



## Checklist of freshwater red algae in the Iberian Peninsula and the Balearic Islands

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With 2 figures and 1 table

**Abstract:** The catalogue presented here is novel not only in its degree of updating but also for the information itself, unpublished so far in any other check-lists, especially those referring to the Portuguese red algal flora. The total number of freshwater rhodophyte taxa identified to date now amounts to 108. These results are organised in such a way as to identify the references according to their type: the check-list contains 68 species, 38 of which are from Portugal and 31 from Spain; 25 further species are cited as synonyms. We also found 15 taxa that we have not included in the list for various reasons concerning their location and authorship. Whenever possible we have connected the references to their respective hydrographic basins, thus contributing not only to information about the biodiversity of freshwater red algae but also their geographic distribution. This work emphasises the importance of check-lists when dealing with an Iberian Flora on red algae, whilst pointing out those areas of Iberia that have remained poorly explored until now and the taxonomic groups of *Rhodophyta* which require further study.

**Key words:** *Rhodophyta*, freshwater, check-list, Spain, Portugal, Iberian Peninsula.

### Introduction

Modern studies into continental Ibero-Balearic red algae (*Rhodophyta*) are hampered by outdated catalogues lacking comprehensive data. A check-list such as the one we provide here might therefore serve as a useful starting point for studies concerning the biological diversity of red algae, for assessing their biodiversity and associating

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them to a specific geographical distribution. It is also essential to plan further work on the subject in an orderly way. References to existing catalogues such as those by Álvarez-Cobelas (1984), Aboal (1998) and Cambra et al. (1998) are frequent in such publications as *THE IBERIAN FLORA OF CONTINENTAL ALGAE I* by Cirujano et al. (2008), who have used them to undertake studies into the ecology, geographical distribution of the species, and algal flora, among other subjects. Thus we emphasise here the importance of compiling a catalogue that for the first time will bring together all the references to freshwater red algae in the Iberian Peninsula and the Balearic Islands.

Exclusively freshwater species account for only 184 (5.7%) (Sheath 1984a, Kwadrans & Eloranta 2010) of the 6,000 known species contained in the *Rhodophyta* group throughout the world (Shneider & Wynne 2007), which may well explain why little is known about them, particularly in the context of the Iberian Peninsula and the Balearic Islands. Although the diversity of this group of algae is more limited in freshwater, the variety of habitats and their physico-chemical composition result in a high level of diversity, which began to be documented and studied two centuries ago.

The first references to red algae in the Iberian Peninsula date back to the middle of the 19th century, thanks to the collection of *Rhodophyta* specimens by botanists such as Welwitsch (1841, cited in Reis 1958) and Clemente (1864). The first finds of continental red algae in the Iberian Peninsula were of *Batrachospermum gelatinosum* (L.) De Candolle, known as *Batrachospermum moniliforme* Roth and *Lemanea fluviatilis* C. Agardh. Since then, botanists such as Amo & Mora (1870), González-Fragoso (1883), Lacoizqueta (1885) and Colmeiro (1889) have also gathered specimens of these taxa. Other authors, among them Henriques (1880), contributed new data that furthered our knowledge about these organisms, especially as far as Portugal is concerned.

The study of Iberian continental red algae came to the fore in the numerous works published by Reis, who systematically studied Portuguese red algae. Some of his work was of a general nature, for example the series "SUBSÍDIOS PARA O CONHECIMENTO DAS RODOFICEAS DE ÁGUA DOCE DE PORTUGAL", published in 1958, 1961, 1962a, 1963, 1965b, 1969, 1973, whilst others of his works focused on specific groups which required a more detailed analysis, published in 1954, 1955, 1960b, 1962b, 1965a, 1967, 1970, 1972a, 1972b, 1974. Reis described many new taxa, such as *Lemanea lusitanica* M.P.Reis (1962), *Batrachospermum ferreri* M.P.Reis (1967) and *Batrachospermum gibbosum* M.P.Reis (1969), for example. Other authors contemporary to Reis who contributed important works were Margalef (1948, 1951, 1952, 1953, 1955a, 1955b, 1956) and González-Guerrero (1945, 1948, 1949, 1950, 1956). Since then, interest in the study of red algae has been increasing. Worthy of mention among those who have contributed to this growing trend is Álvarez-Cobelas (1984), who compiled a list of the taxa cited in Spain. Since then most work devoted to red algae has focused on the description of the characteristic algal flora in certain specific zones such as the basins of the rivers Segura (Aboal et al. 1996), Júcar (Sabater et al. 1989) and Tajo (Carmona et al., 2011).

The aim of this work is to provide a starting point for the study of the *IBERIAN FLORA OF CONTINENTAL RED ALGAE II* (Sánchez Castillo et al. 2009) through a compilation of a comprehensive check-list of all the species of red algae cited for the Iberian Peninsula and the Balearic Islands.

To this end our objectives have been:

- To gather the names of all the species cited in the literature within the Ibero-Balearic context, indicating whenever possible the year when they were identified and in which hydrographic basin.
- To compile the obsolete names, indicating to which species they are assigned or are synonyms of, and where they can be found.
- To highlight the species cited for Portugal but not included in any check-list to date.
- To compare the results for Iberian countries with those for others in an enlarged and complemented European context, especially in the less exhaustively studied southern European countries.
- To describe the relative diversity of red algae in the context of Iberia and the Balearic Islands and associate them with their geographical distribution.
- To identify the less widely studied hydrographic basins where *Rhodophyta* are present so as to plan future studies on the subject.

## Methods

A check-list is a compilation of names of correctly cited species in a given geographical area. Therefore it is important to define the criteria applied with regard to the inclusion of these species, to identify the geographical scope of this work and to establish the systematic approach used.

**GEOGRAPHICAL SCOPE:** The check-list contains all the references to freshwater red algae in the Iberian Peninsula and the Balearic Islands but excludes the Canary Isles and Portuguese dependent islands. Whenever possible citations are also linked to a geographical location in their corresponding hydrographic basin. To this end we have drawn up a map showing the hydrographic basins in both the Iberian Peninsula and the Balearic Islands. The boundaries of all the basins are determined by their corresponding hydrographic confederations (The Ministry for Agriculture, Food and the Environment [www.magrama.gob.es](http://www.magrama.gob.es)).

**INCLUSION OF NAMES:** The bibliographic search encompassed a full review of all works published about Ibero-Balearic freshwater red algae. All the taxa cited in the literature are included in a table. It contains a list of all those species cited at least once and synonymised a posteriori. This table also includes the species valid for a check-list that complies with the criteria explained below. The table lists the name of the species cited, the author and the year it was published, the geographical distribution and the bibliographic reference to the work in which it is cited, including information as to whether it is cited as such or as a synonym. All the results obtained were reviewed using the phycological data-bases ALGAE BASE (Guiry 2010), INDEX NOMINUM ALGARUM (Silva 2011) and Dewayne (2009).

To be included in a check-list a species must comply with a number of characteristics, which is not always possible, especially with names found in early works. In such works locations tend to be unclear, thus posing a problem with the citation. In this work a name is included in the check-list when:

- A binomial name is given.
- The cited species is based on a description that complies with the criteria laid down by the International Code of Botanical Nomenclature.
- The exact location in the Ibero-Balearic region is provided.

Also identified in this work are taxa from unknown locations, or those whose authorship is uncertain or could not be verified from the available data-bases, because, although they are not fully admitted

references, the information is deemed to be valid. These kinds of reference are included in the text with their corresponding explanation.

**SYSTEMATIC CLASSIFICATION:** Since the subject was first broached, changes and controversy have influenced the classification of red algae, especially since results from molecular analyses have suggested new systematic approaches. Yoon et al. (2010) and Wynne & Schneider (2010) differ in their view of the phylum *Rhodophyta* vs *Rhodophyta* & *Cianorhodophyta*, and agree in grouping red algae into seven classes, of which six are to be found in the Ibero-Balearic region: Cyanidiphyceae, Porphyridiophyceae, Bangiophyceae, Compsopogonophyceae, Florideophyceae and Stylonematophyceae. Deemed to be the most appropriate to date, we have used Yoon's classification in our work.

## Results

The bibliographic search has yielded citations for 108 taxa in the Ibero-Balearic region. The 68 species included in the check-list are shown in a table that provides all the relevant information about the cited taxa together, and their geographical location according to the hydrographic basin concerned (Table 1). Emphasis is laid upon taxa cited for Portugal and described for the first time. The number of references listed (%) can be seen on the map showing the Ibero-Balearic hydrographic basins (Fig.1).

A detailed explanation is provided concerning 15 taxa not included in the check-list. In the works of Álvarez-Cobelas (1984) and Llimona et al. (1985) the exact locations for the references are not given, either because the check-list is incomplete or because the location is too vague (i.e. "Catalonia"). Species thus cited are: *Batrachospermum helminthosum* Bory de Saint Vincent 1808, *Batrachospermum testale* Sirodot 1884, synonym of *B. helminthosum*, *Batrachospermum sporulans* Sirodot 1884, synonym of *Batrachospermum skujae* Geitler 1944, *Batrachospermum virgatum* Sirodot 1884, *Batrachospermum tenuissimum* Bory de Saint-Vincent 1830, synonym of *Batrachospermum atrum* (Huds.) Harvey 1841, *Lemanea mamilliosa* Kütz. 1845, *Lemanea torulosa* Sirodot and *Chroodactylon ramosum* (Thwaites) Hansgirg 1885, synonym of *Chroodactylon ornatum* (C.Agardh) Basson 1979.

Other taxa are not listed due to uncertainty about their authorship. The cited species have not been found in the bibliographies or data bases relating to the authors named, whereas in some cases they have been found but ascribed to a different author. The taxa concerned are the following: *Audouinella leiblenii* (Kütz.) Sheath, cited by Margalef (1955b) and Sabater, Aboal & Cambra (1989) and found as *A. leiblenii* (Kütz.) Palmer (1958); *Chantransia chalybea* Fries, cited by González-Guerrero (1945) and found as *C. chalybaea* (Roth) Fries (1825) and lastly, *Lemanea dichotoma* De Candolle, cited by Reis (1965) and mentioned as *L. dichotoma* (De Candolle) De Toni var. *dichotoma* (De Candolle) M.P.Reis (1961).

The taxa *Batrachospermum* sp. in the Balearic basin (Margalef 1948, 1951), *Compsopogon* sp. in the Catalan inland basins (Tomás et al. 1987) and *Polysiphonia* sp. in the Balearic and Segura river basins (Margalef, 1953; Aboal & Llimona, 1989) are worth mentioning, especially those in the Balearic basin, where references to red algae are scarce, although they do not comply with the criteria required to be included in the check-list.



Fig. 1. Map of the different river basins in the Iberian Peninsula and Balearic Islands. The percentages show the number of references for each river basin.

## Discussion

In this check-list of continental red algae 68 species are listed for the Iberian Peninsula and the Balearic Islands, referred to here as the Ibero-Balearic region, which is a considerable number in the light of the 184 species registered for the whole world according to Sheath (1984a), and the 65 species for Europe according to Kwadrans & Eloranta (2011). These latter authors record 21 genera of red algae in Europe (Kwadrans & Eloranta 2011), of which 17 are cited in the Iberian region. Until now the only catalogue of continental red-algal flora for the Iberian region, in which 20 species are listed for Spain, was the one compiled by Álvarez-Cobelas (1984). In their catalogue for Europe, Kwadrans & Eloranta (2010) only include the citations in Álvarez-Cobelas's catalogue for Spain, without referring to other important works, thus underestimating the richness of the flora. The results of this bibliographic review yield a notable increase in the number of citations, both for Spain (increasing from 20 to 31 species) and particularly for Portugal (until now lacking a separate check-list) with 38 species cited. According to the literature France accounts for the largest number of species in Europe: 48 in all (Bourrelly 1970, quoted in Sabater et al. 1989). The validity of this high number, which may be due to errors in transcription, could only be checked against the number provided by Eloranta et al. (2011), which brings it down to 11 species.

Table 1. The taxa found in the literature with their taxonomic class and synonyms (=) whenever they exist. An asterisk indicates taxa described by Reis for the first time in Portugal. The location of the citations in their corresponding river basin is indicated (M-S=Minho-Sil, BAL=Balearic Islands, GAL=Galicia, DUE=Douro, EBR=Ebro, ICAT=Catalonian Inland Basins, TAJ=Tajo (Tagus), JUC=Jucar, SEG=Segura, M-A=Mediterranean-Andalusian, A-A=Atlantic-Andalusian). A black circle (●) and bold references indicate a taxon cited as in the check-list, whilst an open circle (○) and regular references indicates a citation of this taxon under a synonym. For the following three exceptions included on the check-list we explain the differences as regards authorship between what was found in the literature consulted and in the data base: *Batrachospermum dillenii* Bory was found as *B. dillenii* (Bory) Duby; *Batrachospermum montiforme* var. *decaisnearum* Roth has (Sirodot) Reis as authors; and *Batrachospermum stagnale* Bory was found as *B. stagnale* (Bory) Hasall.

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAJ	JUC	SEG	MA	AA	Reference
Cyanidiophyceae	<i>Cyanidium caldarium</i> (Tilden) Geitler 1933														●		García-Fernandez & Aboal, 2011
	<i>Chroodactylon ornatum</i> (C. Agardh) Basson 1979 (=C. ramosum (Thwaites) Hansgöing 1885)													○			Sabater et al., 1989
Stylonematophyceae	<i>Chrootheca richteriana</i> Hansgöing 1884										○						Aboal & Llimona, 1984 b
	<i>Chrootheca rupestris</i> Hansgöing 1886									●							Aboal & Llimona, 1984 a
										●							Aboal, 1989*
																	Busquets et al., 1985
										●							Ballester- Sabater, 2003
																	Margalef, 1955b
										●							Sabater, Aboal & Cambra, 1989
																	Ballester and Sabater, 2003
																	Margalef, 1955b
																	Aboal, 1989*
																	Aboal & Llimona, 1989
	<i>Kyliniella latvica</i> Skuja 1926																Cambra, 1990
	<i>Rhodospira sordida</i> Geitler 1927																García-Fernández et al., 2012
																	Margalef, 1948

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAF	JUC	SEG	MA	VA	Reference
Porphyridiophyceae	<i>Porphyridium purpureum</i> (Bory de Saint Vincent) Drew et Ross 1965 (= <i>P. cruentum</i> (S. F. Gray) Nägeli 1849)			○							○						Margalef, 1952
	<i>Porphyridium sordidum</i> Geitler 1932			●		○											Gonzalez- Guerrero, 1948
	<i>Phragmonema sordidum</i> Zopf, 1882 <i>Bangia atropurpurea</i> (Roth) Agardh 1824					●					●						Margalef, 1953 Rifon, 2000 Aboal, 1996 Sabater, Aboal & Cambra, 1989 Lacoizqueta, 1885
Compsopogonophyceae	<i>Compsopogon coeruleus</i> (Balbis ex. Agardh) Montagne 1846 (= <i>C. lusitanicus</i> Reis 1977)	●					●						●	●			González Frago, 1883 Sabater, Aboal and Cambra, 1989 Aboal, 1986 Aboal, 1989a Sánchez- Castillo et al, 2011
					●								●				Egidos and Aboal, 2003 Cantora-Uriza and Aboal, 2001
Florideophyceae	<i>Hildenbrandia angolensis</i> Welwitsch ex West & West 1897																Busquets, Picado and Hernández- Maríné, 1985 Donze, 1968 Tomas, 1981
	<i>Hildenbrandia rivularis</i> (Liebmann) Agardh 1852																Ros, López Jiménez & Aboal, 1997 Cantoral and Aboal, 2001 Sabater et al., 1989 Margalef, 1956

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAL	JUC	SEG	MA	VA	Reference
			•								•						Tomas, Cambra, & Sabater, 1987
			•								•						Margalef, 1950a
																	Sherwood & Sheath, 2000
	<i>Audouinella hermannii</i> (Roth) Duby 1830			•													López-Rodríguez, Penalta-Rodríguez, 2004
	(= <i>A. violacea</i> (Kützinger) Hamel 1924)													•			Aboal, Prefasi and Asencio, 1996
																	Aboal, 1989a
																	Sabater, Aboal and Cambra, 1989
																	Sabater, Aboal and Cambra, 1989
									○								Póvoa dos Reis, 1963
																	Margalef, 1956
	<i>Audouinella chalybea</i> (Roth) Bory															○	Gonzalez Guerrero, 1950, 1945
	(= <i>Chantransia chalybea</i> Fries 1825)										○						Margalef, 1950b
	(= <i>Pseudochantransia chalybea</i> (Roth) Brand 1909)										•						Margalef, 1946
																	Margalef, 1953
	<i>Audouinella pygmaea</i> (Kützinger)																Aboal, Llimona, 1984a
	Weber-Van Bosse 1921																Sabater, Aboal and Cambra, 1989
	(= <i>A. chalybea</i> var. <i>leiblenii</i> (Kützinger) Margalef 1955)																Aboal, 1989a
	<i>Batbania investiens</i> (Lenormand ex Kützinger) Sirodot 1876																Póvoa dos Reis, 1969
	<i>Batrachospermum arcuatum</i> Kylin 1912																Póvoa dos Reis, 1958
																	Póvoa dos Reis, 1973



Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAL	JUC	SEG	MA	VA	Reference
	<i>Batrachospermum atrum</i> (Hudson) Harvey 1841 (= <i>B. gallaei</i> Sirodot 1884)												•	•			Marco and Aboal, 2008 Aboal, López-Jiménez and Asensio, 1995 Reis, 1967
	* <i>Batrachospermum azeredoi</i> Reis 1967		○						○								Póvoa dos Reis, 1958 González Guerrero, 1949
	* <i>Batrachospermum azeredoi</i> f. <i>cylindroideum</i> Reis 1972								•								Reis, 1967
	* <i>Batrachospermum azeredoi</i> f. <i>elongatum</i> Reis 1969								•								Reis, 1972
	* <i>Batrachospermum azeredoi</i> f. <i>fusoideum</i> Reis 1972								•								Póvoa dos Reis, 1969
	* <i>Batrachospermum azeredoi</i> f. <i>ovoidum</i> Reis 1972								•								Reis, 1972a
	<i>Batrachospermum boryanum</i> Sirodot 1884 (= <i>B. ectocarpoideum</i> Skuja ex L.H.Flint 1949)												•				Reis, 1972a
	<i>Batrachospermum confusum</i> (Bory de Saint Vincent) Hassall 1845 (= <i>B. f. spermatioглоberatum</i> Reis 1962; <i>B. helminthosum</i> Sirodot 1884)												•				Prefasi and Aboal, 1994 Cantoral and Aboal, 2001
	<i>Batrachospermum confusum</i> f. <i>anatinum</i> (Sirodot) Stewart et Vis 2007 (= <i>B. anatinum</i> Sirodot 1884)								○				•				Prefasi and Aboal, 1994 Póvoa dos Reis, 1958 Póvoa dos Reis, 1958 Póvoa dos Reis, 1969
								○									Póvoa dos Reis, 1958 Póvoa dos Reis, 1969
								○									Póvoa dos Reis, 1958 Reis, 1967

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAJ	JUC	SEG	MA	VA	Reference
	<i>Batrachospermum corbula</i> Sirodot 1884		•						•								Póvoa dos Reis, 1958
	<i>Batrachospermum dillenii</i> Bory																González Guerrero, 1949
	<i>Batrachospermum ectocarpum</i> Sirodot 1884		•						•								Póvoa dos Reis, 1958
	* <i>Batrachospermum ferrii</i> Reis 1967											•					Reis, 1967
	<i>Batrachospermum gelatinosum</i> (Linnaeus) De Candolle 1801											•					López Rodríguez and Penalta Rodríguez, 2004
	(= <i>B. arcuatoideum</i> Reis 1973)		•									•					Carmona et al., 2011
	(= <i>B. crouanianum</i> Sirodot 1884)												•				Marco and Aboal, 2008
	(= <i>B. corbula</i> Sirodot var. <i>alcoense</i> Reis 1954)																Aboal and Limona, 1984
	(= <i>B. densum</i> Sirodot 1884)													○			Sabater et al., 1989
	(= <i>B. monitiforme</i> Roth 1800)												○				Clemente and Rubio, 1864
	(= <i>B. radians</i> Sirodot 1884)												○				Aboal, 1989a
	(= <i>B. pyramidale</i> Sirodot 1884)												○				Prefasi and Aboal, 1994
																	Busquets, Picado and Hernández Maríné, 1985
													○				Prefasi and Aboal, 1994
																	Caballero, 1929
																	Reis, 1958
									○								Póvoa dos Reis, 1969
																	Póvoa dos Reis, 1958
													○				González, Guerrero, 1945
																	Póvoa dos Reis, 1963
	* <i>Batrachospermum gibbosum</i> Reis 1969																Póvoa dos Reis, 1969
	* <i>Batrachospermum gulbenkianum</i> Reis 1965																Póvoa dos Reis, 1969
																	Reis 1965b

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAJ	JUC	SEG	MA	AA	Reference
	<i>Batrachospermum helminthosum</i> Bory de Saint-Vincent 1808 (= <i>B. testale</i> Sirodot 1884)										o						Margalef, 1946
	* <i>Batrachospermum helminthosum</i> f. <i>ambiguum</i> Reis 1972											•					Reis, 1972a
	* <i>Batrachospermum helminthosum</i> f. <i>clavaeforme</i> Reis 1972											•					Reis, 1972a
	* <i>Batrachospermum helminthosum</i> f. <i>clavoideum</i> Reis 1972											•					Reis, 1972a
	* <i>Batrachospermum helminthosum</i> var. <i>heteromorphum</i> Reis 1972								•			•					Reis, 1972a
	* <i>Batrachospermum henriquesianum</i> Reis 1972											•					Reis, 1972
	<i>Batrachospermum ludibondum</i> Bory de Saint-Vincent 1808								o								Póvoa dos Reis, 1973
	(= <i>B. stagnale</i> Bory 1808)																
	* <i>Batrachospermum luisitanicum</i> Reis 1969								•			•					Póvoa dos Reis, 1969 Reis, 1967
	<i>Batrachospermum moniliforme</i> Roth f. <i>densum</i> (Sirodot) Israelson 1942								•								Póvoa dos Reis, 1958
	<i>Batrachospermum moniliforme</i> Roth var. <i>decaisnearum</i> (Sirodot) Reis								•			•					Póvoa dos Reis, 1969
	* <i>Batrachospermum pseudocarpum</i> Reis 1973								•								Póvoa dos Reis, 1973
	<i>Batrachospermum stagnale</i> Bory																Póvoa dos Reis, 1973
	<i>Batrachospermum vagum</i> (Roth) Agardh 1824								•			•					Póvoa dos Reis, 1958
	* <i>Lemanea dichotoma</i> (De Candolle) De Toni var. <i>annuloidis</i> (Sirodot) Reis 1961											•					Caballero, 1929
												•					Póvoa dos Reis, 1965

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAF	JUC	SEG	MA	AA	Reference
	<i>Lemanea dichotoma</i> (De Candolle) De Toni var. <i>dichotoma</i> (Sirodot) Reis 1961											•					Reis, 1965
	<i>Lemanea dichotoma</i> (De Candolle) De Toni var. <i>viviana</i> (Sirodot) Reis 1961							•				•					Póvoa dos Reis, 1965
	(= <i>Lemanea catenata</i> Kützting f. <i>incurvata</i> (Bory de Saint-Vincent) Sirodot 1872)								•			•					Póvoa dos Reis, 1965
	<i>Lemanea ciliata</i> (Sirodot) De Toni 1867											•	•				Póvoa dos Reis, 1965
	<i>Lemanea condensata</i> Israelson 1942								•								Lopez Rodriguez, Penalta Rodriguez, 2004
	<i>Lemanea fluviatilis</i> (Linnaeus) Agardh 1811			•													Caballero, 1929
																	Carmona et al., 2011
																	Margalef, 1956
																	Tomas, Cambra, Sabater, 1987
																	Sabater, Aboal and Cambra, 1989
	* <i>Lemanea fluviatilis</i> (Linnaeus) Agardh var. <i>constricta</i> Reis 1961																Póvoa dos Reis, 1965
	<i>Lemanea fucina</i> Bory de Saint-Vincent 1808								•								Póvoa dos Reis, 1965
	<i>Lemanea hispanica</i> Budde 1929																Budde, 1929
	* <i>Lemanea lusitanica</i> Reis 1962																Reis, 1962
	* <i>Lemanea prolifera</i> Reis 1963																Póvoa dos Reis, 1963
	<i>Lemanea rigida</i> (Sirodot) De Toni 1897																Póvoa dos Reis, 1965

Class	Specie	PVAS	CAN	M-S	BAL	GAL	GDN	GUA	DUE	EBR	ICAT	TAL	JUC	SEG	MA	VA	Reference
	<i>Lemanea sudetica</i> Kützing 1845											●					Póvoa dos Reis, 1965
	<i>Paralemanea annulata</i> (Kützing) Vis et Sheath 1992							●	●			●					Póvoa dos Reis, 1963
	(= <i>Lemanea annulata</i> Kützing 1845)											●					Póvoa dos Reis, 1963
	<i>Paralemanea catenata</i> (Kützing) Vis et Sheath 1992							●				●					Póvoa dos Reis, 1965
	(= <i>Lemanea catenata</i> Kützing 1845)											○					Carmona et al., 2011
	<i>Lemanea nodosa</i> Kützing 1867								○			○					Reis, 1963
	<i>Paralemanea torulosa</i> (Roth) Sheath et Sherwood 2002										○						Reis, 1965
	(= <i>Lemanea torulosa</i> (Roth) C. Agardh 1814)										○						Sabater, Aboal and Cambra, 1989
	<i>Polysiphonia subtilissima</i> Montagne 1840			○													Margalef, 1956
	<i>Thorea hispida</i> (Thore) Desvaux 1818								○								Margalef, 1948
	(= <i>T. ramosissima</i> Bory de Saint-Vincent 1808)												●				Póvoa dos Reis, 1965
	<i>Thorea violacea</i> Bory de Saint-Vincent 1808												○				Cantoral and Aboal, 2001
													○				2001
													○				Egidios and Aboal, 2003
													○				Egidios and Aboal, 2003
												○					Caballero, 1929
													○				Tomás, 1981
													○				Cantoral and Aboal, 2001
													○				Sabater, Aboal and Cambra, 1989
													●				Egidios and Aboal, 2003
													●				Cantoral and Aboal, 2001

The genera most often cited in Portuguese and Spanish papers are *Batrachospermum*, with 29 taxa, and *Lemanea*, with 14 taxa. In fact, *Batrachospermum gelatinosum*, *Compsopogon coeruleus* and *Lemanea fluviatilis* are the most frequently cited species for the Ibero-Balearic region, with 17, 9, and 8 entries in the literature respectively. These results match those from detailed studies of red algae undertaken in other countries such as Finland and Sweden, where *B. gelatinosum* (L.) De Candolle and *L. fluviatilis* (L.) C.Agardh also appear among the most cited species (Eloranta & Kwandrans 1996, 2002, 2007).

The geographical distribution of the citations in the hydrographic basins of the Iberian Peninsula and Balearic Islands is shown in Figure 1. Despite the heterogeneity found, it is estimated that because of their wide distribution red algae are present in 50 - 95% of rivers in temperate zones (Sheath 1984b). This matches our results since the presence of this group of red algae has been confirmed throughout most of the Ibero-Balearic region. The basins of the rivers Tajo and Duero contain the largest numbers of *Rhodophyceae* cited, accounting for 24% and 21% of the total respectively. The other basins contain between 1% and 15% of the taxa cited in the literature. There is scarce information about red algae in the Guadalquivir, Mediterranean-Andalusian, Atlantic-Andalusian, Cantabrian, and Basque Country basins. Although this may well be due to natural causes, it is believed that data for the Iberian region is incomplete since there are no studies encompassing the whole of the region, nor regional studies on *Rhodophyta* in these less well studied areas. Once again emphasis is laid on the need to undertake work on the flora of Iberian red algae, particularly with regard to the study of geographical areas, about which there is little phycological knowledge.

A comparison of the number of red-algal flora present in each country is shown to try to understand the biodiversity of the red algae in the Ibero-Balearic region within a European context (Fig. 2).

## Conclusions

A check-list provides a starting point for the study of any given taxonomic group. In this case the list of red algae compiled will be useful for future studies on the taxonomy, ecology and geographical distribution of the species because of the future possible research lines it opens up. The importance of the catalogue stems from the thorough search of the literature undertaken to bring together all the citations of red algae for the Ibero-Balearic region, from the first one in 1841 to the present day.

Although there are plentiful data concerning continental red-algal flora, this work underlines the need for a comprehensive review of the material kept at herbaria to provide a guide for collecting fresh material from the whole Iberian region, especially from zones about which little information is available, and also the need for a detailed study of this region from a taxonomic standpoint. Furthermore, it is necessary to review the information on new species cited by Reis – highlighted in this work – to establish their taxonomic identity. This work was started by Vis et al. (1985) but a more comprehensive study is required. As regards the European level, it is important

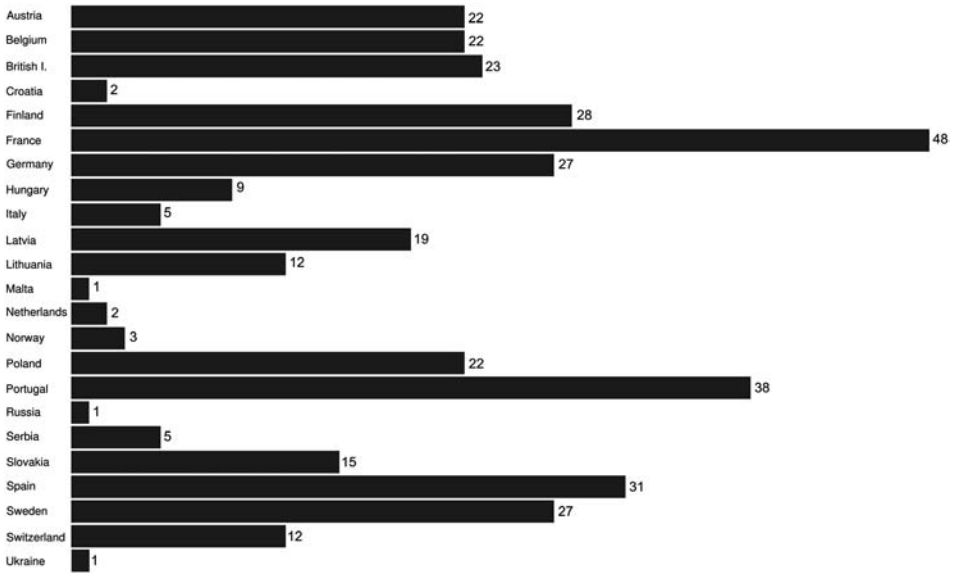


Fig. 2. Number of freshwater red algal taxa recorded in European countries. (Modified from Kwadrans & Eloranta 2010).

to undertake studies focusing on the diversity of red algae, particularly in the southern regions of the continent, about which information is more limited.

According to the results of our study, the Ibero-Balearic region appears to be very rich in continental red algae. This might well be due to its geographical location, which could act as a refuge and transit zone between the boreal taxa of Northern and Central Europe and those from the warm tropical regions of Africa.

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