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**Taxonomic biodiversity of geniculate coralline red algae (Corallinales, Rhodophyta) from the Macaronesian region: summary and analysis**

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**Abstract**

A catalogue and critical review of species and infraspecific taxa of non-fossil geniculate coralline red algae (Corallinales, Rhodophyta) previously reported from the Macaronesian region are presented along with an assessment of species diversity in the region. Published records of geniculate coralline algae are included along with comments relating to type material. Within the catalogue, taxa are organized alphabetically by genus and within this by final epithet. From the 31 taxa recorded, 4 are based on type collections from Macaronesian localities. The types of most species and infraspecific taxa reported from the region have yet to be re-examined in a modern context, and most Macaronesian records require verification. The biodiversity of Macaronesian geniculate coralline algae may be lower than current information indicates.

**Keywords** analysis, baseline, Corallinales, geniculate, Macaronesia, taxonomy

## Introduction

The Macaronesian region *sensu lacto* includes the Azores, Madeira and Salvage Islands (Portugal), the Canaries (Spain) and Cape Verde Islands (Fig. 1). The first studies of (non-fossil) coralline geniculate red algae (Corallinales, Rhodophyta) in this region go back to the beginning of the XIX century with the paper of Lamarck (1815: 233, 237), who described *Corallina millegrana* and *Corallina purpurata* for the Canary Islands.

An important contribution to the knowledge of Macaronesian Corallinales, with an extensive collection for the region, was done by the Dutch oceanographic expeditions CANCAP, in the 1970s and 1980s, with material collected in the Azores, Madeira, Salvage, the Canaries and Cape Verde Islands (Prud'homme van Reine 1988).

Historical revisions of phycological studies including the coralline algae are those by Neto (1994) for the Azores, Levring (1974) and Neto et al. (2001) for Madeira, Afonso-Carrillo (1988) and Haroun et al. (2002) for the Canary Islands and Prud'homme van Reine (1988) for Cape Verde Islands. The accounts of the coralline algae published by Price et al. (1986, 1992) include information on Macaronesian material but only for Cape Verde and the Canary Islands. The work of John et al. (2004) also included data from Madeira but the Azores were not considered in any of these publications.

Currently there are 31 names of geniculate coralline seaweeds reported for the Macaronesian region but there is no published information compiling the data from the various archipelagos. Information is also lacking

on basionym, type material locality, localization, and illustrations, current nomenclatural situation and taxonomic status.

The present study provides a baseline summary and analysis of existing taxonomic information on the geniculate Corallinales for the Macaronesian region *sensu lacto*, along with comments and/or nomenclatural notes as required.

**Arrangement of the Catalogue**

The species records were compiled from identification keys, floristic studies, checklists and published catalogues. Unpublished theses and reports were not considered because some involved names that are not effectively published in the context of the International Code of Botanical Nomenclature (ICBN, McNeill et al. 2006).

The type material of a number of taxa of geniculate Corallinales reported from the Macaronesian region has not been studied in the modern context of taxonomy, meaning that the descriptions are incomplete and factually inaccurate, include criteria that are unreliable and are not based on original research encompassing specific morphological, anatomical and ultrastructural investigations. The presence or absence of genicula in those taxa has been inferred from the genus in which the taxon was placed originally. Thus, taxa whose types have not been studied in a modern context but that originally were described as species or infraspecific taxa of *Amphiroa* J. V. Lamouroux, *Cheilosporum* (Decaisne) Zanardini, *Corallina* Linnaeus, *Haliptilon* (Decaisne) Lindley and *Jania* J. V. Lamouroux are presumed to possess genicula.

Taxa are listed in alphabetical order by the currently accepted name for the genera and constitutent species. For each taxon, the following information is provided: basionym, type material localization, type locality, published illustrations of type material, reference to its study in a modern context and current placement/name. Table 1 summarizes this information. Published records for the Macaronesian region are also provided, following a north-south latitudinal order: Azores, Madeira, Salvage Islands, Canary Islands and Cape Verde Islands. For each archipelago, homotypic synonyms are arranged in chronological order, with author citations and publications details provided for each.

In the case of taxa for which the type material is not known, or when known, was not revised, nor were the specimens studied in the modern context of taxonomy the status and/or disposition of the taxa is reported as

uncertain. Family names of authors are written out in full and Herbarium abbreviations follow Holmgren and Holmgren (1998).

## Catalogue

### *Amphiroa*

Currently the genus *Amphiroa* is recognized as one of six genera in the Corallinaceae, subfamily Lithophylloideae (Bailey 1999, table 4, p. 214). Presently its generic concept is consensual and a detailed diagnosis is provided by Womersley and Johansen (1996: 283-284) and Harvey et al. (2009: 259; table 1, p. 260). The relationship between *Amphiroa* and other Lithophylloideae genera is provided in Woelkerling et al. (2002, table 2, p. 370; table 3, p. 372). The work by Afonso-Carrillo and Sansón (1999: 33-34) provides a key for species diagnosis in the Canaries.

### *Amphiroa beauvoisii* J. V. Lamouroux

*Basionym*: *Amphiroa beauvoisii* J. V. Lamouroux 1816: 299-300. *Holotype*: CN (Norris and Johansen 1981: 6); illustrations: Norris and Johansen (1981, fig. 7b, p.6) and Harvey et al. (2009, figs 18-21, p. 270; figs 22-23, p.271). *Type locality*: Portugal coasts (Lamouroux 1816: 299).

*Current placement/name*: *A. beauvoisii* J. V. Lamouroux according to Norris and Johansen (1981: 6) and Harvey et al. (2009: 268-273) based on the study of the holotype.

*Published records*:

AZORES: Gain (1914: 22), Schmidt (1931: 67), Feldmann (1946: 421), Ardré (1970: 224), Cordeiro-Marino (1978: 46), South and Tittley (1986: 42), Reyes and Sansón (1991: 74), Schneider and Searles (1991: 226), Neto (1994: 25), Prud'homme van Reine et al. (1994: 70), Tittley and Neto (1994: 7), Cremades et al. (1997: 13), and Rosas-Alquicira and Neto (pers. obs.).

MADEIRA: Levring (1974: 68), Augier (1985: 101) and John et al. (2004: 58).

SALVAGE ISLANDS: John et al. (2004: 58).

CANARY ISLANDS: Afonso-Carrillo et al. (1984: 30), Price et al. (1986: 10), Gil-Rodríguez et al. (1987: 146; 2003: 25), Viera-Rodríguez (1987: 241), Afonso-Carrillo and Sansón (1989: 26; 1999: 195), Guadalupe et al. (1995: 37), Haroun et al. (2002: 146), Sangil et al. (2003a: 87; 2004: 89) and Muñoz et al. (2007: 107).

### *Amphiroa cryptarthrodia* Zanardini

*Basionym*: *Corallina verrucosa* Zanardini 1840: 136. *Neotype*: MCVE unnumbered, Zanardini's original collection nr. 14 (Rosas-Alquicira et al. In press); illustrations: Hamel and Lemoine (1953, pl. 5, p. 43) and Rosas-Alquicira et al. (In press, figs 1, 4-20) as *Amphiroa verruculosa* Kützing; Rosas-Alquicira et al. (In press, figs 27-36) as *Amphiroa cryptarthrodia* Zanardini. *Syntype localities*: Trieste and Dalmazia, Adriatic Sea (Rosas-Alquicira et al. In press).

*Current placement/name*: *A. cryptarthrodia* Zanardini according to Rosas-Alquicira et al. (In press) based on the study of neotype material. Afonso-Carrillo et al. (1983: 46) cited the presence of *A. cryptathrodia* at the Canaries as dubious.

*Published records*:

AZORES: Schmidt (1931: 67), Audiffred and Weisscher (1984: 17), South and Tittley (1986: 42), Neto (1994: 25), Tittley and Neto (1994: 7) and Rosas-Alquicira and Neto (pers. obs.).

MADEIRA: Levring (1974: 68), Audiffred and Weisscher (1984: 17, 33) and John et al. (2004: 58).

SALVAGE ISLANDS: Audiffred and Weisscher (1984: 17,33), Price et al. (1986: 11) and John et al. (2004: 58).

CANARY ISLANDS: Lemoine (1929: 71), Gil-Rodríguez and Afonso-Carrillo (1980: 35), Price et al. (1986: 11) and John et al. (2004: 58).

***Amphiroa exilis* Harvey**

*Basionym*: *Amphiroa exilis* Harvey 1849: 95. *Syntypes*: TCD specimens Darwin 595 (with annotation Det. H.W. Johansen Sept 1967) and Darwin 629 (two specimens), BM Darwin 595 (one sheet with the stamp of Hookerianum Herbarium 1867 and the annotation *A. exilis*) and Darwin 629 (with the annotation *A. exilis*); illustrations: Porter (1987, BM Darwin 595, fig. 1, p. 188; BM Darwin 629, fig. 2, p. 189). *Type locality*: Botofogo Bay, Rio de Janeiro, Brazil (Porter 1987: 188-189); Algoa Bay, Cape Province, South Africa (Silva et al. 1996: 220).

*Current placement/name*: *A. beauvoisii* J. V. Lamouroux but status and disposition uncertain as the type was not studied in a modern context. Yendo (1905: 4) based on Madam Weber-van Bosse observations (1904: 100) of Harvey's plants (*A. exilis* presumed type material) proposed *A. exilis* as a heterotypic synonym of *A. beauvoisii*. The synonym *A. beauvoisii* was accepted by Prud'Homme van Reine (1994: 70) based on the concept of Price et al. (1986) for the Azorean material of *A. exilis* which had been collected and identified by Piccone (1889). In contrast to Prud'homme van Reine et al. (1994), we think the name *A. exilis* should be kept until more comparisons and study of type material have been conducted.

*Published records*:

AZORES: Agardh (1870: 363), Piccone (1889: 209) and Tittley et al. (1998: 467).

***Amphiroa fragilissima* (Linnaeus) J. V. Lamouroux**

*Basionym*: *Corallina fragilissima* Linnaeus 1758: 806. *Holotype*: LINN (Yoshida 1998: 533); illustrations: Lamouroux (1821, tab. 21, fig. d) and Weber-van Bosse (1904, fig. 19, pl. XVI) as *Amphiroa fragilissima* (Linnaeus) J. V. Lamouroux. *Type locality*: Jamaica (Silva et al. 1996: 223).

*Current placement/name*: *A. fragilissima* (Linnaeus) J. V. Lamouroux according to Weber-van Bosse (1904: 90-91) based on the study of type material.

*Published records*:

AZORES:

*Amphiroa fragilissima* (Linnaeus) J. V. Lamouroux. South and Tittley (1986: 42), Prud'homme van Reine (1988: 179), Neto (1994: 25) and Rosas-Alquicira and Neto (pers. obs.).

MADEIRA:

*Amphiroa fragilissima* (Linnaeus) J. V. Lamouroux. Levring (1974: 69).

*Amphiroa? fragilissima* (Linné) J. V. Lamouroux. Neto et al. (2001: 403).

*Amphiroa fragilissima.* Grunow (1868: 79).

CANARY ISLANDS:

*Amphiroa fragilissima* J. V. Lamouroux. Afonso-Carrillo et al. (1983: 30), Prud'homme van Reine et al. (1994: 70), Haroun et al. (2002: 146).

*Amphiroa fragilissima* (Linnaeus) J. V. Lamouroux. Afonso-Carrillo (1980b: 54), Afonso-Carrillo et al. (1984: 32), Price et al. (1986: 73), Afonso-Carrillo (1986: 190), González et al. (1986: 315), Viera-Rodríguez (1987: 242), Reyes and Sansón (1991: 74), Elejabeitia et al. (1992: 3), Pinedo et al. (1992: 32), Guadalupe et al. (1995: 37), Afonso-Carrillo and Sansón (1999: 195), Gil-Rodríguez et al. (2003: 25), Montañés et al. (2003: 124) and Sangil et al. (2003a: 87; 2004: 89; 2003b: 310).

*Amphiroa fragilissima*. Jorge et al. (1984: 118) and Afonso-Carrillo and Sansón (1989: 26).

CAPE VERDE ISLANDS:

*Amphiroa fragilissima* J. V. Lamouroux. Price et al. (1986: 73).

*Amphiroa fragilissima* (Linnaeus) J. V. Lamouroux. Price et al. (1986: 73) and Otero-Schmitt and Sanjuan (1992: 382).

***Amphiora rigida* J. V. Lamouroux**

*Basionym*: *Amphiroa rigida* J. V. Lamouroux 1816: 297. *Holotype*: CN (Norris and Johansen 1981: 20); illustrations: Lamouroux (1816, pl. 11, fig. 1, p. 297); Cremades et al. (1997, PC, fig. C, p. 16). *Type locality*: Mediterranean (Lamouroux 1816: 297).

*Current placement/name*: *A. rigida* J. V. Lamouroux according to Norris and Johansen (1981: 21) based on study of holotype material. The presence of this species in the Canary Islands was confirmed by Haroun et al. (2002: 139) but authors did not mentioned if they saw the material. This species is closely related to *A. cryptarthrodia* Zanardini, and it is likely that the reports of *A. rigida* in the Azores correspond to misdeterminations of *A. cryptarthrodia* (Rosas-Alquicira and Neto, pers. obs.).

*Published records*:

AZORES: Piccone (1889: 208), South and Tittley (1986: 42), Neto (1994: 25) and Tittley et al. (1998: 467).

*Amphiroa* cf. *rigida* J.V. Lamouroux. Tittley and Neto (1994: 7).

MADEIRA: Levring (1974: 68) and John et al. (2004: 59).

CANARY ISLANDS: Price et al. (1986: 12), Guadalupe et al. (1995: 37), Gil-Rodríguez et al. (2003: 25) and John et al. (2004: 59).

*Amphiroa rigida*. Afonso-Carrillo and Sansón (1989: 26).

CAPE VERDE ISLANDS: John et al. (2004: 59).

***Amphiroa verruculosa* Kützing**

*Basionym*: *Amphiroa verrucosa* Kützing 1841:18. *Holotype*: L 0055675; illustrations: Kützing (1849, pl. 79, fig. III, p. 700) and Rosas-Alquicira et al. (In press, figs 27-36) as *Amphiroa verruculosa*. *Type locality*: Adriatic Sea (Kützing 1849: 700).

*Current placement/name*: *A. cryptarthrodia* Zanardini according to Rosas-Alquicira et al. (In press) based on the study of neotype material. Neto et al. (2001: 412) cited a doubtful record of *A. verruculosa* from the Archipelago of Madeira.

*Published records*.

MADEIRA: Feldmann (1946: 425) and Neto et al. (2001: 412).

***Cheilosporum***

The genera *Cheilosporum*, *Haliptilon* and *Jania* were grouped into the Janieae tribe, subfamily Corallinoideae, based on the combination of the following features: i) presence of a thick carposporophytic fusion cell; ii)

gonimoblastic filaments arising from fusion cell margins; iii) male conceptacles chambers narrow with a short canal and iv) few tetrasporangia per conceptacle (Johansen and Silva 1978: 413; table 1, p. 414). According to these authors, *Cheilosporum* distinguishes from other Janieae genera by possessing a marginal rather than axial location of conceptacles and the presence of pronounced intergenicular lobes. A complete diagnosis of the genus was provided by Johansen (1981, appendix 1, p. 216). Womersley and Johansen (1996: 296) included a key for the Janieae genera in their book for Southern Australia where they mentioned as segregating generic characters, the branching pattern of the main axes, the intergenicular shape and the conceptacles position. Kim et al. (2007), based on combined molecular (SSU rDNA) and anatomical data (table 1, p. 1313), determined that these characters were not useful to separate the three genera. They concluded that the Janieae should be merged only into the single genus *Jania* recognized by the generic characters previously listed by Johansen and Silva (1978: 413; table 1, p. 414). This conclusion was followed by Woelkerling et al. (2008). Walker et al. (2009), based on cox1 and 18S rRNA analysis of *Haliptilon squamatum* and *Jania rubens*, also concluded they were not distinct but suggested that the clarification of the phylogenetic position of *Haliptilon* and *Jania* required more comparisons and study of original material of the genera involved. We share the opinion of Walker et al. (2009), a reason why in the present catalogue, the genera and species of *Cheilosporum*, *Haliptilon* and *Jania* are treated separately.

***Cheilosporum elegans* J. E. Areschoug**

*Basionym*: *Amphiroa elegans* J. D. Hooker & Harvey 1849: 101. *Type*: TCD Colenso specimen 630; illustrations: Harvey (1849, pl. 38 lower left, p. 101). *Type locality*: New Zealand (Woelkerling and Nelson 2004: 54).

*Current placement/name*: *Cheilosporum elegans* J. E. Areschoug but status and disposition of species uncertain as the type was not studied in a modern context (Woelkerling and Nelson 2004: 55). This conclusion was based on specimens originally described by Hooker and Harvey (in Harvey, 1849: 101) under the name *Amphiroa elegans*, an illegitimate name (ICBN Art. 53.1) since it is a later homonym of *Amphiroa elegans* Sonder (1845: 55), now considered a heterotypic synonym of *Metagoniolithon stelliferum* (Lamarck) Ducker (Silva et al. 1996: 260). Womersley and Johansen (1996: 315, 317) mentioned *C. elegans* J. E. Areschoug and also *Amphiroa elegans* J. D. Hooker & Harvey in Harvey, *nom. illeg.* as heterotypic synonyms of *Cheilosporum sagittatum* (Lamouroux) J. E. Areschoug. A similar suggestion was made by Moura and Guimarães (2002: 69) for *C. elegans* (J. D. Hooker & Harvey in Harvey) Areschoug. These suggestions, however, were made without reviewing type material. Later, Kim et al. (2007) based on molecular and reproductive features proposed to

merge material of *Cheilosporum* and *Haliptilon* within *Jania* genus and suggested the new combination *Jania cultrata* (Harvey) J. H. Kim, Guiry & H.-G. Choi comb. nov. This conclusion, however, was not based on type material observations.

*Published records*:

CAPE VERDE ISLANDS:

*Cheilosporum elegans* (J. D. Hooker & Harvey) J. E. Areschoug. Askenasy (1896: 26) and Price et al. (1986: 65).

*Cheilosporum elegans* Harvey. Price et al. (1986: 65).

***Corallina***

Currently the genus *Corallina* is recognized to belong to the Corallinaceae, subfamily Corallinoideae (Johansen 1981, table 9, p. 188; Harvey et al. 2003, table 4, p. 995). Its generic concept is consensual. The main characteristics are listed in Johansen (1981: 217), and a detailed diagnosis is provided by Womersley and Johansen (1996: 289-290). The relationship between *Corallina* and other Corallinoideae genera is provided by Woelkerling et al. (2008, table 4, p. 282; table 5, p. 287).

***Corallina deshayesii* Montagne**

*Basionym*: *Corallina deshayesii* Montagne 1846: 130. *Type*: not found; illustrations: not found. *Type locality*: not found.

*Current placement/name*: *C. deshayesii* Montagne but status and disposition uncertain as the type was not studied in a modern context. Price et al. (1986: 73) mentioned that *C. deshayesii* may well be a synonym of *Corallina mediterranea* J. E. Areschoug. The designation/localization of the type material and its study in a modern context is required.

*Published records*:

SALVAGE ISLANDS: Price et al. (1986: 73).

***Corallina elongata* J. Ellis & Solander**

*Basionym*: *Corallina elongata* J. Ellis & Solander 1786: 119. *Lectotype*: Ellis's illustrations designated by Irvine and Johansen (1994: 41); illustrations: Ellis (1755, pl. 24, fig. 3, p.49). *Type locality*: Cornwall, England (Irvine and Johansen 1994: 41).

*Current placement/name*: *C. elongata* J. Ellis & Solander according to Irvine and Johansen (1994: 41) based on the study of lectotype material. Walker et al. (2009) in their integrative taxonomic approach including phylogenetic reconstructions based on the cox1 and 18S rRNA genes in addition to a comparative morphological assessment study identified three clusters. *C. officinalis sensu stricto* and *C. elongata* from Britain corresponded to similar groups in the cox1 tree whereas the sequences of the unidentified *Corallina* specimens from Madeira and Tenerife clustered with sequences of *C. caespitosa* R. H. Walker, J. Brodie & L. M. Irvine and *C. elongata* from other locations. The results indicate that the name *C. elongata* has been misapplied in both the Atlantic and Mediterranean. While the concept of the species is not disputed for those samples from Britain and Ireland, the samples from Greece are *C. caespitosa*, and those from elsewhere in the Atlantic are of an unknown species and should be re-evaluated. Higher divergences as observed in the sequences identified to the genus from Tenerife and Madeira in the cox1 gene can be interpreted as the result of geographical isolation and gene pool fragmentation (Hebert et al. 2003). These islands are geographically isolated in the Atlantic but it is not known if the populations interbreed with populations from elsewhere in the Atlantic and Mediterranean. For the relationship between *C. elongata* and *C. mediterranea* J. E. Areschoug see *C. mediterranea* entry.

*Published records*:

AZORES: Castro and Viegas (1983: 20), South and Tittley (1986: 42), Tittley and Neto (1994: 8), Toste et al. (2003: 1270) and Wallenstein and Neto (2006: 199).

*Corallina elongata* Johnst. Castro and Viegas (1987: 63).

*Corallina elongata*. Neto (1994: 26, 2000a: 139, 2000b: 490) and Prud'homme van Reine et al. (1994: 81) and Tittley and Neto (2000: 20).

MADEIRA: Audiffred and Prud'homme van Reine (1985: 38) and John et al. (2004: 73).

*Corallina elongata*. Prud'homme van Reine et al. (1994: 81).

SALVAGE ISLANDS: Price et al. (1986: 73), Prud'homme van Reine et al. (1994: 81) and John et al. (2004: 73).

CANARY ISLANDS: Price et al. (1986: 73), Viera-Rodríguez and Wildpret de la Torre (1986: 215), González et al. (1986: 316), Viera-Rodríguez (1987: 242), Viera-Rodríguez et al. (1987: 273), Reyes and Sansón (1991: 79), Ballesteros et al. (1992: 516), Pinedo et al. (1992: 36), Kristiansen et al. (1993: 95), Irvine and Johansen (1994: 42), Prud'homme van Reine et al. (1994: 81), Guadalupe et al. (1995: 37), Rojas-González and Afonso-Carrillo (2000: 129; 2004: 138), Gil-Rodríguez et al. (2003: 25), Haroun et al. (2003: 108), Montañés et al. (2003: 124), Sangil et al. (2003a: 94 103 , 2003b: 311 , 2004: 89, 2005: 326), Afonso-

Carrillo and Sobrino (2004: 149), John et al. (2004: 73), Muñoz et al. (2007: 107) and Afonso-Carrillo et al. (2009: 238).

*Corallina elongata*. Afonso-Carrillo (1980a: 7, 1980b: 54), Delgado et al. (1984: 105), Haroun et al. (1984: 111), Jorge et al. (1984: 118), Afonso-Carrillo and Sansón (1989: 25), Gil-Rodríguez et al. (1992: 101), Hardisson et al. (1998: 945-950) and Tuya and Haroun (2006: 17).

***Corallina granifera* J. Ellis & Solander**

*Basionym* : *Corallina granifera* J. Ellis & Solander 1786: 120. *Type*: whereabouts uncertain (Woelkerling and Nelson 2004 : 56); illustrations: Ellis and Solander (1786, tab. 21, fig. c.C., p.120). *Type locality*: Mediterranean coasts of Africa (Lamouroux 1816: 288).

*Current placement/name*: *C. granifera* J. Ellis & Solander but status and disposition uncertain as the type was not studied in a modern context. Ardissone (1883: 465) and Yendo (1905: 30) cited *C. granifera* as a synonym of *Corallina virgata* Zanardini but no revision of type material was made. The designation/localization of the type material and its study in a modern context is required.

*Published records*:

AZORES: Gain (1914: 22), Lemoine (1924 :130), Schmidt (1929b: 172, 1931: 65), Feldmann (1946: 421), Weisscher (1982: 31, 1983: 63) and Audiffred and Weisscher (1984: 20).

*Corallina granifera*. Chapman (1955: 801) and Audiffred and Prud'homme van Reine (1985: 38).

CANARY ISLANDS: Price et al (1986: 74) and González et al. (1986: 316).

*Corallina granifera*. Afonso-Carrillo (1980b: 54), Delgado et al. (1984: 105) and Price et al. (1986: 74).

*Corallina granifera* J. Ellis & Solander?. Ardré (1970: 228).

*Jania granifera* Decaisne. Vickers (1896: 306) and Price et al. (1986: 74).

MADEIRA: Lemoine (1924: 130), Børgesen (1929: 70), Schmidt (1931: 101), Seoane-Camba (1965: 110), Weisscher (1982: 31, 1983: 63), Audiffred and Weisscher (1984: 20, 33) and Audiffred and Prud'homme van Reine (1985: 38).

*Corallina granifera* J. Ellis & Solander?. Ardré (1970: 228).

*Jania granifera* Decaisne. Gain (1914: 7) and Neto et al. (2001: 403).

SALVAGE ISLANDS: Price et al. (1986: 74).

CAPE VERDE ISLANDS: Weisscher (1982: 31) and Price et al. (1986: 74).

***Corallina lobata* J. V. Lamouroux**

*Basionym*: *Corallina lobata* J. V. Lamouroux 1816: 286. *Holotype*: CN; illustrations: not found. *Type locality*: The Canaries (Lamouroux 1816: 286).

*Current placement/name*: *C. lobata* J. V. Lamouroux. Examination of a fragment of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212), but the status as a distinct species within the genus remains uncertain until comparative studies of relevant types are undertaken. Afonso-Carrillo (unpublished information) verified that the type material of *C. lobata* was not different from the actual concept of *Haliptilon virgatum* (Zanardini) Garbary & H. W. Johansen (for further comments see Price et al. 1992: 125). As *C. lobata* is an older name it would have priority over *C. virgata* Zanardini (1840) (Afonso-Carrillo and Sansón 1999: 151-152). For more information see *Haliptilon virgatum* entry.

*Published records*:

MADEIRA: Afonso-Carrillo and Sansón (1999: 151).

SALVAGE ISLANDS: Afonso-Carrillo and Sansón (1999: 151).

CANARY ISLANDS: Lamouroux (1816: 286), Afonso-Carrillo et al. (1983: 46, 1984: 26, 30), Price et al. (1986: 75), Reyes and Afonso-Carrillo (1993: 127), Afonso-Carrillo and Sansón (1999: 151).

*Corallina lobata*. Delgado et al. (1984: 105).

CAPE VERDE ISLANDS: Afonso-Carrillo and Sansón (1999: 151).

***Corallina mediterranea* J. E. Areschoug**

*Basionym*: *Corallina mediterranea* J. E. Areschoug 1852: 568. *Type*: Herb. Reg. Acad. Scientiarum Holm; illustrations: not found. *Type locality*: Mediterranean (Agardh 1852: 568).

*Current placement/name*: *C. mediterranea* J. E. Areschoug but status and disposition uncertain as the type was not studied in a modern context. Ardré (1970: 226) and Solms-Laubach (1881 in Ardissone 1883: 464) mentioned that the criteria used to distinguish *C. mediterranea* and *Corallina officinalis* Linnaeus were unsatisfactory and that further research was needed before any decision to merge both species. The historical use of *C. mediterranea* or *C. officinalis* at Salvagens Islands (Madeira) and in the Canary Islands is discussed in Price et al. (1986: 74).

Prud'homme van Reine et al. (1994: 81) redefined the *C. mediterranea* material recorded by Grunow (1868: 77) for the Archipelago of Madeira as *C. elongata* J. Ellis & Solander in the Afonso-Carrillo and Sansón (1989) concept. This synonym was generalized by Price et al. (1986: 73, as *C. elongata* Johnst. Newton 1931: 313) and published as valid by Irvine and Johansen (1994: 41) but only based on the study of the lectotype of *C. elongata*.

For details on the relationship between *C. mediterranea*, *C. elongata* and *C. officinalis*, see *C. mediterranea* and *C. officinalis* entries.

*Published records*:

AZORES: Lemoine (1924: 130), Schmidt (1931: 65), Feldmann (1946: 419), Ardré et al. (1974: 178), Tittley et al. (1998: 468) and Neto (2000b: 485; 2001: 104).

MADEIRA: Grunow (1868: 77), Lemoine (1924: 130), Schmidt (1931: 101) and John et al. (2004: 73).

SALVAGE ISLANDS: Price et al. (1986 : 73).

CANARY ISLANDS: Lemoine (1924: 130), Børgesen (1929: 68), Schmidt (1931: 101), Feldmann (1946: 407), Seoane-Camba (1965: 110), Kohlmeyer (1967: 143), Santos Guerra et al. (1970: 24), Acuña González (1972: 5), Santos Guerra (1972: 95), Perez-Cirera (1975: 19), Afonso-Carrillo et al. (1978: 232) and Price et al. (1986 : 73).

*Corallina mediterranea*. Vickers (1896: 295), Sauvageau (1912: 210) and González (1977b: 100).

*Corallina mediterranea* L. Gil-Rodríguez (1980: 138).

***Corallina microptera* Montagne**

*Basionym*: *Corallina microptera* Montagne 1846: 130. *Type*: M Bourgeau; PC (Afonso-Carrillo and Sansón 1999: 152); illustrations: not found. *Type locality*: Orotava, Tenerife, the Canaries (Montagne 1846: 130). *Current placement/name*: *C. microptera* Montagne. Examination of a fragment of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212), but the status as a distinct species within genus remains uncertain until comparative studies of relevant types are undertaken. According to Bornet (1892) *C. microptera* from the Canary Islands is just a small form of *C. elongata* (as *C. mediterranea* J. E. Areschoug, Afonso-Carrillo and Sansón 1999: 152). Revision of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212). The study of type specimens in a modern context is required for specific diagnosis.

*Published records*:

AZORES:

*Corallina microptera*. Afonso-Carrillo and Sansón (1999: 152).

MADEIRA: Afonso-Carrillo and Sansón (1999: 152).

CANARY ISLANDS: Montagne (1846: 130).

***Corallina millegrana* Lamarck**

*Basionym*: *Corallina millegrana* Lamarck 1815: 233. *Holotype*: PC 0028655 General Herbarium; illustrations: not found. *Type locality*: Tenerife, the Canaries (Lamarck 1815: 233).

*Current placement/name*: *C. millegrana* Lamarck. Examination of a fragment of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212), but the status as a distinct species within genus remains uncertain until comparative studies of relevant types are done.

*Published records*:

CANARY ISLANDS: Afonso-Carrillo and Sansón (1999: 152).

***Corallina officinalis* Linnaeus**

*Basionym*: *Corallina officinalis* Linnaeus 1758: 805. *Lectotype*: LINN 1293. 9 (Irvine and Johansen 1994: 44); illustrations: Walker et al. (2009, *C. officinalis*, fig. 5a; *Corallina compacta* Crouan & Crouan (PC), fig. 5b; *Corallina nana* Zanardini (MCVE), fig. 5c; *Corallina calvadosii* J. V. Lamouroux (PC), figs 5 d-e, p. 296). *Type locality*: European Seas (Lamouroux 1816: 284).

*Current placement/name*: *C. officinalis* Linnaeus according to Irvine and Johansen (1994: 44) and Walker et al. (2009: 295) based on the study of lectotype material. Afonso-Carrillo et al. (1983: 46) mentioned the presence of *C. officinalis* in the Canary Islands as doubtful. Prud'homme van Reine et al. (1994: 81) studying the material collected by Piccone and housed at PAD Herbarium redefined *C. officinalis* from Azores (Piccone 1889: 209), Canaries (Piccone 1884: 42) and Madeira (Piccone 1884: 42) as *C. elongata* J. Ellis & Solander in the concept of Afonso-Carrillo (pers. comm.). However no revision of the type material was made. Irvine and Johansen (1994: 44) provided a detailed account of *C. officinalis* in the British Isles whilst Womersley and Johansen (1996: 291) provided an account of the species in southern Australia.

For details on the relationship between *C. officinalis, C. elongata* and *C. mediterranea* J. E. Areschoug see *C. elongata* and *C. mediterranea* entries.

*Published records*:

AZORES: Piccone (1889: 209), Gain (1914: 15, 22), Schmidt (1931: 65), Feldmann (1946: 419), Levring (1974: 69), Audiffred (1985: 174), Weisscher (1983: 64), Audiffred and Prud'homme van Reine (1985: 38), South and Tittley (1986: 42), Neto (1994: 26), Tittley and Neto (1994: 8, 2000: 20) and Tittley et al. (1998: 468).

*Corallina officinalis*. Schmidt (1929a: 331).

MADEIRA: Piccone (1884: 42-43), Barton (1897: 374), Gain (1914: 7), Schmidt (1931: 101), Levring (1974: 69), Weisscher (1983: 64), Audiffred and Weischer (1984: 33), Audiffred (1985: 174) and Neto et al. (2001: 403).

*Corallina mediterranea* Aresch = *Corallina officinalis* L. Audiffred and Weisscher (1984 : 33).

*Corallina officinalis.* Augier (1985: 100).

SALVAGE ISLANDS: Price et al. (1986: 75) and John et al. (2004:73).

CANARY ISLANDS: Price et al. (1986: 75), Viera-Rodríguez (1987: 242), Viera-Rodríguez et al. (1987: 273), Afonso-Carrillo and Sansón (1999: 195), Gil-Rodríguez et al. (2003: 25) and John et al. (2004: 73).

CAPE VERDE ISLANDS: Price et al. (1986: 75).

***Haliptilon***

The generic concept of this genus is not consensual. For the relationship between *Haliptilon* and other Janieae genera see *Cheilosporum* entry. According to Womersley and Johansen (1996: 296) *Haliptilon* distinguishes from other Janieae genera by possessing a thallus pinnate with compressed axial intergenicula without lobes, usually bearing two or more subterete branchlets, sometimes adventitiously; conceptacles in terminal branchlets, usually single and with apical pores; spore producing conceptacles with 1-3 branchlets.

***Haliptilon cubensis* (Montagne ex Kützing) Garbary & H. W. Johansen**

*Basionym*: *Jania cubensis* Montagne ex Kützing, 1849: 709-710. *Type*: Montagne Herbarium (Agardh 1852); illustrations: Garbary and Johansen (1982, fig. 10, p. 216) as *Haliptilon cubensis* (Montagne ex Kützing) Garbary & H. W. Johansen. *Type locality*: Cuba (Kützing 1849: 710).

*Current placement/name*: *H. cubensis* (Montagne ex Kützing) Garbary & H. W. Johansen. Examination of a fragment of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212), but the status as a distinct species within genus remains uncertain until comparative studies of relevant types are done. Following their suggestion to merge material of *Cheilosporum* and *Haliptilon* within the *Jania* genus (Kim et al. 2007, see *Cheilosporum* entry), these authors suggested the new combination *J. cubensis* (Montagne ex Kützing 1849, p. 709–10). According to Afonso-Carrillo (unpublished results) plants from the Canary Islands reported as *Corallina cubensis* (Montagne ex Kützing) Kützing or *H. cubensis* are not morphologically different from *Haliptilon virgatum* (Zanardini) Garbary & H. W. Johansen

*Published records*:

CANARY ISLANDS:

*Corallina cubensis*. Delgado et al. (1984: 105) and Jorge et al. (1984: 118).

*Corallina cubensis* (Montagne) Kützing. Gil-Rodríguez and Afonso-Carrillo (1980: 36), Afonso-Carrillo et al. (1983: 30, 1984: 32) and Price et al. (1992: 125).

*Haliptilon cubense* (Montagne ex Kützing) Garbary & H. W. Johansen. Gil-Rodríguez et al. (2003: 25) and John et al. (2004: 86).

CAPE VERDE ISLANDS:

*Corallina cubensis* Montagne ex Kützing. Askenasy (1896: 26) and Price et al. (1992: 125).

*Jania cubensis* Montagne ex Kützing. Price et al. (1992: 125).

***Haliptilon purpuratum* (Lamarck) Garbary & H. W. Johansen**

*Basionym*: *Corallina purpurata* Lamarck 1815: 237. *Type*: PC; illustrations: not found. *Type locality*: Tenerife, the Canaries (Lamarck 1815: 237).

*Current placement/name*: *H. purpuratum* (Lamarck) Garbary & H. W. Johansen. Examination of the thallus surface of a fragment of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212), but the status as a distinct species within genus remains uncertain until comparative studies of relevant types are undertaken. Afonso-Carrillo and Sansón (1999: 153) mentioned that according to the original description of *C. purpurata* and the variable morphology of *Haliptilon virgatum* (Zanardini) Garbary & H. W. Johansen these two species are not distinct and a revision of both species based on examination of type material is recommended.

*Published records*:

CANARY ISLANDS:

*Haliptilon purpuratum* (Lamarck) Garbary & H. W. Johansen. Afonso-Carrillo and Sansón (1999: 153, 195).

***Haliptilon squamatum* (Linnaeus) Johansen, L. Irvine & Webster**

*Basionym*: *Corallina squamata* Linnaeus 1758: 806. *Lectotype*: Ellis's illustrations designated by Irvine and Johansen (1994: 50); illustrations: Ellis (1755, pl. 24, fig. c.C, p. 63). *Type locality*: European Seas (Lamouroux 1816: 287).

*Current placement/name*: *Haliptilon squamatum* (Linnaeus) Johansen, L. Irvine & Webster according to Johansen et al. (1973: 212) and Irvine and Johansen (1994: 49) based on the study of lectotype material. Prud'homme van Reine et al. (1994: 81) examining the material collected by Piccone from Azores (1889), the

Canaries (1884) and Madeira (Grunow 1868) housed at PAD Herbarium considered it as *H. virgatum* (Zanardini) Garbary & H. W. Johansen, following the concept of Afonso-Carrillo and Sansón (1989: 25). Nevertheless the type material was not observed. The presence of *H. squamatum* in the Archipelagos of Madeira and the Canaries is dubious and needs confirmation (Afonso-Carrillo et al. 1983: 46; Neto et al. 2001: 412). Kim et al. (2007: 1317) based on molecular and reproductive features proposed the new combination *Jania squamata* (Linnaeus) J. H. Kim, Guiry & H.-G. Choi.

*Published records*:

AZORES:

*Corallina squamata* J. Ellis & Solander. Schmidt (1929b: 171, 1931: 65) and Feldmann (1946: 419).

*Haliptylon squamatum*. Neto (1994: 26).

*Haliptilon squamatum* (Linnaeus) H.W. Johansen., L.M. Irvine & A.M. Webster. South and Tittley (1986: 42) and Tittley and Neto (1994: 9, 2005: 250).

MADEIRA:

*Corallina squamata*. Grunow (1868: 78).

*Corallina squamata* J. Ellis & Solander. Grunow (1868: 78) and Schmidt (1929b : 171, 1931: 101).

*Haliptilon squamatum* (Linnaeus) H. W. Johansen, L.M. Irvine & A.M. Webster. John et al. (2004: 86).

CANARY ISLANDS:

*Haliptilon squamatum* (Linnaeus) H. W. Johansen, L. M. Irvine & A. M. Webster. Afonso-Carrillo et al. (1983: 46), Price et al. (1992: 125), Irvine and Johansen (1994: 49), Irvine and Johansen (1994: 49), Afonso-Carrillo and Sansón (1999: 195), Gil-Rodríguez et al. (2003: 25) and John et al. (2004: 86).

***Haliptilon virgatum* (Zanardini) Garbary & H. W. Johansen**

*Basionym*: *Corallina virgata* Zanardini 1844: 1025. *Type*: MCVE (Stafleu and Cowan 1988: 516); illustrations: not found. *Type locality*: Adriatic Sea (Zanardini 1844: 1025).

*Current placement/name*: *H. virgatum* (Zanardini) Garbary & H. W. Johansen. Examination of a fragment of the type material revealed stable characters at the genus level (Garbary and Johansen 1982: 212), but the status as a distinct species within genus remains uncertain until comparative studies of relevant types are done. Kim et al. (2007) based on molecular and reproductive features proposed to merge *Haliptilon* within *Jania* genus (see *Cheilosporum* entry) but did not suggest a new combination for *H. virgatum*.

For the relationship between *H. virgatum* and *Corallina lobata* J. V. Lamouroux, see *C. lobata* entry.

*Published records*:

AZORES: Piccone (1889: 210) and Neto and Tittley (1995: 490).

*Haliptylon virgatum* (Zanardini) Garbary & H. W. Johansen. South and Tittley (1986: 42), Prud'homme van Reine et al. (1994: 81), Tittley and Neto (1994: 9), Tittley et al. (1998: 468) and Wallenstein and Neto (2006: 199).

MADEIRA:

*Haliptilon virgatum* (Zanardini) Garbary & H. W. Johansen. Audiffred and Prud'homme van Reine (1985: 41) and John et al. (2004: 87).

SALVAGE ISLANDS: Price et al. (1992: 125).

CANARY ISLANDS*:* Piccone (1889: 210) and Price et al. (1992: 125).

*Haliptilon virgata* (Zanardini) Garbary & H. W. Johansen. Viera-Rodríguez and Wildpret de la Torre (1986: 217), Price et al. (1992: 125), Prud'homme van Reine et al. (1994: 94), Afonso-Carrillo and Sansón (1999: 195), Rojas-González and Afonso-Carrillo (2002b: 100), Gil-Rodríguez et al. (2003: 25) and Muñoz et al. (2007: 107).

*Haliptilon virgatum*. Gil-Rodríguez et al. (1992: 112) and Prud'homme van Reine et al. (1994: 81).

*Haliptilon virgata*. Afonso-Carrillo and Sansón (1989: 25).

*Haliptilon virgatum* (Zanardini) Garbary & H. W. Johansen. Elejabeitia et al. (1992: 8), Pinedo et al. (1992: 39), Guadalupe et al. (1995: 37), Haroun et al. (2003: 108), Montañés et al. (2003: 124), Sangil et al. (2003a: 103, 2003b, 2004: 89: 311, 2005: 326) and John et al. (2004: 87).

***Jania***

The generic concept of this genus is not consensual. For the relationship between *Jania* and other Janieae genera see *Cheilosporum* entry. According to Womersley and Johansen (1996: 296), *Jania* distinguishes from other Janieae genera by possessing a dichotomous thallus with terete or compressed intergenicula bearing axial conceptacles.

***Jania adhaerens* J. V. Lamouroux**

*Basionym*: *Jania adhaerens* J. V. Lamouroux 1816: 270. *Holotype*: CN (Johansen 1971: 247; Cribb 1983); illustrations: not found. *Type locality*: Mediterranean (Lamouroux 1816: 270).

*Current placement/name: J. adhaerens* J. V. Lamouroux but status and disposition uncertain as the type was not studied in a modern context.

*Published records*:

AZORES: South and Tittley (1986: 42), Prud'homme van Reine (1988: 179), Neto (1994: 26, 2001: 104), Tittley and Neto (1994: 9) and Tittley et al. (1998: 468).

MADEIRA: John et al. (2004: 93).

SALVAGE ISLANDS: Price et al. (1992:135), Kristiansen et al. (1993: 95) and John et al. (2004: 93).

CANARY ISLANDS: Afonso-Carrillo (1980b: 55), Gil-Rodríguez and Afonso-Carrillo (1980: 36), Afonso-Carrillo et al. (1984: 30), González et al. (1986: 319), Afonso-Carrillo and Sansón (1989: 26, 1999: 196), Reyes and Sansón (1991: 79), Ballesteros et al. (1992: 520), Pinedo et al. (1992: 40), Price et al. (1992: 135), Ballesteros (1993: 21), Kristiansen et al. (1993: 95), Guadalupe et al. (1995: 37), Reyes et al. (2000: 140), Haroun et al. (2002: 146, 2003: 110), Rojas-González and Afonso-Carrillo (2002b: 102), Gil-Rodríguez et al. (2003: 25), Montañés et al. (2003: 124), Sangil et al. (2003a: 103, 2003b: 311), John et al. (2004: 93), Sangil et al. (2004: 89, 2005: 326) and Muñoz et al. (2007: 107).

CAPE VERDE ISLANDS: Otero-Schmitt and Sanjuan (1992: 382), Price et al. (1992: 135) and Otero-Schmitt (1993: 47).

***Jania capillacea* Harvey**

*Basionym*: *Jania capillacea* Harvey 1853: 84-85. *Holotype*: TCD (Toumey 70) (Dawson 1953: 116; Cribb 1983); illustrations: not found. *Type locality*: Honda Bay, Florida, USA (Silva et al. 1996: 241).

*Current placement/name*: *J. capillacea* Harvey but status and disposition uncertain as the type was not studied in a modern context. Similarities between this species and *J. adhaerens* J. V. Lamouroux are discussed in Cribb (1983) and Schneider and Searles (1991). Further comments on the relation between *J. capillacea* and *Jania pumila* J. V. Lamouroux for the Canary Islands in *J. pumila* entry.

*Published records*:

AZORES: Neto (2001: 104) and Wellenstein and Neto (2006: 1999).

MADEIRA: John et al. (2004: 93).

SALVAGE ISLANDS: Price et al. (1992: 135) and John et al. (2004: 93).

CANARY ISLANDS: Afonso-Carrillo and Sansón (1989: 26, 1999: 196), Reyes and Sansón (1991: 79), Pinedo et al. (1992: 40), Price et al. (1992: 135), Ballesteros (1993: 22), Prud'homme van Reine et al. (1994: 94), Gil-Rodríguez et al. (2003: 25), Haroun et al. (2003: 110), Sangil et al. (2003a: 103, 2003b: 311) and John et al. (2004: 93).

*Jania capillacea* J. V. Lamouroux. Afonso-Carrillo et al. (1983: 46, 1984: 30) and Price et al. (1992: 135).

CAPE VERDE ISLANDS: Otero-Schmitt and Sanjuan (1992: 382), Price et al. (1992: 135) and Otero-Schmitt (1993: 51).

***Jania crassa* J. V. Lamouroux**

*Basionym*: *Jania crassa* J. V. Lamouroux 1821: 23. *Holotype*: CN Lamouroux Herbarium under *Jania* in folder c8-f74 (Woelkerling and Nelson 2004: 53); illustrations: Lamouroux (1821, pl. 69, figs 9-10, p. 23) and Johansen (1971, fig. 10, p. 244) as *J. crassa* ; Johansen and Womersley (1994, fig. 37, p. 622) as *Jania verrucosa* J. V. Lamouroux; see comments. *Type locality*: Dusky Sound, South Island, New Zealand (Lamouroux 1821: 23).

*Current placement/name*: *J. verrucosa* J. V. Lamouroux but status and disposition uncertain as the type of *J. verrucosa* was not studied in a modern context. Johansen and Womersley (1994: 617) and Womersley and Johansen (1996: 305, 307) considered *J. crassa* as a heterotypic synonym of *J. verrucosa* stating that they are almost "certainly conspecific at least in southern Australia". This conclusion was only based on the study of the holotype of *J. crassa*. However, according to Woelkerling and Nelson (2004: 65) the proposed conspecifity needs to be confirmed through a comparative study of both types.

*Published records*:

AZORES: South and Tittley (1986: 43), Neto (1994: 26) and Tittley and Neto (1994: 9).

*Jania crassa*. Prud'homme van Reine (1988: 179), Stengenga et al. (1997: 585) and Neto (2000a: 140, 2000b: 490).

CAPE VERDE ISLANDS: Otero-Schmitt and Sanjuan (1992: 384) and Price et al. (1992: 136).

***Jania intermedia* (Kützing) P. C. Silva**

*Basionym*: *Corallina intermedia* Kützing 1858: 37-38, 42. *Type*: not found; illustrations: Kützing (1858, pl. 79, fig. I, p. 36-38; pl. 86, fig. IV, p. 42). *Type locality:* Cape of Good Hope, South Africa (Silva et al. 1996: 242).

*Current placement/name*: *J. intermedia* (Kützing) P. C. Silva but status and disposition uncertain as the type was not studied in a modern context. Silva et al. (1996: 242) mentioned that the correct combination is *J. intermedia* and not *Jania intermedia* Kützing which was only a bibliographic reference and not the name of the basionym. Neto et al. (2001: 412.) studying Madeira specimens cited it as doubtful record mentioning that "it might be a variety of *J. rubens* (Linnaeus) J.V. Lamouroux". According to Woelkerling and Nelson (2004: 57), this name should be considered a *nomen nudum* as there are no valid diagnosis descriptions.

*Published records*:

MADEIRA:

*Corallina intermedia* Grunow. Neto et al. (2001: 412).

***Jania longifurca* Zanardini**

*Basionym*: *Jania longifurca* Zanardini 1844: 1025. *Type*: probably in MCVE Zanardini's collections; illustrations: not found. *Type locality*: Dalmatia, Italy (Zanardini 1844: 1025).

*Current placement/name*: *J. longifurca* Zanardini but status and disposition uncertain as the type was not studied in a modern context. Sansón et al. (1991: 531) mentioned that this species is poorly known in the Canary Islands and needs further studies. The designation/localization of the type material and its study in a modern context is required.

*Published records*:

AZORES: Feldmann (1946: 421), South and Tittley (1986: 43), Neto (1994: 26), Tittley et al. (1998: 468) and Neto (2000a: 140, 2000b: 490, 2001:105).

MADEIRA: Levring (1974: 70), Sansón et al. (1991: 530) and Neto et al. (2001: 404).

CANARY ISLANDS: Sansón et al. (1991: 530), Afonso-Carrillo and Sansón (1999: 196), Haroun et al. (2002: 146) and Gil-Rodríguez et al. (2003: 25).

***Jania micrarthrodia* J. V. Lamouroux**

*Basionym*: *Jania micrarthrodia* J. V. Lamouroux 1816: 271. *Holotype*: CN Lamouroux Herbarium; illustrations: Lamouroux (1816, pl. 9, fig. 5a; pl. 69, figs 7-8, p. 271); Johansen and Womersley (1994, figs 32-36, p. 622). *Type locality*: Australasia (Lamouroux 1816: 271).

*Current placement/name*: *J. micrarthrodia* J. V. Lamouroux according to Johansen and Womersley (1994: 611-613) based on the study of type material. Gil-Rodríguez et al. (2003: 212) mentioned that the material of *J. micrarthrodia* for the Canaries could not be located.

*Published records*:

CANARY ISLANDS: Price et al. (1992: 136) and Afonso-Carrillo and Sansón (1999: 196).

***Jania natalensis* Harvey**

*Basionym*: *Jania natalensis* Harvey 1849: 107. *Type*: TCD (Johansen 1971: 247); illustrations: not found. *Type locality*: Port Natal, South Africa (Johansen 1971: 247).

*Current placement/name*: *Jania verrucosa* J. V. Lamouroux but status and disposition uncertain as the type was not studied in a modern context. Johansen and Womersley (1994: 616) merged *J. natalensis* in synonymy with *J.*

*verrucosa* but no revision of the type material was made. Agardh (1870: 363) cited *J. natalensis* as doubtful to the Azores (Santa Maria).

*Published records*:

AZORES: Schmidt (1929b:172; 1931: 66).

*Corallina natalensis* Kützing. Neto (2000b: 485).

*Jania natalensis*?. Agardh (1870: 363) and Piccone (1889: 214).

*Jania*? *Natalensis* Harvey. Gain (1914: 22).

***Jania pumila* J. V. Lamouroux**

*Basionym* : *Jania pumila* J. V. Lamouroux 1816: 269. *Holotype*: CN Lamouroux Herbarium; illustrations: Lamouroux (1816, pl. 9, fig. 2, p. 269). *Type locality*: Red Sea and Western Indies (Lamouroux 1816 : 269). *Current placement/name*: *J. pumila* J. V. Lamouroux but status and disposition uncertain as the type was not studied in a modern context. The holotype specimen of *J. pumila* housed in Lamouroux's Herbarium in Caen is in depauperate and/or sterile conditions being difficult to interpret (Johansen and Womersley 1994: 610; Abbott 1999: 189). Villena-Balsa et al. (1987: 20) revising material from the Canary Islands identified it provisionally as *J. pumila*. They mentioned that the material could belong to other species also characterized by reduced-size plants and not correctly described e.g. *Jania gibbosa* J. V. Lamouroux, *J. pygmea* J. V. Lamouroux, *J. compressa* J. V. Lamouroux and *J. capillacea* Harvey.

*Published records*:

MADEIRA: Levring (1974: 70), González (1978: 48) and Neto et al. (2001: 404).

SALVAGE ISLANDS: Price et al. (1992: 136) and John et al. (2004: 93).

CANARY ISLANDS: Price et al. (1992: 136), Afonso-Carrillo et al. (1978: 232, 1983: 30, 1984: 30), González (1978: 48), Gil-Rodríguez and Afonso-Carrillo (1980: 36), Pinedo et al. (1992: 40), Afonso-Carrillo and Sansón (1999: 196), Haroun et al. (2003: 112), Gil-Rodríguez et al. (2003: 25), Sangil et al. (2003a: 103 , 2005: 326) and John et al. (2004 :93).

*Jania pumila*. Afonso-Carrillo and Sansón (1989: 25) and Price et al. (1992: 136).

***Jania rubens* (Linnaeus) J. V. Lamoroux var. *corniculata* (Linnaeus) Yendo**

*Basionym*: *Corallina corniculata* Linnaeus 1758: 806. *Lectotype*: LINN 1293.19 (Irvine and Johansen 1994: 56); illustrations: not found. *Type locality*: European Ocean (Irvine and Johansen 1994:56).

*Current placement/name*: *Jania rubens* (Linnaeus) J. V. Lamoroux var. *corniculata* (Linnaeus) Yendo, but status and disposition uncertain as the type was not studied in a modern context. Irvine and Johansen (1994: 56) in their revision of the British Isles material considered the name *J. rubens* var. *corniculata* (Linnaeus) Yendo as valid but without checking the type material. Recently John et al. (2004: 93) considered *J. corniculata* (Linnaeus) J. V. Lamouroux as a synonym of *Jania rubens* (Linnaeus) J. V. Lamouroux but did not provide any taxonomic comments. In their integrative taxonomic approach including phylogeny reconstructions based on the cox1 and 18S rRNA genes in addition to a comparative morphological assessment study Walker et al. (2009) observed that *J. rubens* var. *rubens* and *J. rubens* var. *corniculata* clustered together in both phylogenies suggesting that for those genes there was no genetic basis for the morphological variation. These conclusions however were not based on type material observations.

*Published records*:

AZORES: Gain (1914: 22), Tittley et al. (1998: 468) and Neto (2000b: 485, 2001: 105).

*Jania corniculata* J. V. Lamouroux. Piccone (1889: 213).

*Jania corniculata* (Linnaeus) J. V. Lamouroux. South and Tittley (1986: 42).

*Jania* cf. *corniculata* (Linnaeus) J.V. Lamouroux. Neto (1994: 26) and Tittley and Neto (1994: 9).

*Jania rubens* J. V. Lamouroux var. *corniculata* (Linnaeus) Yendo. Schmidt (1931: 66).

MADEIRA:

*Jania* cf. *corniculata*. Neto et al. (2001: 404).

*Jania corniculata* (Linnaeus) J. V. Lamouroux. Audiffred and Prud'homme van Reine (1985: 43).

SALVAGE ISLANDS :

*Jania* cf. *corniculata*. John et al. (2004: 93).

CANARY ISLANDS:

*Jania corniculata* (Linnaeus) J. V. Lamouroux. Gil-Rodríguez and Afonso-Carrillo (1980: 36), Afonso-Carrillo et al. (1983: 30, 1984: 30) and Price et al. (1992: 135).

*Jania corniculata*. Afonso-Carrillo and Sansón (1989: 26).

*Jania rubens* (Linnaeus) J. V. Lamouroux var. *corniculata* (Linnaeus) Yendo. Price et al. (1992: 135) and Irvine and Johansen (1994: 57).

***Jania rubens* (Linnaeus) J. V. Lamoroux var. *rubens***

*Basionym*: *Corallina rubens* Linnaeus 1758: 806. *Lectotype*: UPS Herb. Burser vol. XX, 72; designated by Irvine and Johansen (1994: 56); illustrations: Lamoroux (1816, pl. 9, figs 6-7, p. 272) as *Jania rubens* (Linnaeus) J. V. Lamouroux. *Type locality*: European Ocean (Linnaeus 1758: 806).

*Current placement/name*: *J. rubens* (Linnaeus) J. V. Lamoroux var. *rubens*, a conclusion of Irvine and Johansen (1994: 56) after studying the lectotype in a modern context. Price et al. (1992: 136) suggested that *J. rubens* and *Corallina rubens* J. Ellis & Solander in González (1977a: 26) are synonyms. Prud'homme van Reine et al. (1994: 94) confirmed the diagnosis of the *J. rubens* material from Cape Verde Islands collected by Piccone (1886) and housed at PAD and W Herbarium but recognized that material was from Tenerife (the Canaries) and not from Cape Verde Islands. They followed Taylor's (1960) concept and did not review the type material.

*Published records*:

AZORES: Gain (1914: 15, 22) and Prud'homme van Reine et al. (1994: 94).

*Jania rubens.* Schmidt (1929a: 331).

*Jania rubens* (Linnaeus) J. V. Lamouroux. Feldmann (1946: 417), Castro and Viegas (1983: 20, 1987: 63), Weisscher (1983: 70), South and Tittley (1986: 43), Tittley and Neto (1994: 9), Neto (2000a: 140, 2000b: 490-491), Toste et al. (2003: 1270) and Wallenstein and Neto (2006: 199).

*Jania rubens* J. V. Lamouroux. Schmidt (1931: 66).

*Jania rubens*. Agardh (1870: 363), Palminha (1957: 66), Neto (1994: 26, 2000b: 490) and Neto and Tittley (1995: 489).

*Jania rubens* (Linnaeus) Areschoug. Lemoine (1924: 130).

*Jania rubens* (Linnaeus) J. V. Lamouroux var. *rubens*. Audiffred and Prud'homme van Reine (1985: 43) and Irvine and Johansen (1994: 55).

MADEIRA:

*Corallina rubens* J. V. Lamouroux. Gain (1914: 10) and John et al. (2004: 93).

*Jania rubens* J. V. Lamouroux. Piccone (1884: 10), Gain (1914: 9) and Schmidt (1931: 101).

*Jania rubens* (Linnaeus) J. V. Lamouroux. Grunow (1868: 78) and Levring (1974: 70).

*Jania rubens.* Johnston (1969: 215), Augier (1985: 100) and Afonso-Carrillo and Sansón (1989: 26).

*Jania rubens* (Linnaeus) J. E. Areschoug. Lemoine (1924: 130).

SALVAGE ISLANDS: Price et al. (1992 : 136) and John et al. (2004: 93).

CANARY ISLANDS:

*Corallina* (*Jania*) *rubens* Linnaeus. Askenasy (1896: 26) and Prud'homme van Reine et al. (1994: 94).

*Jania rubens*. Johnston (1969: 215), González (1977b: 100), Delgado et al. (1984: 106), Gil-Rodríguez et al. (1992: 109) and Price et al. (1992: 136).

*Jania rubens* (Linnaeus) J. V. Lamouroux. Ardré (1970: 229), Santos Guerra et al. (1970: 24), Cordeiro-Marino (1978: 50), González (1978: 48), Afonso-Carrillo et al. (1978: 232, 1984: 30), Afonso-Carrillo and Gil-Rodríguez (1980: 165), Gil-Rodríguez and Afonso-Carrillo (1980: 36), López Hernández and Gil-Rodríguez (1981: 156), Weisscher (1983: 70), González et al. (1986: 319), Viera-Rodríguez and Wildpret de la Torre (1986: 216), Reyes and Sansón (1991: 79), Pinedo et al. (1992: 40), Medina and Haroun (1993: 110), Kristiansen et al. (1993: 95), Guadalupe et al. (1995: 37), Afonso-Carrillo and Sansón (1999: 196), Gil-Rodríguez et al. (2003: 25), Rojas-González and Afonso-Carrillo (2002a: 33), Haroun et al. (2003: 112), Montañés et al. (2003: 124), Sangil et al. (2003a: 103), John et al. (2004: 93), Rojas-González and Afonso-Carrillo (2004: 138) and Muñoz et al. (2007: 107).

*Jania rubens* J. V. Lamouroux. Vickers (1896: 306), Schmidt (1931: 101 and Price et al. (1992: 136).

*Jania rubens* (Linnaeus). Piccone (1884: 42, 56) and Acuña González (1972: 5).

*Jania rubens*. Price et al. (1992: 136).

*Jania rubens* (Linnaeus) J. V. Lamouroux var. *rubens*. Irvine and Johansen (1994: 55).

CAPE VERDE ISLANDS:

*Corallina* (*Jania*) *rubens* Linneaus. Price et al. (1992: 136).

*Jania rubens* (Linnaeus) J. V. Lamouroux. Piccone (1886: 66), Price et al. (1992: 136) and Prud'homme van Reine et al. (1994: 94).

*Jania rubens* J. V. Lamouroux. Schmidt (1931: 101).

*Jania* cf. *rubens* (Linnaeus) J. V. Lamouroux. Otero-Schmitt and Sanjuan (1992: 382).

***Jania tenella (*Kützing) Grunow**

*Basionym*: *Corallina tenella* Kützing 1858: 41. *Holotype*: L (Dawson 1953: 121); illustrations: Kützing (1858, pl. 85, fig. II, p. 41). *Type locality*: Naples, Italy (Silva et al. 1996: 244).

*Current placement/name*: *J. tenella* (Kützing) Grunow but status and disposition uncertain as the type was not studied in a modern context.

*Published records*:

CAPE VERDE ISLANDS:

*Corallina* (*Jania*) *tenella* Kützing. Price et al. (1992: 136).

***Jania verrucosa* J. V. Lamouroux**

*Basionym* : *Jania verrucosa* J. V. Lamouroux 1816: 270. *Holotype*: CN Lamouroux Herbarium (Womersley and Johansen 1996: 305); illustrations: Lamouroux (1816, pl. 9, fig. 4 a.B, p. 270). *Type locality*: North America (Lamouroux 1816: 270).

*Current placement/name*: *J. verrucosa* J. V. Lamouroux but status and disposition uncertain as the type was not studied in a modern context. For the relationship between *J. verrucosa*, *J. natalensis* and *J. cryptarthrodia* see *J. natalensis* and *J. cryptarthrodia* entries.

*Published records*:

AZORES:

*Jania verrucosa*. Neto (2000b: 491; 2001:105).

CAPE VERDE ISLANDS: Price et al. (1992: 136).

**Discussion**

From the thirty one names of species and infraspecific taxa of geniculate Corallinales recorded from the Macaronesian region, four are based on type material collected from localities within this region while the rest (87%) are based on types from localities elsewhere (Table 1). All species are validly published (ICBN, Art. 6.2, 29.1, 42.3 and 60). The correct application of these names to species and specific taxa, however, is linked to an understanding of the type material and to the provisions of the ICBN (McNeill et al. 2006).

For *Haliptilon cubensis*, *H. virgatum* and the four names based on Macaronesian collections (*Corallina lobata*, *C. microptera*, *C. millegrana* and *Haliptilon purpurata*), only a fragment of the holotype material was studied. The generic placement of the taxa was confirmed by ultrastructural investigations but the status of the species could not be determined (Garbary and Johansen 1982). As a result, published information does not include detailed specific morphological and anatomical accounts, and its nomenclature lacks the foundations essential for stability. Therefore, although those taxa are currently treated as distinct species by various authors, this treatment requires substantiation through morphological, anatomical and ultrastructural detailed studies of relevant type material.

From the list compiled in the present work, 15 taxa have not been studied in a modern context. *Jania intermedia* is a *nomen nudum* (ICBN, Art. 1) and therefore nomenclaturally illegitimate. The remaining 14 taxa, although listed as distinct species in various publications, require re-assessment through further studies of relevant type material. The same situation happens with the proposed heterotypic synonyms. An example is the

synonymy of *Corallina mediterranea* with *C. elongata* published by Irvine and Johansen (1994: 41). The segregating characters defined by these authors for *C. elongata*, related to reproductive and vegetative morphology, cannot be contrasted with the available original description of *C. mediterranea* from Areschoug (1852: 568-569). Also, the presence in the main axes of intergenicula as long as wide, described by Walker et al. (2009: 295-296) as distinguishing feature for *C. elongata*, does not agree with the description of *C. mediterranea*. The occurrence of most of these taxa in Macaronesia has yet to be verified as most records represent occasional findings from one single location.

Only ten types of Corallinales occurring in Macaronesia have been studied in a modern context. From these, two (*Jania crassa* and *Amphiroa verruculosa*) are considered heterotypic synonyms of other taxa. The heterotypic synonymy of *Jania crassa* with *Jania verrucosa* (Johansen and Womersley 1994), however, requires further studies comparing both types. The remaining 8 species are considered to be distinct taxa. Their diagnosing characters were emended based on, respectively, vegetative and reproductive anatomy in the case of *Amphiroa* (Norris and Johansen 1981: 5-6), vegetative and reproductive morphology in *Corallina* (Walker et al. 2009: 295; table 4, p. 296) and morphological and anatomical vegetative characters in *Jania* (Johansen and Womersley 1994: 606). The confirmation of these species in the Macaronesia requires the study of their voucher specimens in ligth of these new concepts.

To summarize, only 8 of the 31 species and infraspecific taxa of geniculate Corallinales listed for Macaronesia have been confirmed to represent distinct species. Three others have been found to be heterotypic synonyms of other taxa and one (*Jania intermedia*) is nomenclaturally illegitimate. There remains 19 taxa which have yet to be fully reassessed through detailed studies encompassing specific morphological, anatomical and ultrastructural investigations, preferably complemented with molecular studies. This task has many difficulties, starting with the fact that for three species (*Corallina deshayesii*, *C. granifera* and *C. intermedia*) the type collection whereabouts are uncertain. However, this kind of taxonomic work may confirm the molecular conclusions of Kim et al. (2007) suggesting that the genera *Cheilosporum*, *Haliptilon* and *Jania* (tribe Janieae) should be merged into a single genus *Jania* recognized by the generic characters listed by Johansen and Silva (1978: 413, table 1, p. 414).

**Conclusion**

The present catalogue and its analysis represent initial steps in creating a reliable database on the species diversity of geniculate Corallinales in the Macaronesian region. Although 31 names of geniculate Corallinales

have been recorded for this region, the actual number of species and genera present is uncertain and will continue to remain so until detailed monographic studies are undertaken. How many of the names previously used for the Macaronesian region taxa can correctly be applied to specimens for this region also remains uncertain as does the number of species present, but so far undetected. An accurate figure of the actual diversity for the Macaronesian geniculate corallines requires extensive work involving new collections, the detailed study of fresh material, historical collections and type material, complemented, if possible, with molecular evaluations.

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**Table 1** Current status and disposition of geniculate Corallinales reported from the Macaronesian Region

| Current placement/name | | Basionym | Valid publication | Type material studied in modern context | Remarks | Species status |
|---|---|---|---|---|---|---|
| Genus | Epithet | | | | | |
| *Amphiroa* | *beauvoisii* | = | Lamouroux 1816: 299-300 | Norris and Johansen 1981, Harvey et al. 2009 | | Distinct species |
| | *cryptarthrodia* | *Corallina verrucosa* | Zanardini 1840: 136 | Rosas-Alquicira et al. In press | | Distinct species |
| | *exilis* | = | Harvey 1849: 95 | | | Uncertain |
| | *fragilissima* | *Corallina fragilissima* | Linnaeus 1758: 806 | Weber-van Bosse 1904 | | Distinct species |
| | *rigida* | = | Lamouroux 1816: 297 | Norris and Johansen 1981 | | Distinct species |
| | *verruculosa* | *Amphiroa verrucosa* | Kützing 1841: 18 | Hamel and Lemoine 1953, Rosas-Alquicira et al. In press | | Synonym of *A. cryptarthrodia* |
| *Cheilosporum* | *elegans* | *Amphiroa elegans* | Hooker and Harvey 1849: 101 | | Generic disposition as *Cheiolosporum* certain | Uncertain |
| *Corallina* | *deshayesii* | = | Montagne 1846: 130 | | Designation/localization of the type material is required | Uncertain |
| | *elongata* | = | Ellis and Solander 1786: 119 | Irvine and Johansen 1994 | | Distinct species |
| | *granifera* | = | Ellis and Solander 1786: 120 | | Designation/localization of the type material is required | Uncertain |
| | *lobata* [a] | = | Lamouroux 1816: 286 | Only a fragment of the holotype was studied (Garbary and Johansen 1982) | Generic disposition as *Corallina* certain | Uncertain |
| | *mediterranea* | = | Areschoug in Agardh 1852: 568 | | Considered a synonym of *C. elongata* (Irvine and Johansen 1994), but without comparing both types | Uncertain |
| | *microptera* [a] | = | Montagne 1846: 130 | Only a fragment of the holotype was studied (Garbary and Johansen 1982) | Generic disposition as *Corallina* certain | Uncertain |
| | *millegrana* [a] | = | Lamarck 1815: 233 | Only a fragment of the holotype was studied (Garbary and Johansen 1982) | Generic disposition as *Corallina* certain | Uncertain |
| | *officinalis* | = | Linnaeus 1758: 805 | Irvine and Johansen 1994, Walker et al. 2009 | | Distinct species |

[a]Species based on types from the Macaronesian region

**Table 1 (Cont.)** Current status and disposition of geniculate Corallinales reported from the Macaronesian Region

| Current placement/ name | | Basionym | Valid publication | Type material studied in modern context | Remarks | Species status |
|---|---|---|---|---|---|---|
| Genus | Epithet | | | | | |
| *Haliptilon* | *cubensis* | *Jania cubensis* | Montagne in Kützing 1849: 709-710 | Only a fragment of the holotype was studied (Garbary and Johansen 1982) | Generic disposition as *Haliptilon* certain | Uncertain |
| | *purpuratum* [a] | *Corallina purpurata* | Lamarck 1815: 237 | Only a fragment of the holotype was studied (Garbary and Johansen 1982) | Generic disposition as *Haliptilon* certain | Uncertain |
| | *squamatum* | *Corallina squamata* | Linnaeus 1758: 806 | Johansen et al. 1973, Irvine and Johansen 1994 | No | Distinct species |
| | *virgatum* | *Corallina virgata* | Zanardini 1844: 1025 | Only a fragment of the type was studied (Garbary and Johansen 1982) | Generic disposition as *Haliptilon* certain | Uncertain |
| *Jania* | *adhaerens* | = | Lamouroux 1816: 270 | | | Uncertain |
| | *capillacea* | = | Harvey 1853: 84-85 | | | Uncertain |
| | *crassa* | = | Lamouroux 1821: 23 | Johansen and Womersley 1994 | Considered a synonym of *Jania verrucosa (* Johansen and Womersley 1994*)*, but without comparing both types | Uncertain |
| | *intermedia* | *Corallina intermedia* | Kützing 1858: 37-38,42 | | Designation/localization of the type material is required | *Nomen nodum* (Woelkerling and Nelson 2004) |
| | *longifurca* | = | Zanardini 1844: 1025 | | Designation/localization of the type material is required | Uncertain |
| | *micrarthrodia* | = | Lamouroux 1816: 271 | Johansen and Womersley 1994 | No | Distinct species |
| | *natalensis* | = | Harvey 1849: 107 | | Considered a synonym of *Jania verrucosa* (Johansen and Womersley 1994), but without comparing both types | Uncertain |
| | *pumila* | = | Lamouroux 1816: 269 | | Holotype in poor conditions being difficult to interpret (Johansen and Womersley 1994) | Uncertain |
| | *rubens* var. *corniculata* | *Corallina corniculata* | Linnaeus 1758: 806 | | | Uncertain |
| | *rubens* var. *rubens* | *Corallina rubens* | Linnaeus 1758: 806 | Irvine and Johansen 1994 | | Distinct species |
| | *tenella* | *Corallina tenella* | Kützing 1858: 41 | | | Uncertain |
| | *verrucosa* | = | Lamouroux 1816: 270 | | Considered a distinct species of *Jania* (Johansen and Womersley 1994) but without studying its type material | Uncertain |

[a]Species based on types from the Macaronesian region

## Figure Captions

**Fig. 1** The Macaronesian region.