, a rather common alga of the Greek coasts. These two species share similar external morphology and their distinction requires detailed examination. Thus, the Greek records of *C. adhaerens*, which all lack sufficient documentation, should be treated as debatable, pending new documented records.

**Enteromorpha stipitata P. Dangeard**

The single record by Schnetter & Schnetter (1981) from Kephallonia Island (Ionian Sea) lacks description or illustration. It is based on *Conferva membranacea var. caespitosa* C. Agardh, which was originally described by C. Agardh (1824: 121) for tropical plants collected from Antilles and Tenerife. C. Agardh (1824) also cited *C. caespitosa* Bory, which is probably a nomen nudum, as a synonym of his plant. C. Agardh’s combination was later transferred by De Toni (1889: 359) to the genus *Siphonoclados*, reporting also a specimen collected from Corsica by Debeaux. In our opinion, the Greek record should be treated as debatable, pending confirmation.

**Siphonoclados membranaceus var. caespitosa (C. Agardh) De Toni**

This taxon was reported by Reinbold (1898) from Rhodos Island (Aegean Sea) lacking description or illustration. It is based on *Conferva membranacea var. caespitosa* C. Agardh, which was originally described by C. Agardh (1824: 121) for tropical plants collected from Antilles and Tenerife. C. Agardh (1824) also cited *C. caespitosa* Bory, which is probably a nomen nudum, as a synonym of his plant. C. Agardh’s combination was later transferred by De Toni (1889: 359) to the genus *Siphonoclados*, reporting also a specimen collected from Corsica by Debeaux. In our opinion, the Greek record should be treated as debatable, pending confirmation.

**Spongomerphera aeruginosa (Linnaeus) van den Hoek**
- = *Cladophora lanosa f. uncialis* (O.F. Müller) Hauck

The single record by Diannelidis (1948, as *Cladophora lanosa f. uncialis*) from Pagasitikos Gulf (Aegean Sea) should be confirmed since this species occurs mainly in northern Europe. It should be noted that *C. lanosa f. uncialis* is based on *Conferva uncialis* O.F. Müller, which according to van den Hoek (1963) might refer to *Cladophora vagabunda* or *C. dalmatica*.

**Ulva bifrons Ardré**

The single record by Schnetter & Schnetter (1981) from Kephallonia Island lacks description or illustrations and is pending confirmation, as there are no other reports of this species from the Eastern Mediterranean Sea (Gallardo et al., 1993).

**Ulva lactuca Linnaeus**

Despite the numerous Mediterranean records, including the Greek ones (see Athanasiadis, 1987), its occurrence in the Mediterranean Sea needs to be confirmed (Gallardo et al., 1993). It should be noted that the molecular identity of the holotype does not match that of N. Europe specimens that have since been assigned to this binomial (Butler, 2007). Wolf et al. (2012) molecular analyses indicated that old specimens from the Adriatic Sea should be assigned to *Ulva rigida*. Sfriso (2010b) reports the presence of both *U. rigida* and *U. laetevirens* from the Northern Adriatic Sea whereas *U. lactuca* was found to be a misidentification.

**Ulva lactuca var. lacinulata (Kützing) W.R. Taylor**
- = *Ulva lactuca f. lacinulata* (Kützing) Hauck

This rather rare taxon has been reported in Greece only by Petkoff (1943, as *Ulva lactuca f. lacinulata*) from the Macedonian coast (N. Greece). Since neither a description nor illustrations were provided, the occurrence of this entity in Greece needs to be confirmed.

**Prasiola crispa (Lightfoot) Kützing**

This species has been reported from the Venice lagoon by Curiel et al. (2004) and Sfriso (2010a) and the single Greek record by Anagnostidis (1968) from the Macedonian coast (N. Greece) should be confirmed.
Taxa Excludenda

Cladophora catenata (Linnaeus) Kützing

\[= Cladophora catenata \text{ Hauck nom. illeg.} =\]
\[= Converva catenata Linnaeus\]

According to van den Hoek (1963) Mediterranean records of Cladophora catenata probably refer to C. lehmanniana, and the occurrence of C. catenata in the Mediterranean Sea has not been confirmed (Gallardo et al., 1993; Furnari et al., 1999). Therefore, in the absence of descriptions or illustrations the Greek records from the Aegean (Politis, 1932; Schiffler & Schussnig, 1943; Anagnostidis, 1968 – with reservations) and the Ionian Sea (Grevelle, 1826, as Converva catenata; Grunow, 1861) should be excluded from the Greek flora.

Cladophora glomerata var. crassior (C. Agardh) van den Hoek

\[= Cladophora callicoma Kützing\]
\[= Cladophora crispata (Roth) Kützing\]

The records of Anagnostidis (1968, as Cladophora crispata) and Grunow (1861, as C. callicoma) refer to freshwater specimens, and thus should be excluded from the seaweed flora of the Greek coasts.

Codium tomentosum Stackhouse

This species does not seem to occur in the Eastern Mediterranean Sea (Furnari et al., 1999) and we agree with Athanasiadis (1987: 154) that the numerous Greek records are probably misidentifications of Codium vermiculata. In our opinion, the species should be excluded from the Greek flora.

Halimeda opuntia (Linnaeus) J.V. Lamouroux

This tropical species does not occur in the Mediterranean Sea and the single record by Candargy (1899) from Lesvos Island (Aegean Sea) should be considered as a misidentification (Gerloff & Geissler, 1974).

Prasiola stipitata Suhr ex Jessen

The records from Thera Mainos Gulf (Anagnostidis 1968, with reservations) and Kephallonia Island (Schnetter & Schnetter, 1981) should be excluded from the Greek flora, since this species does not occur elsewhere in the Mediterranean Sea.

Rhizoclonium hieroglyphicum (C.Agardh) Kützing

The single record by Anagnostidis (1968) from Methoni Bay (Aegean Sea) must be a misidentification since \textit{Rhizoclonium hieroglyphicum} is mainly a freshwater species. According to Gallardo et al. (1993), the species should be listed among the \textit{taxa inquirenda}.

Ulva gigantea (Kützing) Bliding

\[= Phycoseris gigantea Kützing\]

The Greek records by Haritonidis & Tsekos (1975) from the Macedonian coast (N. Greece) and Grunow (1861, as Phycoseris gigantea) from the Ionian Islands must be misidentifications since this species is restricted to northern Europe (Gallardo et al., 1993).

Ulva latissima Linnaeus sensu J. Agardh

\[= Ulva lactuca var. latissima (Linnaeus) A.P. de Candolle\]

Although the holotype is a kelp [Sacccharina latissima (Linnaeus) C.E. Lane, C. Mayes, L.D. Druehl & G.W. Saunders], the binomial Ulva latissima has been traditionally misapplied to representatives of the genus Ulva (Pappenfuss, 1960: 303). More specifically, European records are apparently referable to U. gigantea (Bliding, 1968). In line with this concept, the Greek records by Candargy (1899) from Lesvos Island and Reinbold (1898, as U. lactuca var. latissima) from Rhodes Island should probably be associated with an Ulva species, but due to the lack of sufficient documentation they should be excluded from the Greek flora.

Urospora wormskiioldii (Mertens ex Hornemann) Rosenvinge

\[= Codium gregarium A. Braun\]

Diannelidis (1950, 1953) reported Codium gregarium from the N. Sporades (Aegean Sea) with reservations, considering it as the diploid phase of Urospora mirabilis Areuschou [currently accepted name=U. penicilliformis (Roth) Areschoug]. However, according to Burrows (1991), C. gregarium probably represents the diploid phase of U. wormskiioldii, which is not known to occur in the Mediterranean Sea. Hence, the species should be excluded from the Greek flora.

Taxa Inquirenda

Chaetomorpha fibrosa (Kützing) Kützing

The taxonomic status of this species remains unknown and requires re-investigation (Athanasiadis, 1987; Furnari et al., 1999). Reinbold (1898) reported this species from Rhodes Island, but in the absence of a description or illustration the identity of his material remains unclear.

Cladophora crystallina (Roth) Kützing

Taxon of uncertain taxonomic position since, according to van den Hoek (1963), this species is referable either to Cladophora glomerata or to C. vagabunda. In Greece, C. crystallina has been recorded from the Aegean (Politis, 1936; Anagnostidis, 1968) and Ionian Sea (Grunow, 1861). Based on the same context, Cladophora crystallina var. tenusissima Ercegović and C. crystallina var. subdichotomy Ercegović, reported both by Nizamuddin & Lehnberg (1970) from Sikinos Island (Aegean Sea) should be treated as \textit{taxa inquirenda}. 

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Cladophora glomerata var. marina Kützing

The taxonomic status of this taxon has been questioned by van den Hoek (1963) and thus we maintain the Greek records from the N. Aegean (Petkoff, 1943) and S. Aegean Sea (Politis, 1928, 1932, 1936; Giaccone, 1968a) on the list of taxa inquenda.

Cladophora graeca Schiffner

This species was originally reported from N. Sporades and Mykonos Island (Aegean Sea) by Schiffner & Schussnig (1943), but in the absence of a diagnosis it is a nomen nudum. Besides, according to van den Hoek (1963), Schiffner’s herbarium material is partly based on Cladophora vagabunda.

Cladophora refracta Kützing

Van den Hoek (1963) cited Cladophora refracta (Roth) Kützing as a taxon with obscure status, based on Conferva refracta Roth, an illegitimate superfluous name for Cladophora hirta O.F. Müller, a taxon of uncertain application (Furnari et al., 1999). In our opinion, the single Greek record by Anagnostidis (1968, as Cladophora refracta Kützing) from Thermaikos Gulf (Aegean Sea), which lacks description or illustration, should be listed among the taxa inquenda.

Cladophoropsis psylliannis (Schmitz) Wille

= Siphonoclados psylliannis Schmitz

Originally described from Pystallia islet in the Saronikos Gulf (Schmitz, 1879, as Siphonoclados psylliannis; paratype from the Gulf of Naples), but the type material is untraceable and the original description is too vague to permit a taxonomic conclusion (Leliaert & Coppejans, 2006: 671). Since Schmitz’s material the species was never recorded again to our knowledge. Despite our personal samplings around Pystallia islet from the year 1998 to 2013 we never detected the species.

Conferva fracta var. elongata (Roth) Roth

Fauché et al. (1832-33) erected Ceramium fractum var. elongatum (Roth) Bory based on material collected at Tinos Island (Aegean Sea), which was apparently based on Conferva fracta var. elongata (Roth) Roth, the identity of which is obscure according to van den Hoek (1963: 223).

Derbesia cervicornis Schiffner

This species was originally described by Schiffner & Schussnig (1943) based on plants collected at Naxos Island (Aegean Sea), but Athanasiadis (1987) questioned the taxonomic identity of this material since according to the protologue it could well belong to a form of Pedobesia simplex. It should be noted that the species was never reported again to our knowledge.

Enteromorpha adriatica Bliding

Originally described from Croatia (Rovinj, Split, Dubrovnik) by Bliding (1960) but a type element was not designated. In Greece, the single record by Chryssosvergis (1995) from Maliakos Gulf lacks description or illustrations and the identity of her material remains unknown.

Enteromorpha flexuosa subsp. linziformis (Bliding) Bliding

This combination is based on Enteromorpha linziformis Bliding, originally reported from France (Concarneau, Finistère) and Croatia (Split) by Bliding (1960), but lacking the selection of a type specimen. The single record from the Ionian Sea by Christia et al. (2011) refers to a brackish-water specimen, while no description or illustrations were given.

Microdictyon schmitzi Miliarakis

The species was originally described by Miliarakis (1887), with reservations, from Skiathos Island (Aegean Sea). However, it was never recorded since then, neither to the type locality nor from the Aegean Sea, and its taxonomic status remains obscure.

Ulva lactuca f. genuina Hauck

= Enteromorpha intestinalis var. genuina Schiffner nom. illeg.

According to Wolf et al. (2012), old Adriatic specimens of this taxon collected by Hauck in 1885 in Trieste should refer to Ulva rotundata. Hence, the type specimen of this taxon needs re-examination. In Greece, it was reported by Petkoff (1943) from the Macedonian coast (N. Greece) and Schiffner & Schussnig (1943, as E. intestinalis var. genuina) from Mykonos Island.

Ulva rigida var. laciniata (Wulfen) J. Agardh

= Ulva lactuca var. laciniata (J. Agardh) Schiffner

Taxon of uncertain taxonomic position possibly associated to Ulva rigida (Gallardo et al., 1993). In Greece, it has been reported by Schiffner & Schussnig (1943, as U. lactuca var. laciniata) from Mykonos Island but the identity of their material is unknown.

Ulva sporadica Miliarakis

Originally described by Miliarakis (1887) from Skiathos Island, but never found again neither to the type locality nor in the Aegean Sea. According to Athanasiadis (1987), it might be associated with Ulva lactuca.

Valonia caespitula Zanardini

Originally described from Croatia (Šibenik) by Zanardini (1843) and later reported by Miliarakis (1887) from the Island of Skiathos. The taxonomic identity of the species was questioned by De Toni (1889), who cited it as a possible synonym of Valonia utricularis.
Discussion

In the first review of Greek seaweeds (Diannelidis, 1950) only 40 taxa (at species and infraspecies level) of currently accepted Ulvophyceae had been listed. Later on, Gerloff & Geissler (1974) listed 61, while Athanasiadis (1987) listed 68 taxa for the Aegean Sea only. Lastly, in a survey of 214 Mediterranean green algae, Gallardo et al. (1993) included 79 taxa from Greece. The 96 confirmed taxa reported in the present study reflect a further increase of our knowledge, and it should be attributed to the several new studies carried out during the last years (e.g. Sartoni & De Biasi, 2009; Catra & Giardina, 2009; Tsiamis et al., 2010a, b, 2013b).

The distribution of these 96 green seaweeds along the coasts is as follows: 74 taxa have been found in the N. Aegean, 80 taxa in the S. Aegean and 74 taxa in the Ionian Sea (Fig. 1). This pattern may be related to the number (or extent of detail) of the studies conducted within each region.

The Greek marine flora seems to host by far less green algae compared with the neighbouring Italian coasts, where 150 taxa have been recorded (Furnari et al., 2010). This difference definitely reflects the fewer phycological studies that have been conducted in Greece, and generally in the Eastern Mediterranean Sea, with several coastal regions and islands still remaining poorly surveyed particularly in the sublittoral and circalittoral zones.

Finally, some green algal taxa require further investigations, especially species of Ulva, Cladophora, Chaetomorpha and Rhizoclonium. In addition, many taxa are pending confirmation, whereas several others are treated as taxa excludenda or inquirenda (11, 9 and 15 taxa respectively). This is partly due to taxonomic difficulties but also to the scarcity of Greek specimens deposited in public herbaria.

In conclusion, the continuous increase in the number of green algae reported in Greece indicates that there are still major gaps in our knowledge of the marine flora of the Aegean and Ionian Seas, and that the number of species is expected to increase with additional surveys in unexplored areas and particularly in deeper habitats.

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