

## Contribution to the Seaweed Flora of the Canary Islands: New Records of Florideophyceae

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### Abstract

Seven species of Florideophyceae are reported from the Canary Islands for the first time: *Predaea huismanii* Kraft, *Platysiphonia caribaea* Ballantine *et Wynne*, *Jania longifurca* Zanardini, *Spermothamnion flabellatum* Bornet, *Callithamnion decompositum* J. Agardh, *Helminthocladia agardhiana* Dixon and *Rissoella verruculosa* (Bertolini) J. Agardh. Data concerning ecological conditions, geographical distribution, morphology, anatomy and phenology are presented. Observations on *Platysiphonia miniata* (C. Agardh) Børgesen which has previously only been reported once from the Canary Islands, are also given.

### Introduction

Afonso-Carrillo and Gil-Rodríguez (1982) have shown that the Canary Islands have a seaweed flora comprised of species with different biogeographical distribution patterns: Atlantic-American, Atlantic-European, Mediterranean and Atlantic-African (Feldmann 1946).

The first general account of the marine algae of the Canary Islands was given by Børgesen (1925–30), who recorded 369 species. These records were mainly from the intertidal zone of two localities (Puerto Ortava in Tenerife and near Las Palmas in Gran Canaria) during the winter of 1920–21. Later, Gil-Rodríguez and Afonso-Carrillo (1980) published a checklist increasing the number of benthic marine algae to 434 known species. Further studies (Afonso-Carrillo *et al.* 1984, Gil-Rodríguez *et al.* 1985, Viera-Rodríguez *et al.* 1987, Afonso-Carrillo 1988, 1989, Afonso-Carrillo and Sansón 1989) have increased the known flora to 461 species (93 Chlorophyta, 79 Phaeophyta, 264 Rhodophyta and 22 Cyanophyta). The present work adds seven species of Florideophyceae to the flora.

### Material and Methods

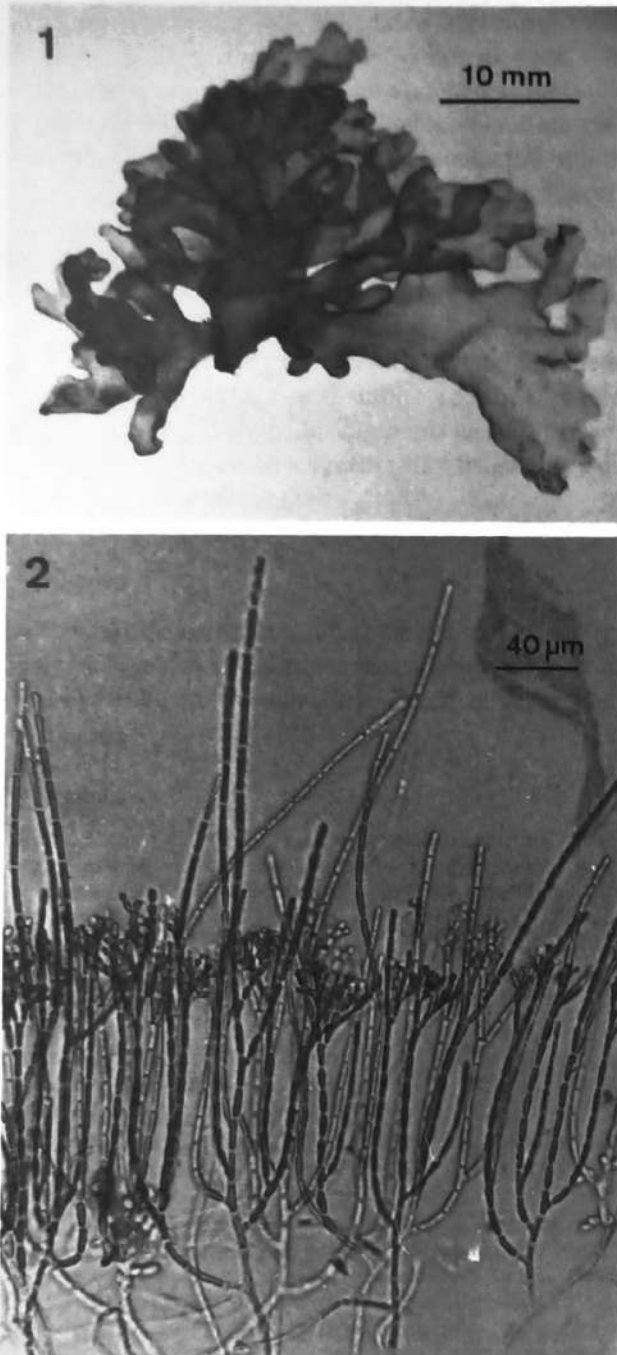
Specimens were collected between 1985 and 1990 at several localities in Tenerife and Lanzarote and were

deposited at TFC (Departamento de Biología Vegetal, Botánica, Universidad de La Laguna, Canary Islands). Permanent slides for anatomical studies were prepared from specimens preserved in 4% formalin in sea water, sectioned by hand with a razor blade and mounted in 20% aqueous 'Karo' dextrose. Camera lucida drawings and photomicrographs were obtained with the use of a Zeiss microscope. *Jania longifurca* Zanardini specimens were studied by scanning electron microscopy procedures as outlined in Afonso-Carrillo *et al.* (1984 b). Selected dried fragments were sectioned and rinsed under distilled water. After air drying, fragments were coated with gold and viewed with a Hitachi S-450 Stereoscan Microscope.

### Results and Discussion

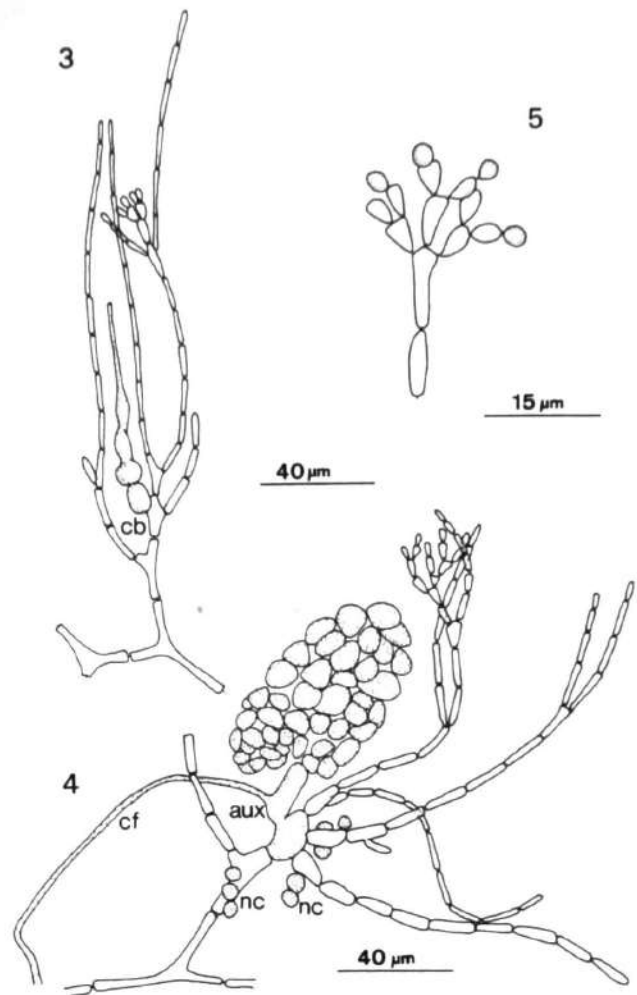
#### 1. *Predaea huismanii* Kraft (Figs 1–5)

The genus *Predaea* (Nemastomaceae) was described by De Toni (1936) and includes generally gelatinous species distinguished by features including habit, shape of outer cortical cells, presence or absence of gland cells, site of origin of the gonimoblast, number of carpogonial branch cells and number of nutritive cells on cells adjacent to auxiliary cells. According to Verlaque (1990), thirteen species of *Predaea* are known from tropical, subtropical and warm temper-



Figs 1–2. *Predaea huismanii* Kraft.  
Fig. 1. Habit. Fig. 2. Transverse section of the plant showing exserted assimilatory cortical filaments.

ate regions of the Northern and Southern Hemispheres. According to Kajimura (1987), only three of these species have been reported from the Atlantic Ocean: *Predaea feldmanii* Børgesen from St. Helena I., North Carolina, Venezuela and Ghana; *P. weldii*



Figs 3–5. *Predaea huismanii* Kraft.  
Fig. 3. Cortical filaments showing a 3-celled carpogonial branch (cb). Fig. 4. Mature carposporophyte. Note the small chains of nutritive cells (nc) and the lateral point of fusion of the connecting filament (cf) to the auxiliary cell (aux). Fig. 5. Spermatangia terminal on distichous pinnae.

Kraft *et* Abbott from Hawaii, Australia and Venezuela and *P. masonii* De Toni from Clarion I., Pacific and Atlantic Mexico, North Carolina and Ghana.

Plants collected in the Canary Islands (Fig. 1) have assimilatory filaments which are variable in length and exserted (Fig. 2), resulting in the hairy texture of the thallus. The Canarian plants agree with the description of *P. huismanii* Kraft (Kraft 1984) from Australia, the only known locality for this species. Plants are characterized by

(a) 3-celled carpogonial branches,

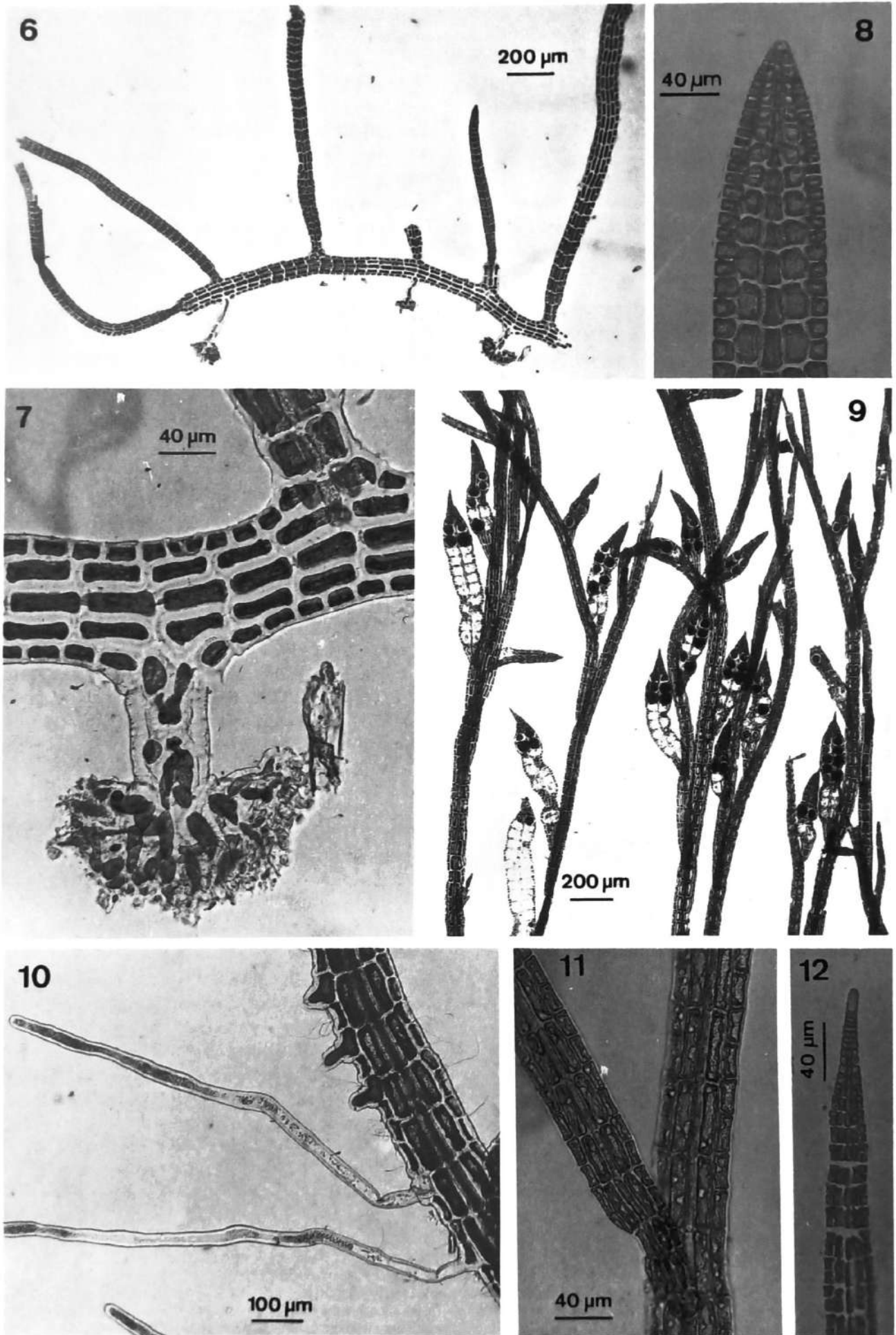
Figs 6–12.

Figs 6–8. *Platysiphonia caribaea* Ballantine *et* Wynne.

Fig. 6. Habit. Fig. 7. Detail of a multicellular rhizoid and the origin of an erect branch. Note the origin of the rhizoid from flanking cells and the endogenous origin of the branch. Fig. 8. Apical region of an erect branch.

Figs 9–12. *Platysiphonia miniata* (C. Agardh) Børgesen.

Fig. 9. General aspect of erect branches showing numerous tetrasporangial stichidia. Fig. 10. Detail of unicellular rhizoids. Fig. 11. Lateral branch arising from the distal end of a central cell. Fig. 12. Apical region of an erect branch.



(b) nutritive cells single or in small chains of 2–3 cells (Fig. 4),

(c) up to 2 clusters of nutritive cells on the proximal and two distal cells adjacent to the auxiliary cell (Fig. 4) and

(d) distichous spermatangial pinnae (Fig. 5).

The presence of nutritive cell clusters on cells adjacent to the auxiliary cell separate this species from the rather similar *Nemastoma confusum* Kraft *et* John (Kraft and John 1976).

*Predaea huismanii* was collected at Las Teresitas, a sheltered locality in E Tenerife, growing at 1–3 m depth, on an anchor rope over a sandy bottom. Carposporangial and spermatangial plants were collected in June–July [TFC (Phyc) 5703]. Tetrasporangia were not observed.

## 2. *Platysiphonia caribaea* Ballantine *et* Wynne (Figs 6–8)

Eleven species of *Platysiphonia* Børgesen (Delesseriaceae) are known world wide (Ballantine and Wynne 1985) with only two species, *P. miniata* (C. Agardh) Børgesen and *P. caribaea*, previously reported from the Northern Atlantic. *Platysiphonia caribaea* was recently described from the Western Caribbean (Ballantine and Wynne 1985) and only recorded from Puerto Rico, Belize and Mexico. Sterile plants collected in the Canary Islands (Fig. 6) agree with the description given by Ballantine and Wynne. The plants possess postrate axes attached by multicellular rhizoids originating from both flanking cells, ending in a digitate disc (Fig. 7). Unramified erect branches arise endogenously from the proximal end of a central cell of the postrate axes (Fig. 7). The apical cells of erect branches are small, 14–15 µm wide and hemispherical (Fig. 8). Apices associated with blade regeneration are evident (Fig. 6).

*Platysiphonia caribaea* was collected at Orzola, a semiexposed locality at NNE of Lanzarote, growing in tide pools mixed with other caespitose species [TFC (Phyc) 5704]. Previously it is only known from deep reef environments in the Caribbean (Ballantine and Wynne 1985).

## 3. *Platysiphonia miniata* (C. Agardh) Børgesen (Figs 9–12)

*Platysiphonia miniata* is a widespread species originally described from the south of Spain and later reported from India, Western and Southern Africa, Australia, Brazil and Puerto Rico (Ballantine and Wynne 1985). Weisscher (1983) recorded this species from the Salvage Islands and Audiffred (1985) from El Hierro (Canary Islands), Morocco and Mauretania.

Based on the account in Ballantine and Wynne (1985), *P. miniata* (Figs 9–12) is differentiated from *P. caribaea* primarily on the basis of the lateral branches which arise from the distal end of a central axial cell (Fig. 11).

*Platysiphonia miniata* was collected at Punta del Hidalgo, a semiexposed locality in NE Tenerife, growing in tide pools mixed with other caespitose Rhodomelaceae species as an epiphyte of *Galaxaura rugosa* (Ellis *et* Solander) Lamouroux. Tetrasporic plants were collected in January [TFC (Phyc) 5705].

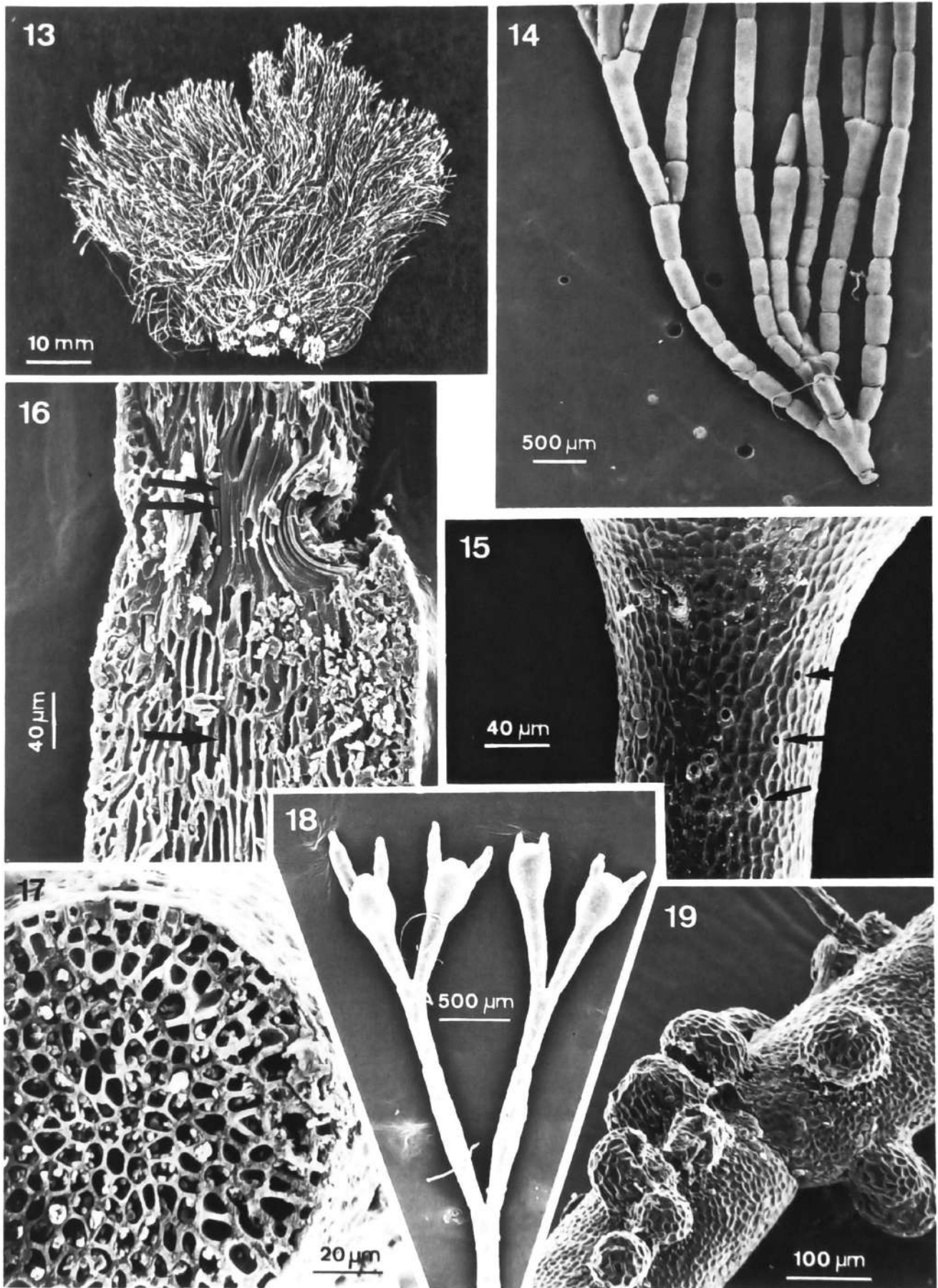
## 4. *Jania longifurca* Zanardini (Figs 13–19)

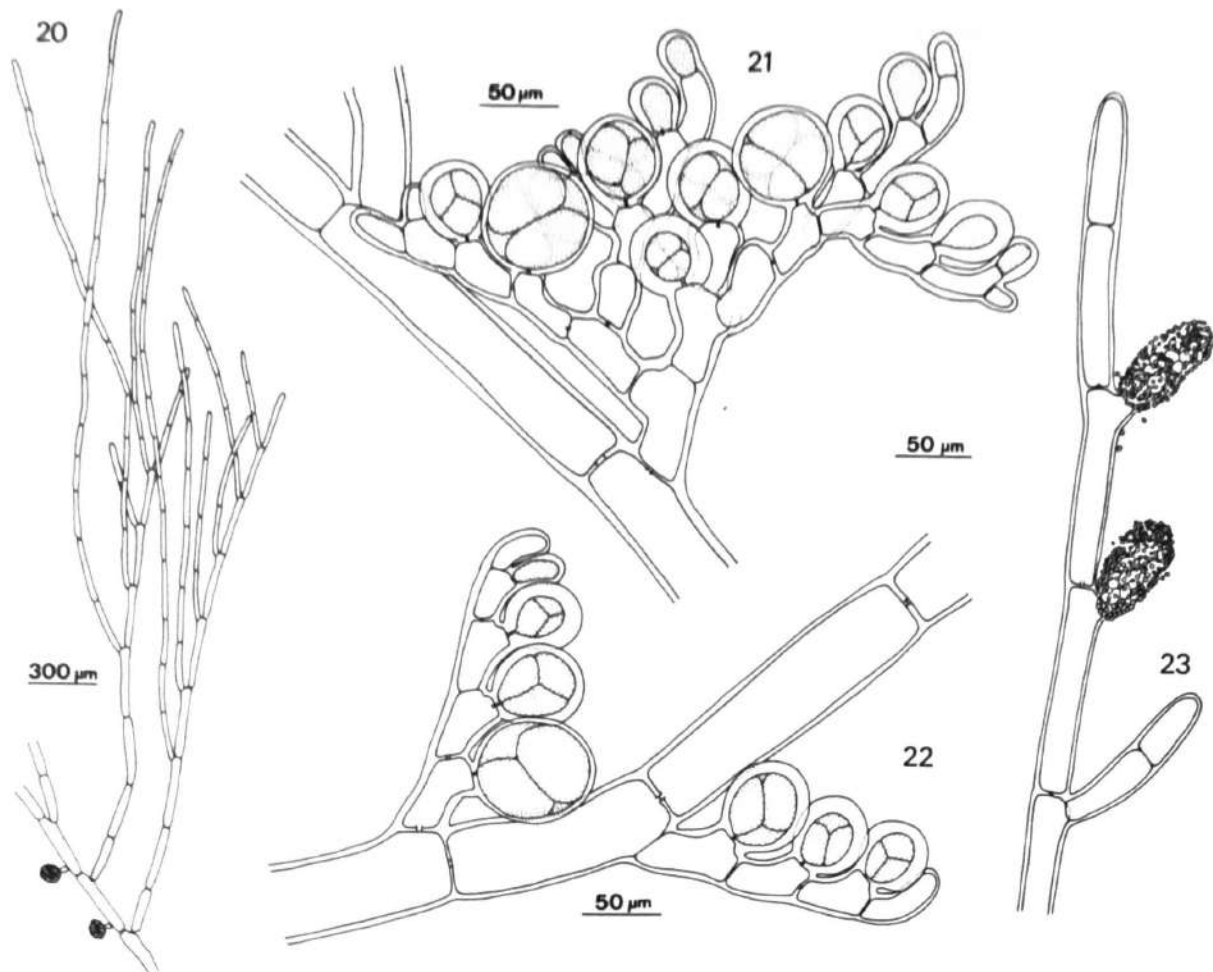
*Jania longifurca* (Corallinaceae) has been frequently reported from the Mediterranean Sea (Hamel and Lemoine 1953, Giaccone 1978, Athanasiadis 1987), the European Atlantic coast, from Roscoff (France) to Mauretania (Lemoine 1924, Ardré 1970) and Madeira (Levring 1974).

According to Lemoine (1924), Hamel and Lemoine (1953) and Bressan (1974), among species of *Jania* reported from the Eastern North Atlantic, *J. longifurca* is easily distinguished by intergenicula up to 400 µm diam. and genicular cells considerably longer than intergenicular cells. Nevertheless, *J. longifurca* is a poorly known species in need of further study. Some vegetative features of plants collected in the Canary Islands were studied with SEM. *Jania longifurca* forms erect branches raising from an extensive crust (Fig. 13), with narrow branching angles, intergenicula 200–400 µm diam., mainly at the basal region of the plant (Fig. 14). Intergenicula surfaces (Fig. 15) show elongate polygonal cells called *Jania*-type by Garbary and Johansen (1982) and trichocyte bases are rounded

Figs 13–19. *Jania longifurca* Zanardini.

Fig. 13. Habit of a group of plants arising from a basal crust. Fig. 14. SEM. Aspect of the intergenicula at the basal portion. Fig. 15. SEM. Surface of intergenicula showing the *Jania*-type surface and the trichocytes (arrows) *Corallina*-type. Fig. 16. SEM. Longitudinal fracture of a branch showing intergenicular medullary cells (arrow) and genicular cells (double arrow). Fig. 17. SEM. Intergenicular transverse fracture showing thin walled medullary cells containing numerous grains of floridean starch. Fig. 18. SEM. Surface view of terminal branches showing tetrasporangial conceptacles. Fig. 19. SEM. Intergenicula infected by *Choreonema thuretii*.





Figs 20–23. *Spermotheramnion flabellatum* Bornet.

Fig. 20. Habit. Figs 21–22. Tetrasporangia placed on the adaxial side of special branches. Note the older tetrasporangia at the proximal portion of the branches. Fig. 23. Spermatangial heads.

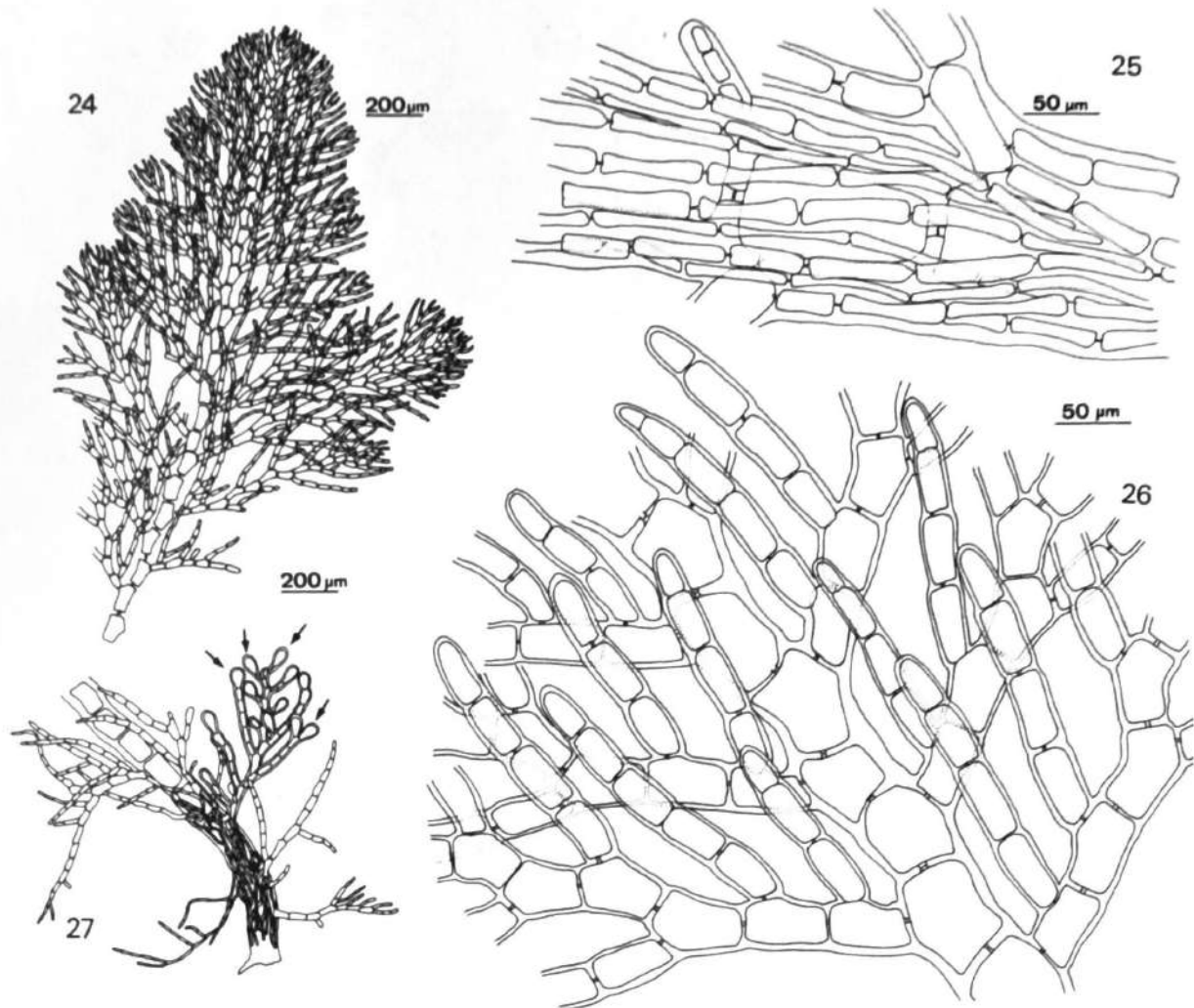
as in *Corallina*-type (Garbary and Johansen 1982). Longitudinal fractures of branches show intergeniculate medullary cells, 40–60 µm long, and longer geniculate cells, 100–120 µm (Fig. 16). Intergeniculate transverse fractures show thin walled medullary cells containing numerous floridean starch grains and thick walled cortical cells (Fig. 17). Only tetrasporangial conceptacles, 360–480 µm outer diam., were observed (Fig. 18). Among *Jania* species, *J. longifurca* may be characterized as possessing several vegetative features previously reported as typical of *Corallina*: geniculate cells relatively much longer than intergeniculate cells, extensive crusts and *Corallina*-type trichocytes (Johansen and Silva 1978, Garbary and Johansen 1982). Nevertheless, other vegetative features such as strictly dichotomous branching, intergeniculate surfaces of the *Jania*-type and infection by *Choreonema thuretii* (Bornet) Schmitz (Fig. 19) are typical of *Jania*.

*Jania longifurca* was collected in tide pools at Playa de los Patos, an exposed locality in N Tenerife [TFC (Phyc) 5610].

5. *Spermotheramnion flabellatum* Bornet in Bornet *et* Thuret (Figs 21–23)

*Spermotheramnion flabellatum* (Ceramiaceae) has been commonly reported from the Mediterranean Sea (Feldmann-Mazoyer 1941, Athanasiadis 1987). Gallardo *et al.* (1985) have recently reported it from the Atlantic coast of Spain as well.

Plants examined agree with previous accounts of the species. Thalli reach up to 0.7 cm in height and grow attached to utricles of *Codium* by short rhizoids ending in a digitate disc. The rhizoids originate at the distal end of the postrate axial cells (Fig. 20). Tetrasporangia are placed adaxially on specialized short branches or occasionally are terminal on short stalks (Fig. 21). The older tetrasporangia were observed towards the branch base (Fig. 22), in contrast to that observed by Feldmann-Mazoyer (1941). Spermatangial heads are elongated and sessile on the adaxial side of erect branches (Fig. 23). Female plants were not observed.



Figs 24–27 *Callithamnion decompositum* J. Agardh.

Fig. 24 Habit. Fig. 25. Dense basal cortication. Fig. 26. Detail of the branching showing consecutive adaxial branching by two adjacent branchlets. Fig. 27. Inflated hyaline cells (arrows) grouped on a special lateral branch.

*Spermothamnion flabellatum* was collected at Orzola, Lanzarote, growing on *Codium bursa* (L.) C. Agardh in tide pools [TFC (Phyc) 5705].

6. *Callithamnion decompositum* J. Agardh (Figs 24–26)

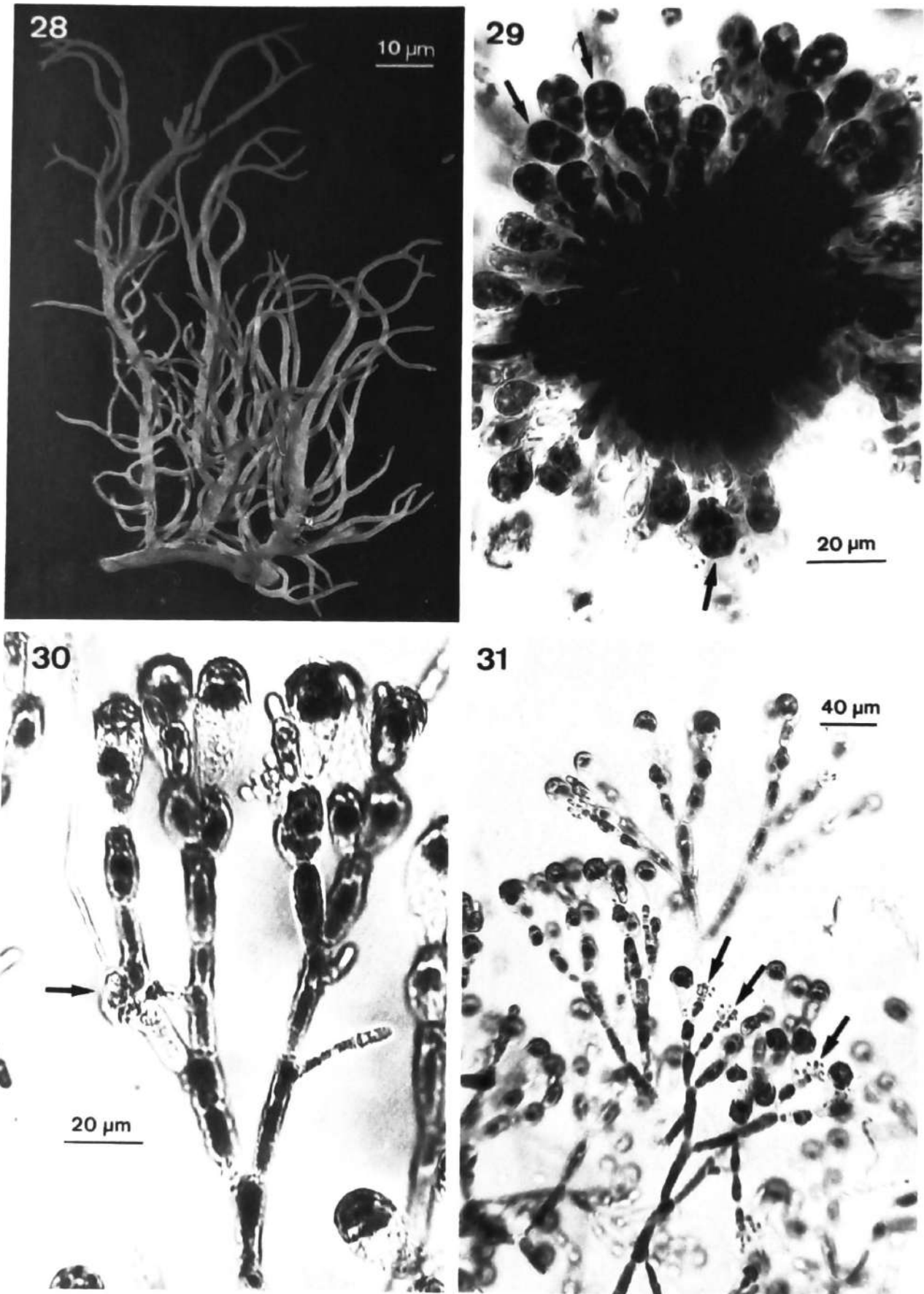
*Callithamnion decompositum* (Ceramiaceae) has been recorded from the Eastern North Atlantic from the Faroes to Senegal (Dixon and Price 1981). Although the range of morphological expression of *C. decompositum* is not clearly elucidated yet, the specimens from the Canary Islands (Fig. 24) agree with the accounts of Halos (1965), as *Aglaothamnion*, and Dixon and Price (1981). It differs from *C. tripinnatum* C. Agardh in its greater cell dimensions, dense basal cortication (Fig. 25) and consecutive adaxial branching on the basal-most two cells of lateral branches (Fig. 26). Apical organization is always complanate, a feature that clearly segregates it from *C. hookeri* (Dillwyn) S. F. Gray (see Dixon and Price 1981).

Terminal inflated pear-shaped hyaline cells, up to 85 µm long and 45 µm wide, which are grouped on special lateral branches (Fig. 27) are very commonly produced. They were observed both in carposporangial and tetrasporangial plants and appear different from parasporangia reported by Halos (1965, Figs 2E, 3C).

*Callithamnion decompositum* was collected at Puerto de la Cruz, N Tenerife, growing in an exposed tide pool. Tetrasporangial, carposporangial and spermatangial plants were collected in May–June [TFC (Phyc) 5707].

7. *Helminthocladia agardhiana* Dixon (Figs 28–31)

Dixon (1962) proposed the name *H. agardhiana* Dixon (Helminthocladaceae) as a substitute for *H. hudsonii* (C. Agardh) J. Agardh because the specimen collected by J. Agardh from Tangier was not conspecific with that to which the basionym *Mesogloia hud-*



Figs 28–31. *Helminthocladia agardhiana* Dixon.

Fig. 28. Habit. Fig. 29. Aspect of carposporophyte showing carpotetrasporangia (arrows). Fig. 30. Cortical filaments with a carpopogonial branch (arrow). Fig. 31. Spermatangial groups terminal on cortical filaments (arrows).



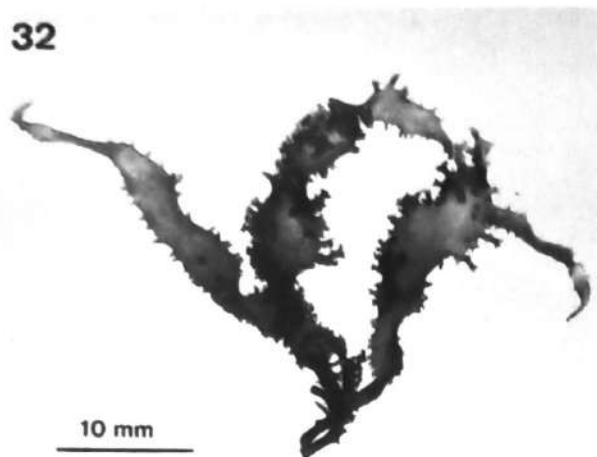


Fig. 32. *Rissoella verruculosa* (Bertolini) J. Agardh. Habit.

*sonii* C. Agardh was applied. *Helminthocladia agardhiana* is restricted to Morocco (Dangeard 1949), the Mediterranean Sea (Giaccone and Bressan 1973) and the Atlantic coasts of Spain (Gallardo *et al.* 1985).

The Canarian material (Fig. 28) is in good agreement with previous accounts of this taxon (Feldmann 1939; Bodard 1971; Dixon 1962). According to Bodard (1971), amongst the species of *Helminthocladia* only *H. agardhiana* and *H. senegalensis* Bodard have carpotetrasporangia (Fig. 29). In *H. agardhiana*, gonimoblasts lack involucre cells (Fig. 29), a feature that clearly segregates this species from *H. senegalensis*.

*Helminthocladia agardhiana* was collected at El Mé-dano, a sheltered locality in S. Tenerife, growing epilithic at 1–3 m depth, occasionally epiphyte on *Cymodocea nodosa* (Ucria) Ascherson. Cystocarpic (Fig. 30), carpotetrasporic (Fig. 29) and spermatangial plants (Fig. 31) were collected in May–June [TFC (Phyc) 5708].

8. *Rissoella verruculosa* (Bertolini) J. Agardh (Fig. 32).

*Rissoella verruculosa* (Rissoellaceae) has only previously been reported from the Western Mediterranean Sea (Feldmann 1937, Gallardo *et al.* 1985).

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- The Canarian material agrees with Kylin (1930). Plants possess cartilaginous and flattened erect fronds which are twisted and proliferous from the margins (Fig. 32). Plants arise from a short stipe and are attached to the substratum by a small crust. Globose cystocarps with an obvious pore protrude externally from the cortex. Spermatangial and tetrasporangial plants were not observed.
- Rissoella verruculosa* was collected at El Guincho, an exposed locality in N Tenerife, growing on basaltic rocks in the upper littoral zone below the *Chthamalus stellatus* band. Cystocarpic plants were collected in May–August [TFC (Phyc) 5709].

## Conclusion

As a result of their geographic position, the Canary Islands are subject to settlement of spores from seaweed species with different biogeographical affinities. *Predaea huismanii*, recently described by Kraft (1984) from Rottneest Island, is only previously known from Western Australia. *Platysiphonia caribaea*, described by Ballantine and Wynne (1985) has only previously been reported from the Western Caribbean. *Rissoella verruculosa* has previously been considered as an endemic species of the Mediterranean Sea (Feldmann 1937).

The remainder of the species newly reported from the Canary Islands (*Jania longifurca*, *Spermothamnion flabellatum*, *Callithamnion decompositum* and *Helminthocladia agardhiana*) have been previously recorded from the Eastern Atlantic and their presence in the Canary Islands is not unexpected.

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