MARINE MICRO-ORGANISMS AND SEAWEEDS IN THE SOLENT

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Introduction

The past 15 years have seen extensive studies on the marine micro-organisms of the Solent. Studies have been been varied and at least five establishments on the south coast are actively involved in these researches: Departments of Biological Sciences and Oceanography, Southampton University; Department of Biological Sciences, Portsmouth Polytechnic; Exposure Trials Station, Central Dockyard Laboratory Portsmouth; C.E.G.B. Research Laboratory, Fawley and the Southern Water Authority, Southampton.

In this paper, a brief review is presented of the micro-organisms of the Solent.

Fungi

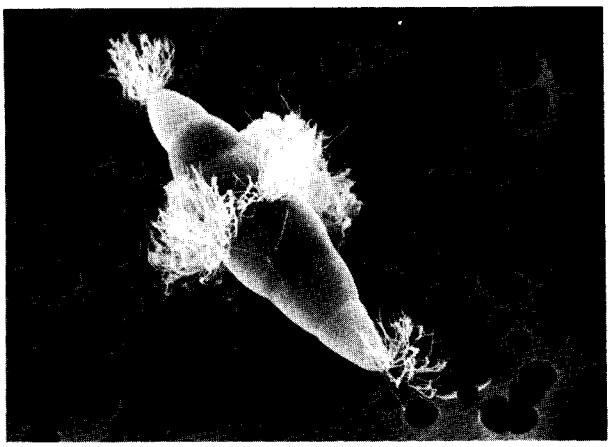
Some 350 marine fungi are known to grow on a variety of substrata e.g. wood, rope, polyurethane, algae and marine invertebrates. Most of these are saprophytic although parasitic forms also occur (Alderman and Jones, 1971a, b; Alderman, 1976). These fungi belong to the Phycomycetes, Ascomycetes (no Discomycetes), Basidiomycetes and Fungi Imperfecti.

Since 1958, the author has been monitoring the fungi found growing on wood, rope, algae and *Spartina* culms. This work has considered their taxonomy (Jones, 1962, 1963a), ecology (Jones, 1963b, 1968, 1971, 1976; Irvine, 1970; Jones and Irvine, 1971, 1972; Byrne, 1971; Jones *et al.*, 1972; Byrne and Jones, 1974), physiology (Jones and Jennings, 1964, 1965; Jones *et al.*, 1971; Harrison, 1972; Jones and Ward, 1973; Bremer, 1974, 1976; Harrison and Jones, 1974a, 1975a; Byrne and Jones, 1975a, b), ultrastructure (Jones and Alderman, 1971; Harrison, 1972; Alderman, 1974; Harrison and Jones, 1974b, c, 1975b; Moss and Jones, 1977; Jones and Moss, 1978), and their role in the deterioration of treated timber (Jones, 1972; Irvine *et al.*, 1972 Eaton, 1976; Leightley and Eaton, 1977). A list of the lignicolous fungi found in the Solent is presented in Table 1.

Dr Manners (Southampton University) and his colleagues have been working on the cause of 'die back' of *Spartina townsendii* (Goodman, 1957, 1959, 1960; Goodman, *et al.*, 1959; Goodman and Williams, 1961; Sivanesan and Manners, 1970a, b). Table 2 lists some of the fungi associated with the culms of *Spartina* while Table 3 lists the fungi on the subterranean parts and rhizosphere of *S. townsendii* agg.

Work currently in progress at Portsmouth Polytechnic includes a study of spore settlement in marine fungi and an estimation of the number of propagules at present in sea water (Jones, 1973; Fazzani and Jones 1977). Rees (1980) determined the density and sedimentation rates of spores of selected marine fungi. Sedimentation rates of the spores tested fell into four distinct bands: 0.06, 0.10-0.21, 0.26-0.30 and 0.38-0.40mm sec^{-1}. *Torpedospora radiata* had the slowest settlement rate while the majority of the spores had sedimentation rates within the 0.10-0.21mm sec^{-1} band (13 of the 18 fungi tested). Rees concludes that the appendages of marine fungal spores play probably the single most important role in mediating settlement. Work is also in progress on spore entrapment and attachment.

The colonisation of cast seaweed by marine fungi in the Solent has been investigated. The most common species was *Dendryphiella salina.* A new hyphomycete, *Sigmoidea marina* was found growing on *Laminaria* and *Fucus* fronds (Haythorn *et al.*, 1980). The ability of marine fungi to break down seaweeds was also studied and *D. salina* gave high protein yields (Haythorn and Jones, in press).



Corollospora comata, *a lignicolous marine Pyrenomycete scanning electron microscope micrograph of an ascospore showing polar and equatorial hair-like appendages which may aid in spore entrapment and attachment.*

Table 1. Marine lignicolous fungi collected in the Solent.

Fungi Imperfecti

Alternaria maritima Suth
Cirrenalia macrocephala (Kohl.) Meyers & Moore
Cremasteria cymatilis Meyers & Moore
Culcitalna achrospora Meyers & Moore
Dendryphiella salina (Suth.) Pugh & Nicot
Dictyosporium pelagica (Linder) Hughes
Humicola alopallonella Moore & Meyers
Macrophoma gymnogongri Feldmann
Monodictys pelagica
Phoma sp.
Stagonospora sp.
Stemphylium maritimum Johnson
Zalerion maritimum (Linder) Anastasiou
Ceriosporopsis calyptrata Kohlm.
Ceriosporopsis halima Linder.
Chaetomium erectum Skolko & Groves
Chaetomium globosum Kunse ex Fr.
Corollospora maritima Werden
Gnomonia salina Jones
Halosphaeria appendiculata Linder.
Halosphaeria hamata (Höhnk) Kohlm.
Leptosphaeria discors (Sacc. & Ellis)
Leptosphaeria macrosporidium Jones
Leptosphaeria orae-maris Linder.
Leptosphaeria pelagica Jones
Lulworthia floridana Meyers
Lulworthia purpurea (Wilson) Johnson
Lulworthia rufa (Wilson) Johnson
Nias inornata Kohlm.
Sphaerulina pedicellata Johnson

Table 2. Fungi on Spartina sp. collected in the Solent.

Fungi	Austwick, 1950	Goodman, 1959	Jones, 1962, 1963, unpublished
Fungi imperfecti			
Alternaria maritima	+	+	+
Asteromyces cruciatus	–	–	+
Cladosporium herbarum	+	+	–
Dendryphiella salina	–	–	+
Dictyosporium toruloides	–	–	+
Monodicty putredinis	–	–	+
Phoma spp.	+	+	+
Stemphylium maritimum Johnson	–	–	+
Ascomycetes			
Ceriosporopsis halima	–	–	–
Haligena elaterophora	–	–	–
H. spartinae	–	–	+
Halosphaeria hamata	–	–	+
Leptosphaeria albopunctata (West) Sacc.	–	–	+
L. discors (Sacc. & Ellis) Sacc. & Ellis	+	+	+
L. halima Johnson	–	–	–
L. macrosporidium Jones	–	–	+
L. marina Ellis & Everhart	–	–	–
L. maritima (Cke. & Plowr.) Sacc.	–	–	–
L. orae-maris Linder	–	–	–
L. pelagica Jones	–	–	+
L. typharum (Desm.) Karsten	+	+	+
Lulworthia medusa	+	+	+
Lignicola laevis	–	–	+
Gnomonia salina Jones	–	–	+
Pleospora herbarum (Fr.) Rabenhorst	+	+	+
P. pelagica Johnson	–	–	–
P. spartinae Ellis & Everhart	–	–	–
Spaerulina pedicellata	–	–	+

This is not a complete list of species found on *Spartina*. Jones (unpublished) has collected some 80 species growing on the culms of Spartina.

Table 3. Fungi isolated more than five times from underground parts of Spartina (after Sivanesan and Manners, 1970a).

	Total H	Total D	Status
Penicillium frequentans	168	344	C
White sterile mycelium	246	225	C
Penicillium variabile Wehmer	41	104	D
Cephalosporium sp.	40	76	C
Trichoderma koningii	51	56	C
Cladosporium herbarum	36	40	C
Penicillium digitatum Sacc.	32	19	C
P. spinulosum Thom.	20	28	C
Brown sterile mycelium	12	28	D
Mucor hiemalis	25	12	H
Aspergillus fumigatus	19	13	C
Botrytis cinerea	18	12	C
Fusarium solani (Mart.) Sacc.	13	17	C
Mucor spinosus	16	12	C
Penicillium cyclopium Westling	2	23	D
Fusarium oxysporum Schlecht. ex Fr.	13	1	H
Alternaria alternata	10	3	H
Pullularia pullalans (de Bary) Berkh.	9	4	H
Penicillium chrysogenum Thom	1	12	D
Phoma sp.	7	5	C
Mucor racemosus	7	4	C
Rhizopus nigricans	9	2	H
Verticillium lateritium (Ehrenb.) Rabenh.	3	7	S
Popularia sphaerosperma	7	1	S
Scopulariopsis brevicaulis (Sacc.) Bain.	4	3	S
Aspergillus ustus (Bain.) Thom & Church	5	1	S
A. versicolor (Vuill.) Tirob.	2	3	S

Status; C, 'common'; D, 'die-back'; H, 'healthy'; S, 'sporadic'.

The decay of wood by microfungi has been investigated at the ultra-structural level. Ascomycetes and Fungi Imperfecti caused soft rot attack (Jones, 1972; Leightley and Eaton, 1977) while the Basidiomycete *Nia vibrissa* caused a white rot type of attack (Leightley and Eaton, 1979). It is suggested that the soft rot fungi are better adapted than the Basidiomycetes in the decay of wood in aquatic habitats (Jones, 1980).

Since 1968, the mycologists at Portsmouth Polytechnic have been isolating marine Phycomycetes from a variety of substrata collected along the Solent. These fungi belong to the Thraustochytriales and Labyrinthulales. The former are a group of exclusively marine fungi that are biflagellate and have monocentric sporangia. They are unique in that the ecotoplasmic net system does not contain organelles, the sporangial wall is multilamellate and made up of small scales produced in the Golgi, and they possess an organelle termed the sagenogenetosome (Moss, 1980). Work on these organisms has concentrated on their isolation, growth in the laboratory, physiological experiments (Alderman and Jones, 1971b; Bremer, 1974, 1976), taxonomy (Alderman *et al.*, 1974; Jones *et al.*, 1978), and ultrastructure including histochemistry (Harrison and Jones, 1974b, c, 1975a, b; Chamberlain, 1980; Moss, 1980; Bremer and Moss, 1980). Some of the thraustochytrids isolated from Solent waters are listed in Table 4. Preliminary ecological studies have been undertaken (Bremer, 1976) in order to determine their role in nature and this aspect will be receiving further investigation over the next three years.

Bacteria

Work at Portsmouth has concentrated on the isolation of bacteria from wood submerged in Langstone Harbour and the determination of their cellulolytic activity under laboratory conditions (Holt and Jones, 1978; Furtado, 1979; Holt *et al.*, 1980). This study also includes the Actinomycetes and their ability to degrade wood. Actinomycetes are early colonisers of wood and may influence the subsequent colonisation by micro-fungi (Eaton and Dickinson, 1976; Cavalcante, unpublished). The inter-relationship of bacteria and fungi, bacteria and marine wood borers in the breakdown of timber in the sea is also under investigation.

In recent years, the role of bacteria in primary film formation on maritime ships has attracted the attention of scientists. Work at Portsmouth has concentrated on characterizing the bacterial flora, the mode of bacterial attachment and the secretion of polymeric substances. Bacteria isolated from test panels in Langstone and Portsmouth Harbours are tolerant of the toxins used

Table 4. Marine monocentric biflagellate fungi isolated from various sites.

Site	*Thraustochytrium* sp. Proliferous series	*Thraustochytrium* sp. Non profilerous	*Hyalochlorella marina* and free floating types	Total
1. The Fleet, Dorset	14	4	2	20
2. Langstone Harbour, Hants.	2	1	—	3
3. Southsea Castle, Hants.	9	6	—	15
4. Burnham-on-Crouch, Essex.	6	—	1	7
5. Bosham, Hants.	2	—	—	2
6. Monknash, S. Wales.	1	—	—	1
7. Other sites.	1	3	1	5
8. Bembridge, Isle of Wight.	68	3	1	72
Total	103	17	5	125

in marine antifouling paints. The polymeric substances secreted by the bacteria may bind or chelate the metallic ions leached from antifouling paints.

Sivanesan and Manners (1970a, b) have studied the bacteria present in muds colonized by *Spartina townsendii* and their possible role in *Spartina* 'die-back'.

Algae

The Isle of Wight was a favourite collecting site of algologists in the 1850's. However, in more recent times they have been somewhat neglected. Miss Blaikley, of the then Portsmouth College of Technology, has listed some algae collected on panels submerged in Chichester Harbour (Stubbings and Houghton, 1964; Blaikley, 1964). The most comprehensive list of the algae of the Isle of Wight was made by Kain (1958) at Bembridge. However, a number of algae known to occur on the Isle of Wight do not feature in this list, e.g. *Padina pavonia.*

In 1967, Farnham (1978) initiated a study of the seaweeds present in the Solent. Many of the species encountered were new to the U.K. (Farnham and Irvine, 1968, 1973. Table 5; In February 1973, yet another introduced species was discovered at Bembridge, namely *Sargassum muticum* (Farnham *et al.*, 1973). The rate of growth, competition effect and the spread of this seaweed is being carefully monitored for the reasons outlined by Jones and Farnham (1973), Farnham and Jones (1974) and Lewey (1976). The occurrence of *S. muticum* in the Solent and on the South Coast has attracted much attention, and various aspects of its biology have been studied including occurrence and distribution (Gray and Jones, 1977), regenerative ability of the alga (Fletcher and Fletcher, 1975a, b), ecology (Jephson and Gray, 1977), physiology (Kane and Chamberlain, 1979; Chamberlain, *et al.*, 1979), biochemistry (Gorham, 1979), effect of herbicides on *S. muticum* (Lewey and Jones, 1977), and the colonisation of *Sargassum* by epiphytes (Withers *et al.*, 1975; Knight-Jones *et al.*, 1975; Gray, 1979).

Tables 6 and 7 list some of the more interesting algae encountered in the Solent (Jephson *et al.*, 1975; Fletcher, 1976a, 1977a, 1978). Permanent quadrats have been established on shores in the Solent to monitor any changes in the algal flora of the area. These studies are long term but differences are discernible when the present distribution of certain seaweeds is compared with earlier records.

Knowledge of the British epiphytic crustose Corallinaceae is fragmentary. The ecological and taxonomical studies of Chamberlain (1977a, b, 1978, 1979) on material collected in the Solent are of extreme interest.

Another topic under investigation at Portsmouth Polytechnic is the settlement of marine fouling algae. This is concerned mainly with factors affecting settlement and a detailed ultrastructural study of spores before, during and after settlement. The effect of toxicants on settlement stages is in progress as well as the settlement of algae on panels submerged from

Table 5. Recent algal introductions into the Solent region.

	British distribution	Date of Discovery	Suggested origin
Grateloupia filicina var. *luxurians*	Fleet: Solent — E. Sussex	1947	Pacific: California
Grateloupia doryophora	Solent	1969	Pacific: California
Sargassum muticum	Solent Plymouth — E. Sussex	1971	Pacific: Japan or N. America
Neoagardhiella baileyi	Solent	1973	Pacific: N. America

rafts in Langstone Harbour. The latter will yield information on the seasonal settlement of seaweeds in local waters (Fletcher, 1974, 1975a, b, 1976b, 1977a, b, 1978; Fletcher and Chamberlain, 1975; Chamberlain, 1976). In addition to these studies which refer to green, brown and red seaweeds, the role of diatoms in primary fouling is also under investigation (Chamberlain, 1976; Daniels, 1978).

Houghton (Exposure Trials Station, Central Dockyard Laboratory) is also directing work on the effect of toxicants and water velocity on the settlement of various fouling algae (Houghton *et al.*, 1974; Gage, 1975).

Little is known of the phytoplankton present in Langstone Harbour. Studies to date have been fragmentary but the most detailed has been that of Askew (1972). Manton and Oates (1979) have reported on Choanoflagellates collected in water samples from Portsmouth Harbour. Further information is provided in Section 10.

The effect of sewage effluent on the growth of animals and plants in Langstone Harbour is under active study. One aspect concerns the growth of *Ulva* and *Enteromorpha* in relation to increased effluent levels. Other seaweed and phytoplankton, will be studied under laboratory conditions for their tolerance of increased phosphate and nitrate concentrations.

Conclusion

Due to local research interests, work on marine fungi has received considerable attention and probably more is known of their activity in Solent waters than for any other part of the U.K. Information on the algal flora of the Solent is being documented and permanent quadrats established on a number of shores. These studies should yield information on the stability of the local seaweed flora. The Solent region appears to be a favourable area for the establishment of exotic marine species. Possible explanations include shipping acting as vectors, the time of low-water spring tides which occurs early morning or late afternoon so that plants in the lower eulittoral pools, lagoons, channels etc., are not exposed to the rigours of the midday sun in summer (Farnham, 1980), and the "open" communities in the lower eulittoral in the Solent which allow a high diversity of species and low relative abundance of any one species, thus providing an ideal situation for an "invading" species. The presence of *Sargassum muticum* in the Solent has not affected the distribution and occurrence of indigenous species. Jephson and Gray (1977) and Gray (1979) have shown that the alga supports an abundant and diverse epiphytic flora and fauna.

Table 6. Some of the more interesting algae found in the Solent (nomenclature follows Parke and Dixon, 1976).

Species	Point of interest
Chlorophyceae	
"Chlorochytrium inclusum" "Codiolum petrocelidis"	Non-specific phases in the life histories of *Spongomorpha* spp.
Derbesia/Halicystis spp	Rarely recorded sublittoral species
Monostroma spp	Taxonomic investigations required
Phaeophyceae	
Acinetospora crinata	May be phase in life history of *Feldmannia* q.v.
Cutleria multifida "Aglaozonia parvula"	Sporadic occurrence; culture investigations required
Cylindrocarpus microscopicus	Only recent British record
Eudesme virescens	Summer ephemeral in Bembridge lagoons
Feldmannia globifera	Eastern limit on south coast of England
Padina pavonia	Sporophytes only found; eastern limit on south coast, see Price *et al.* (1979)
Sargassum muticum	Ecological effects of this alien species, see Farnham (in press)
Sporochnus pedunculatus	Ecological investigation of this sublittoral species
Stilophora rhizodes	Summer ephemeral; ecological study
Striaria attenuata	Summer ephemeral; ecological study
Zanardinia prototypus	Under-recorded sublittoral species, see Jephson *et al.* (1975)

Species	Point of interest
Rhodophyceae	
Ahnfeltia plicata/Porphyrodiscus	Further life history studies required, see Farnham & Fletcher (1976)
Audouinella sp	Taxonomic investigation of an endophytic species found in *Gracilaria bursa-pastoris*
Bonnemaisonia hamifera (gametophyte)	Recorded from the Isle of Wight in 1897 by Holmes but not found in recent years, although its tetrasporangial phase *(Trailliella)* is quite common
Callophyllis flabellata	Only authentic record for this species in the British Isles; culture and ecological investigations required
Cordylcladia erecta	Taxonomic and reproductive studies required
Fosliella spp	Currently being investigated, see Chamberlain (1977)
Gonimophyllum buffhamii	Rare parasite on *Cryptopleura*
Gracilaria bursa-pastoris	This uncommon species is locally abundant; taxonomic study required
Grateloupia doryphora	Introduced species, see Farnham & Irvine (1973)
G. filicina var. luxurians	Introduced entity, see Farnham & Irvine (1968), Farnham (1968)
Griffithsia devoniensis	Recent occurrence in local harbours
G. flosculosa	Nuisance-cost in blocking cooling pipes to industrial installations
Halarachnion ligulatum	Summer ephemeral in sublittoral; life history and ecological studies required
Lomentaria clavellosa	Variable occurrence from year to year
Meredithia microphylla	Taxonomic and reproductive studies required
Naccaria wigii	Sporadic appearance in the sublittoral
Neoagardhiella gaudichaudii	A recently discovered alien, see Farnham & Irvine (1979)
Rhodophysema georgii	Further study required, see Fletcher (1975)
Rhodymenia delicatula	Under-recorded sublittoral species
Scinaia forcellata	Ecological studies required
Seirospora seirosperma	Culture investigations required
Xanthophyceae	
Vaucheria spp	Ecological and taxonomic investigations required
Charophyceae	
Lamprothamnium papulosum	Further ecoligical studies of this brackish species required, see Daniel *et al.* (in press)

Table 7. Some marine algae from Normandy Salterns (W. F. Farnham & R. L. Fletcher)

3 main areas were sampled:

(1) Marina, along the waterline of floating pontoons
(2) Shore, alongside the sea-wall
(3) Mudflats & ditches, behind the sea-wall.

Cyanophyceae (Blue-green algae)

Calothrix ? vivipara Harv. Born. et Flah. (2)
Lyngbya spp. (2) & (3)
Mastigoooleus testarum Largerh. Born et Flah. (2), in shells
Microcoleus chthonoplastes (Mert. in Hornum.) Thur. Com. (3)
Oscillatoria formosa (Borg) Com. (3)
O. margaritifer (Kuts) Com. (3)
Plectonema terebrans Born. et Flah Com. (2) in shell
Schizothrix calcicola (C. Ag.) Com. (2) in shell
Spirulina major Kitz Com. (3)

Rhodophyceae (Red algae)

Antithamnion cruciatum (C. Ag.) Nag (2)
Callithamnion corybosum (Sm.) Lyngb. e (1)
C. hookeri (Dillw.) S. F. Gray e (1)
Ceramium rubrum (Heds) C. Ag. (1) (2)
* *Chondria coerulescens* (J. Ag.) Falkenb.) (2)
Chondrus crispus Stackh (2)
Dumontia incrassata (O. F. Mull.) Lamour (2)
Erythrotrichia carnea (Dillw.) J. Ag. (1) (2) epiphytic
* *Falkenbergia rufalanosa* (Harv.) Schm. (= *Asparagopsis armata* Harv) (2)
Coniotrichum alsidii (Zanard.) Howe (1) (2)
Gracilaria verrucosa (Ruds.) Papenf. (2)
* *Grateloupia filicina* (Lamour.) C. Ag. var. *Luxurians* Gepp & Gepp O — probably a Pacific introduction (Farnham & Irvine 1968)
Griffithsia floculosa (Ellis) Batt (1) (2)
Hildenbrandia prototypus Nardo O (2)
Hypoglossum woodwardii Kutz. (2)
Phymatolithon lenormandii (2) on *Littorina* and stones
Plocamium cartilagineum (L.) Dixon (2)
Polysiphonia brodiaei (Dillw.) Spreny. O (1)
P. elongata (Huds.) Spreny. (1)
P. lanosa (L.) Tundy, on *Ascophyllum* (2)
P. nigrescens (Huds.) Crev. (1) (2)
P. urceolata (Lightf. ex Dillw.) Grev. e, (1) (2)
P. ? denudata J. Ag. (1)
Porphyra umbilicalis (L.) J. Ag. (2)
Porphyridium cruentum (Smith & Sowerby) Hag (3)

Phaeophyceae (Brown algae)

Ascophyllum nodosum (L.) Le Jol. (2)
Dictyota dichotoma (Huds.) Lamour (2)
Ectocarpus fasciculatus Harv. P.S. (1)
Ectocarpus siliculosus (Dillw.) Lyngb. (1)
Elachistea fucicola (Vell.) Areach on *Fucus* U.S. (2)
Fucus serratus L. (2)
F. spiralis L. (2)
F. vesiculosus L. (2)
Giffordia granulosa (Sm.) Hamel P.S. (1)
Halidrys siliquosa (L.) Lyngb. (2) drift
Laminaria saccharina (L.) Lamour (1)
* *Pelvetia canaliculata* (L.) Dene et Thuret, with perithecia of *Mycosphaerella* (2)
Petroderma maculiforme (Wollny) Kuck. (2)
Pilaeyella littoralis (L.) Kjollm. (2)
Pseudolithoderma extenum (Crouan frat.) S. Lund. P.S. (2)
Ralfsia clavata (Harv. in Hock) Crouan frat. U.S. (2)
R. verrucosa (Arench) J. Ag. U.S. (2)
Scytosiphon lomentarius (Lyngb.) Link (1)
* *Taonia atomaria* (Woodw.) J. Ag. o (2)

Diatoms

A large number of undetermined spp. was found epiphytic or on mud.

Chrysophyceae

Unicellular and palmelloid forms found on mud in (3).

Xanthophyceae (Yellow-green algae)

Vaucheria spp.

Chlorophyceae (Green algae)

Blidingia minima (Nag ex Kuts.) Kylin (1)
Bryopsis plumosa (Huds.) C. Ag. (2)
Chaetomorpha capillaris (Jutz.) Beg. (2)
C. linum (O. F. Mull.) Kutz. (2)
Codidum — phases (2) in shells
Enteromorpha comressa (L.) Grev. (2)
E. intestinalis (L.) Link (1) (2) (3)
E. proligera (O. F. Mull.) J. Ag. (3)
E. ralfsii Harv. (3)
Eugomontia (2), in shells
Ulothrix pseudoflacca Wille (3)
Ulva lactuca L. (1) (2)

Charophyceae — (stoneworts)

* *Lamprothamnium papulosum* J. Groves, abundant in Salterns. Allen (1950) — "It is very rare, being known from only three British localities". This is probably the most interesting species collected here. It is interesting to find a member of a typically freshwater group under fully marine conditions. As it is a coloniser, some attention may be required to prevent its replacement by a climax vegetation of aquatic vascular plants. The Salterns Lagoon is/was drained annually, otherwise removal by dredging of the vegetation in the Salterns might be necessary every 3-4 years to maintain this *Lamprothamnium* population.

Our general conclusions are that this area is of interest phycologically for the standard communities existing on these saltmarsh and muddy shore conditions, with the indicated species* of interest in their own right.

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