

Considerations on the Genus *Callithamnion* (Ceramiaceae, Rhodophyta) in the Canary Islands

MARTA SANSON & M. CANDELARIA GIL-RODRIGUEZ

12 Figures

Actually, the taxonomy of the genus *Callithamnion* LYNGBYE is not clear at all. The morphology of the thallus is considered very plastic under several environmental conditions (HARRIS 1962) and until now the application of names have been confused.

The genus *Callithamnion* have been studied in many localities under different aspects (ROSENINGE 1924; MATHIAS 1927; BODDEKE 1958; HARRIS 1962 & 1966; EDWARDS 1969 & 1979; WHITTICK 1978; PRICE 1978; DIXON & PRICE 1981). However, the available information about the *Callithamnion* from the Canary Islands was limited to records of occurrence.

Until the critical assessment of PRICE et al. (1986) about the seaweeds of the western coast of tropical Africa and adjacent islands, where the *Callithamnion* are treated, seven species of this genus have been recorded from the Canary Islands:

- C. byssoides* ARNOTT ex HARVEY in HOOKER
- C. corymbosum* (J.E. SMITH) LYNGBYE
- C. ellipticum* MONTAGNE
- C. gallicum* NAGELI
- C. granulatum* (DUCLUZEAU) C. AGARDH
- C. hookeri* (DILLWYN) S.F. GRAY
- C. tetragonum* (WITHERING) S.F. GRAY

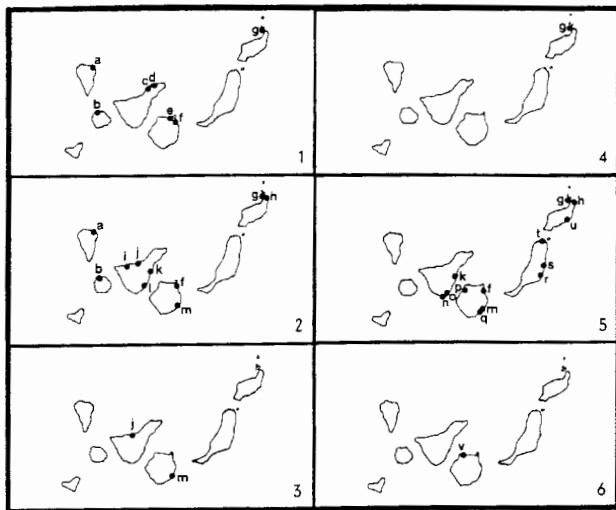
Later, MORALES-AYALA & VIERA-RODRIGUEZ (1988) collected *Callithamnion neglectum* (FELDMANN-MAZOYER) WYNNE and SANSON et al. (1991) reported *Callithamnion decompositum* J. AGARDH from the Canary Islands.

The present paper was designed to provide a critical revision of the genus *Callithamnion* in the Canary Islands as well as to propose a provisional key to the Canarian species.

Material and methods

Data were obtained from plants collected in intertidal pools of different localities in the Canary Islands and deposited at TFC (Department of Vegetal Biology, University of La Laguna, Canary Islands) and from the literature.

The fresh samples were studied before and after fixation in 4% formalin in sea-water and mounted in 20% aqueous 'Karo' dextrose for permanent slides.



Figs 1-6. Distribution of *Callithamnion*-species. 1: *C. byssoides*; 2: *C. corymbosum*; 3: *C. granulatum*; 4: *C. hookeri*; 5: *C. tetragonum*; 6: *C. neglectum*.

Localities: a: Fajana de Barlovento (La Palma). b: Los Organos (Gomera). c: El Prís (Tenerife). d: Valle Guerra (Tenerife). e: Las Canteras (G. Canaria). f: Playa Sta. Catalina (G. Canaria). g: La Graciosa (Lanzarote). h: Orzola (Lanzarote). i: Garachico (Tenerife). j: Puerto de la Cruz (Tenerife). k: Güímar (Tenerife). l: Los Abriguitos (Tenerife). m: Arinaga (G. Canaria). n: El Médano (Tenerife). o: Pta. Rasca (Tenerife). p: Pto. de las Nieves (G. Canaria). q: Los Balillos (G. Canaria). r: Pozo Negro (Fuerteventura). s: Castillo de Fuste (Fuerteventura). t: Corralejo (Fuerteventura). u: Las Caletas (Lanzarote). v: Gáldar (G. Canaria).

Results and discussion

It was pointed out previously that nine species of *Callithamnion* have been reported from the Canary Islands (see PRICE et al. 1986; MORALES-AYALA & VIERA-RODRIGUEZ 1988; SANSON et al. 1991).

However, three of these are probably confused records. *C. ellipticum* was recorded by MONTAGNE (1841) with some doubts, suggesting the relationship between this species and *C. spongiosum* HARVEY. According to PRICE et al. (1986), MONTAGNE's plants resembles a modified *C. granulatum* plant. Besides, no locality for this species was mentioned by him (BOERGESEN 1930). After MONTAGNE (1841), *C. ellipticum* have not been recorded from this archipelago. Likewise, the *C. gallicum* record from the Canary Islands is mixed up. SAUVAGEAU collected a few small specimens that referred to this species in Orotava (Tenerife) and Mlle VICKERS referred a plant collected in Gran Canaria to "*C. gallicum*?" (BOERGESEN 1930). Later, *C. gallicum* have not been collected in the Canary Islands.

C. granulatum (Figs 3, 10, 11) was collected in Gran Canaria (DELGADO et al. 1986) and once in Tenerife (GIL-RODRIGUEZ 1980). According to PRICE et al. (1986) and our own observations, is singular that there were so few records of this species from the Canary Islands. In similar mediterranean conditions *C. granulatum* is common. Nevertheless, although

FELDMANN-MAZOYER (1940), FELDMANN (1942) and GAYRAL (1958) included the Canary Islands in the distribution area of this species, the presence of *C. granulatum* in this archipelago is uncertain.

On the contrary, the other six species of *Callithamnion* have been collected more recently:

C. byssoides (Fig. 1) have been reported from La Palma (GIL-RODRIGUEZ et al. 1985), Gomera (HAROUN-TABRAUE et al. 1984), Gran Canaria (BOERGESEN 1930; WEISSCHER et al. 1985; JORGE et al. 1986) and La Graciosa (VIERA-RODRIGUEZ 1985). Only two specimens of this species were collected in Tenerife (TFC Phyc. n^o 4047, 4101).

C. corymbosum (Fig. 2) have been collected in La Palma (GIL-RODRIGUEZ et al. 1985), Gomera (HAROUN-TABRAUE et al. 1984), Tenerife (LOPEZ-HERNANDEZ & GIL-RODRIGUEZ 1982), Gran Canaria (VICKERS 1896; BOERGESEN 1930; DELGADO et al. 1986), Lanzarote (GIL-RODRIGUEZ et al. 1985) and La Graciosa (VIERA-RODRIGUEZ 1985).

Recent collections in Tenerife have shown that specimens of this species are relatively common in intertidal pools of exposed localities, i.e. Puerto de la Cruz.

C. hookeri (Fig. 4) was recorded for the first time from the Canary Islands in La Graciosa (VIERA-RODRIGUEZ 1985). However, DIXON & PRICE (1981), LAWSON & JOHN (1982), ARDRE [1970, as *Aglaothamnion scopulorum* (C. AGARDH) G. FELDMANN] and GAYRAL [1966, as *Aglaothamnion scopulorum* (J. AGARDH) G. FELDMANN] included the Canary Islands in the distribution area of this species. In recent collections from Tenerife this species have not been found.

C. tetragonum (Fig. 5) have been collected in Tenerife (AFONSO-CARRILLO et al. 1979; LOPEZ-HERNANDEZ & GIL-RODRIGUEZ 1982), Gran Canaria (BOERGESEN 1930; DELGADO et al. 1986; JORGE et al. 1986), Fuerteventura (AFONSO-CARRILLO & GIL-RODRIGUEZ 1980), Lanzarote (GIL-RODRIGUEZ & AFONSO-CARRILLO 1980) and La Graciosa (VIERA-RODRIGUEZ 1985).

C. neglectum (see WYNNE 1986) (Fig. 6) have been recently found in the Canary Islands (Gran Canaria) for the first time (MORALES-AYALA & VIERA-RODRIGUEZ 1988). Until now, this species have not been collected in the rest of the archipelago.

Finally, *C. decompositum* was also recently collected at Puerto de la Cruz (Tenerife, Canary Islands) for the first time (SANSON et al. 1991).

According to HARRIS (1962) and DIXON & PRICE (1981), there are many features too plastic to be utilized for separating species in *Callithamnion*. Nevertheless, HARRIS (1962) proposed another characters sufficiently non-plastic to be used:

1. number of nuclei in mature cells,
2. number of branches in spermatangiophore,
3. number of cells in spermatangiophore branches,
4. shape of carpogonial branch,
5. length of cells,
6. number of tetrasporangia on each cell,
7. shape of chromoplast masses,
8. origin of laterals,
9. shape of gonimolobes on first-formed gonimoblast,
10. length of gonimoblasts,
11. relative rate of growth of laterals.

However, some of these features are ephemeral and others variable in the Canarian material (i.e. length of cells).

The following provisional key (adapted from DIXON & PRICE 1981) establish the main features to segregate the Canary Islands species; nevertheless, further studies are needed in order to propose a definitive key of the Canarian species of *Callithamnion*.

Provisional key for the genus *Callithamnion* on the Canary Islands

- 1 Laterals of limited growth not overtopping the axis on which they arise 5
- 1* Laterals of limited growth overtopping bearing axis 2
- 2 Protuberances of lateral ramuli arising from the first product of a principal apical cell 3
- 2* Protuberances of lateral ramuli arising on or after the second product of a principal apical cell *C. byssoides*
- 3 Apical cells of limited growth ramuli rounded terminally, sometimes finish off in a long hyaline hair 4
- 3* Apical cells of limited growth ramuli very small and conical *C. tetragonum* (Figs 7-8)
- 4 Cell lengths not exceeding 5 x breath in any part of the thallus *C. hookeri*
- 4* Cell lengths exceeding 5 x breath in axes and principal lateral branches *C. corymbosum* (Fig. 9)
- 5 Apical organization always complanate; the lower two cells of primary laterals with adaxial branches *C. decompositum*
- 5* Apical organization alternate-spiral or irregular; the lower two cells of primary laterals with alternate branches *C. hookeri*

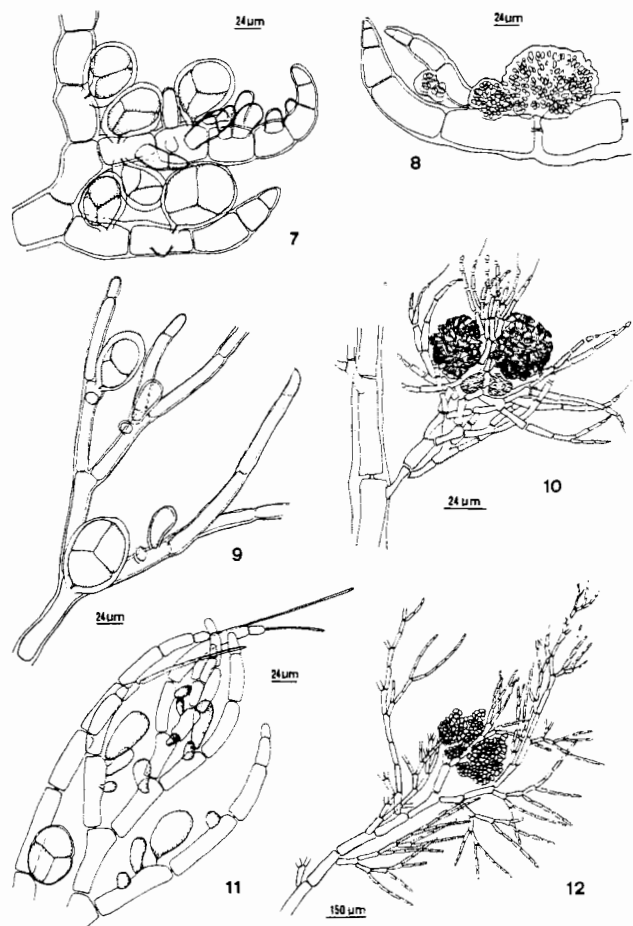
C. neglectum (Fig. 12) have not been included in this key because of the lack of sufficient data about the specimens from the Canary Islands. Only once have been collected from the archipelago (MORALES-AYALA & VIERA-RODRIGUEZ 1988).

Summary

After a critical revision of the records of the *Callithamnion* species from the Canary Islands as well as the study of new material, the presence of six species of this genus is confirmed: *C. byssoides*, *C. corymbosum*, *C. decompositum*, *C. hookeri*, *C. tetragonum* and *C. neglectum*. However, three of the previously reported species have probably been confused (*C. granulatum*, *C. ellipticum* and *C. gallicum*). A provisional key to identify the Canarian species is given.

Acknowledgements

We thank J. REYES for his help.



Figs 7-12. Details of *Callithamnion*-species from the Canary Islands. 7: Arrangement of tetrasporangia in *C. tetragonum*; 8: Spermatangia in *C. tetragonum*; 9: Tetrasporangia in *C. corymbosum*; 10: Mature carposporophyte in *C. granulatum*; 11: Tetrasporangia in *C. granulatum*; 12: Mature carposporophyte in *C. neglectum*.

References

AFONSO-CARRILLO, J. & GIL-RODRIGUEZ, M.C. (1980): Datos para la flora marina de la Isla de Fuerteventura. - *Vieraea*, 10 (1-2): 147-170; Santa Cruz de Tenerife.

AFONSO-CARRILLO, J. & WILDPRET DE LA TORRE, W. (1979): Estudio de la vegetación algal de la costa del futuro polígono industrial de Granadilla (Tenerife). - *Vieraea*, 8 (1): 201-242; Santa Cruz de Tenerife.

ARDRE, F. (1970): Contribution à l'étude des algues marines du Portugal I. La Flore. - *Port. Acta Biol.*, (B) 10: 137-555, pl. 1- 56; Lisboa.

BODDEKE, R. (1958): The genus *Callithamnion* LYNGB. in the Netherlands. A taxonomic and oecological study. - *Acta bot. neerl.*, 7: 589-604; Amsterdam.

BOERGENSEN, F. (1930): Marine algae from the Canary Islands especially from Teneriffe and Gran Canaria III. Rhodophyceae Part III Ceramiales. - *Biol. Meddr.*, 9 (1): 1-159; Copenhagen.

- DELGADO, E., GONZALEZ, M.N. & JORGE, D. (1986): Contribución al estudio de la vegetación ficológica de la zona de Arinaga (Gran Canaria). - Bot. Macaron., 12-13: 97-110; Las Palmas de Gran Canaria.
- DIXON, P.S. & PRICE, J.H. (1981): The genus *Callithamnion* (Rhodophyta: Ceramiaceae) in the British Isles. - Bull. Br. Mus. nat. Hist., (Bot.) 9: 99-141; London.
- EDWARDS, P. (1969): The life history of *Callithamnion byssoides* in culture. - J. Phycol., 5: 266-268; Kansas.
- - - (1979): A cultural assessment of the distribution of *Callithamnion hookeri* (DILLW.) S.F. GRAY (Rhodophyta, Ceramiales) in nature. - Phycologia, 18: 251-263; Oxford.
- FELDMANN-MAZOYER, G. (1940): Recherches sur les Céramiacées de la Méditerranée Occidentale. - 510 pp. + 4 pl.; Imprimerie Minerva, Algiers.
- FELDMANN, J. (1942): Les algues marines de la Côte des Albères. IV. Rhodophycées. - Trav. Algol., 1: 29-113; Paris.
- GAYRAL, P. (1958): Algues de la côte atlantique marocaine. - La nature au Maroc, 2: 1-523; Rabat.
- - - (1966): Les algues des côtes Françaises (Manche et Atlantique). Notions fondamentales sur l'écologie, la biologie et la systematique des algues marines. - 632 pp.; Ed. Doin-Deren & Cie; Paris.
- GIL-RODRIGUEZ, M.C. & AFONSO-CARRILLO, J. (1980): Adiciones a la flora marina y catálogo ficológico para la Isla de Lanzarote. - Vieraea, 10 (1-2): 59-70; Santa Cruz de Tenerife.
- GIL-RODRIGUEZ, M.C., HAROUN-TABRAUE, R.J., AFONSO-CARRILLO, J. & WILDPRET DE LA TORRE, W. (1985): Adiciones al catálogo de algas marinas bentónicas para el Archipiélago Canario. II. - Vieraea, 15 (1-2): 101-112; Santa Cruz de Tenerife.
- HAROUN-TABRAUE, R.J., GIL-RODRIGUEZ, M.C., AFONSO-CARRILLO, J. & WILDPRET DE LA TORRE, W. (1984): Estudio del fitobentos del Roque de los Organos (Gomera). Catálogo florístico. - Vieraea, 13: 259-276; Santa Cruz de Tenerife.
- HARRIS, R.E. (1962): Contribution to the taxonomy of *Callithamnion* LYNGBYE emend. NAEGELI. - Bot. Notiser, 115: 18-28; Lund.
- - - (1966): Contribution to the genus *Callithamnion* LYNGBYE emend. NAEGELI: taxonomy of the species indigenous to the British Isles. - Adv. Front. Pl. Sci., 14: 109-131.
- JORGE, D., GONZALEZ, M.N. & DELGADO, E. (1986): Macrofitobentos del litoral del Puerto de las Nieves (Gran Canaria). - Bot. Macaron., 12-13: 111-122; Las Palmas de Gran Canaria.
- LAWSON, G.W. & JOHN, D.M. (1982): The marine algae and coastal environment of tropical West Africa. - Beih. Nova Hedwigia, 70: 276-281; Vaduz.
- LOPEZ-HERNANDEZ, M. & GIL-RODRIGUEZ, M.C. (1982): Estudio de la vegetación ficológica del litoral comprendido entre Cabeza del Socorro y Montaña del Mar, Güimar, Tenerife. - Vieraea, 11: 141-170; Santa Cruz de Tenerife.
- MATHIAS, W.T. (1927): The cytology of *Callithamnion*. - Rep. Br. Ass. Advmt Sci., 1927 (95): 380 pp.
- MONTAGNE, C. (1841): Plantes cellulaires. - In: BARKER-WEBB, P. & BERTHELOT, S., Histoire Naturelle des Iles Canaries, ..., Phytographia Canariensis, Sectio ultima, 3 (2): I-XV+[1]+1-208; Paris.
- MORALES-AYALA, M.S. & VIERA-RODRIGUEZ, M.A. (1990): Adiciones al catálogo de las algas marinas bentónicas para el Archipiélago Canario. IV. - Vieraea, 18: 189-192.
- PRICE, J.H. (1978): Ecological determination of adult form in *Callithamnion*: its taxonomic implications. - In: IRVINE, D.E.G. & PRICE, J.H. (eds): Modern approaches to the taxonomy of red and brown algae. - Systematics Association Special Volume 10: 263-300; London.
- PRICE, J.H., JOHN, D.M. & LAWSON, G.W. (1986): Seaweeds of the western coast of tropical African and adjacent islands: a critical assessment. IV: Rhodophyta (Florideae), 1. Genera A-F. - Bull. Br. Mus. nat. Hist., (Bot.) 15 (1): 1-122; London.
- ROSENINGE, L.K. (1924): The Marine Algae of Denmark. Contributions to their Natural History. Part 3 Rhodophyceae 3 (Ceramiales). - K. Danske Vidensk. Selsk. Skr., (7) 7: 285-486; Copenhagen.
- SANSON, M., REYES, J. & AFONSO-CARRILLO, J. (1991): Contribution to the Seaweed Flora of the Canary Islands: New records of Florideophyceae. - Bot. Mar. 34: 527-536.
- VICKERS, A. (1896): Contribution à la flore algologique des Canaries. - Annals Sci. nat., (Bot.) 8 [VIII] (4): 293-306.
- VIERA-RODRIGUEZ, M.A. (1985): Flórlula y Vegetación bentónica de la Isla de la Graciosa. Canarias. - Tesis Doctoral (unpublic.). Univ. La Laguna, 268 pp. + 45 Láms; Santa Cruz de Tenerife.
- WEISSCHER, F.C.M., PRUD'HOMME VAN REINE, W.F. & DUINEVELD, G.C.A. (1985): Marine algal vegetation of Bahia del Confital near Las Palmas de Gran Canaria. Unpublished manuscript [from PRUD'HOMME VAN REINE] on the results of the Netherlands CANCAP Expeditions to the Canarias and Salvaje Islands.
- WHITTICK, A. (1978): The life history and phenology of *Callithamnion corymbosum* (Rhodophyta: Ceramiaceae) in Newfoundland. - Can. J. Bot., 56: 2497-2499; Canada.
- WYNNE, M.J. (1986): A checklist of benthic marine algae of the tropical and subtropical western Atlantic. - Can. J. Bot., 64: 2239-2281; Canada.

The authors' address

M. SANSON and M.C. GIL-RODRIGUEZ, Departamento de Biología Vegetal, Universidad de La Laguna, E-38271 La Laguna, Islas Canarias, España.