A red seaweed (*Ceramium virgatum*)

MarLIN – Marine Life Information Network
Biology and Sensitivity Key Information Review

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Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/species/detail/1476]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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A specimen of *Ceramium virgatum* with a branch of *Corallina* to the right.
Photographer: Dr F. Arenas

See online review for distribution map

Distribution data supplied by the Ocean Biogeographic Information System (OBIS). To interrogate UK data visit the NBN Atlas.

Researched by	Dr Keith Hiscock & Paolo Pizzolla	**Refereed by**	Dr Fabio Rindi
Authority	Roth, 1797		
Other common names	-	**Synonyms**	*Ceramium nodulosum* Roth, 1797, *Ceramium rubrum* Roth, 1797

Summary

Description

A small red seaweed growing up to 30 cm tall. It has a filamentous frond that is irregularly and dichotomously branched, with the branches narrowing towards pincer-like tips. The holdfast is a minute conical disc that extend into a dense mass of rhizoidal filaments. The plant is reddish-brown to purple in colour and has a banded appearance when viewed closely.

Recorded distribution in Britain and Ireland

Found on most suitable shores around Britain and Ireland.

Global distribution

Maggs & Hommersand (1993) note that the '*Ceramium rubrum* complex' is widely distributed in the North Atlantic but the distribution of component species requires reassessment.

Habitat

Ceramium virgatum is both epilithic and epiphytic, often growing on the stipes and fronds of *Fucus* spp., *Mastocarpus stellatus* and *Laminaria hyperborea* as well as on the leaves of *Zostera marina* in the subtidal. It is frequent on *Codium fragile subsp. Tomentosoides* in intertidal rockpools (F. Rindi, pers. comm.).

Depth range

-

Identifying features

- Deep clear red (but may be bleached).
- Fronds to 30 cm length gradually attenuating upwards.
- Axes 0.5 to 1 mm in diameter basally but may be swollen or nodular.
- Fronds irregularly dichotomous, often with lateral branches which may be simple, forked or repeatedly dichotomous.
- Apices straight of forcipate.

Additional information

Discrimination of separate species of *Ceramium* is often difficult. This species can be identified with certainty only by careful microscopic observation and in the field can be easily confused with other species of *Ceramium* with similar morphology namely *Ceramium botryocarpum*, *Ceramium pallidum* and *Ceramium secundatum* (F. Rindi, pers. comm.). The above taxonomy uses the recent nomenclature from Hardy & Guiry (2003). The confusion concerning *Ceramium nodulosum* and *Ceramium rubrum* was discussed by Maggs *et al.* (2002).

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Rhodophyta	Red seaweeds
Class	Florideophyceae	
Order	Ceramiales	
Family	Ceramiaceae	
Genus	Ceramium	
Authority	Roth, 1797	
Recent Synonyms	Ceramium nodulosum Roth, 1797Ceramium rubrum Roth, 1797	

Biology

Typical abundance	High density
Male size range	3-30cm
Male size at maturity	
Female size range	Medium-large(21-50cm)
Female size at maturity	
Growth form	Filiform / filamentous
Growth rate	See additional information
Body flexibility	High (greater than 45 degrees)
Mobility	Not relevant
Characteristic feeding method	Autotroph
Diet/food source	
Typically feeds on	Not relevant
Sociability	
Environmental position	Epifloral
Dependency	See additional information.
Supports	None
Is the species harmful?	No

Biology information

Ceramium virgatum colonizes rock and algal habitats from the midshore in rockpools to the open shore near to low water level and in the shallow subtidal (see Maggs & Hommersand, 1993). It also grows attached to the leaves of *Zostera marina* (see, for instance, Whelan & Cullinane, 1985). It occurs on bedrock through to pebbles. Dickinson (1963) notes that the species is either perennial or pseudoperennial. Settlement onto new surfaces can be rapid. For instance, panels were colonized within a month of being placed in Langstone Harbour (Brown *et al*., 2001)

Habitat preferences

Physiographic preferences	Open coast, Strait / sound, Sea loch / Sea lough, Ria / Voe, Estuary, Enclosed coast / Embayment

Biological zone preferences	Lower eulittoral, Mid eulittoral, Sublittoral fringe, Upper infralittoral
Substratum / habitat preferences	Macroalgae, Artificial (man-made), Cobbles, Gravel / shingle, Pebbles, Rockpools
Tidal strength preferences	Very Weak (negligible), Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Exposed, Extremely exposed, Extremely sheltered, Moderately exposed, Sheltered, Very exposed, Very sheltered
Salinity preferences	Full (30-40 psu), Variable (18-40 psu)
Depth range	
Other preferences	
Migration Pattern	Non-migratory / resident

Habitat Information

Ceramium virgatum may be particularly abundant in the summer. It thrives in rockpools and occurs in still water situations where dilution with freshwater is likely to occur.

Life history

Adult characteristics

Reproductive type	Alternation of generations
Reproductive frequency	Annual protracted
Fecundity (number of eggs)	>1,000,000
Generation time	See additional information
Age at maturity	Insufficient information
Season	See additional information
Life span	2-5 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Spores (sexual / asexual)
Duration of larval stage	See additional information
Larval dispersal potential	See additional information
Larval settlement period	

Life history information

Edwards (1973) reports that *Ceramium virgatum* (as *rubrum*) has a triphasic life history consisting of a sequence of gametophytic, carposporophytic and tetrasporophytic phases in which the first and the third are morphologically similar. Maggs & Hommersand (1993) report that spermatangia are recorded in January, March-April, June and August-September; cystocarps in January-February and April-September; tetrasporangia in February-September. Although no information on dispersal has been found directly for *Ceramium virgatum*, Norton (1992) concluded that dispersal potential is highly variable in seaweeds. Spores of *Ulva* sp. (as *Enteromorpha*) have been reported to travel 35 km, *Phycodrys rubens* 5 km and *Sargassum muticum* up to 1 km. However, the point is made that reach of the furthest propagule and useful dispersal range are not the same thing and recruitment usually occurs on a much more local scale, typically within 10 m of the parent plant.

Sensitivity review

This MarLIN sensitivity assessment has been superseded by the MarESA approach to sensitivity assessment. MarLIN assessments used an approach that has now been modified to reflect the most recent conservation imperatives and terminology and are due to be updated by 2016/17.

Physical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Substratum Loss	High	Very high	Low	Moderate

Plants will be removed with the substratum and therefore intolerance is high. Recoverability is expected to be very high: see additional information below.

	Intolerance	Recoverability	Sensitivity	Confidence
Smothering	Intermediate	Very high	Low	Moderate

Ceramium virgatum is an erect species which grows up to 20 cm in length. Filamentous algae generally have delicate thalli and can therefore be expected to be sensitive to smothering (F. Rindi, pers. comm.). In addition, developing propagules are likely to be buried by 5 cm of sediment and would be unable to photosynthesize. For example, Vadas *et al.* (1992) stated that algal spores and propagules are adversely affected by a layer of sediment, which can exclude up to 98% of light. There is therefore likely to be some mortality of the population and intolerance is assessed as intermediate. Recoverability is expected to be very high: see additional information below.

	Intolerance	Recoverability	Sensitivity	Confidence
Increase in suspended sediment	Intermediate	Very high	Low	Low

Ceramium virgatum is not likely to be affected directly by an increase in suspended sediment. However, increased suspended sediment will increase light attenuation (considered in 'turbidity') and siltation. As discussed above in 'smothering', increased rate of siltation may inhibit development of algal spores and propagules resulting in some mortality. However, Hily *et al*. (1992) observed that, in conditions of high turbidity, *Ceramium virgatum* (as *C. rubrum*) (and *Ulva* sp.) dominated sediments in the Bay of Brest, France. The effects of increased suspended sediment are therefore equivocal but, because some deeper populations are likely to be adversely affected by reduction in light penetration and because of possible smothering, overall an intolerance of intermediate is suggested. Recovery is expected to be very high: see additional information below.

	Intolerance	Recoverability	Sensitivity	Confidence
Decrease in suspended sediment	Tolerant*	Not relevant	Not sensitive*	High

Ceramium virgatum is likely to benefit from a decrease in suspended sediment through effects of increased light penetration (see decreased turbidity below).

	Intolerance	Recoverability	Sensitivity	Confidence
Dessication	High	Very high	Low	Moderate

Ceramium virgatum occurs profusely in rockpools, on the lower shore and in the subtidal but not on the open shore away from damp places suggesting that it is intolerant of desiccation. Recovery is expected to be very high: see additional information below.

	Intolerance	Recoverability	Sensitivity	Confidence
Increase in emergence regime	Intermediate	Very high	Low	High

Ceramium virgatum occurs on the lower shore and in the subtidal suggesting that it is intolerant of high amounts of emergence. Recovery is expected to be very high: see additional information below.

Decrease in emergence regime Tolerant Not relevant Not sensitive Moderate

Ceramium virgatum occurs predominantly in rockpools and in the subtidal and could potentially benefit from a decrease in emergence regime.

Increase in water flow rate Intermediate Very high Low Moderate

Moderate water movement is beneficial to seaweeds as it carries a supply of nutrients and gases to the plants, removes waste products, and prevents settling of silt. However, if flow becomes too strong, plants may be displaced. Additionally, an increase to stronger flows may inhibit settlement of spores and remove adults or germlings. It is likely therefore that the benchmark increase in water flow rate to 'strong' or 'very strong' flow would result in some mortality, particularly of older individuals or those attached to the least stable substrata. Intolerance is therefore assessed as intermediate. Recoverability is recorded as very high (see additional information below).

Decrease in water flow rate Tolerant Not relevant Not sensitive Moderate

Ceramium virgatum occurs in conditions of weak or very weak tidal streams (for instance, it is characteristic in the biotope '*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock - SIR.Lsac.Ldig' (Connor *et al.* 1997a) and is recorded from some of the most sheltered parts of Hardangerfjord in Norway (Jorde & Klavestad, 1963). It is therefore expected that, providing stagnation and deoxygenation do not occur, the species will be not sensitive.

Increase in temperature Low Very high Very Low Low

Lüning (1990) records that *Ceramium virgatum* (as *rubrum*) survives at temperatures from 0 to 25°C with optimal growth at about 15°C. The species is therefore likely to be tolerant of higher temperatures than it experiences in the seas around Britain and Ireland. Temperatures in rockpools are recorded by Morris & Taylor (1983) and by Goss-Custard *et al.* (1979) as rising to or slightly above 25°C. However, rockpool temperatures could rise significantly above 25°C and some mortality may occur in exceptional conditions. Photosynthesis and growth may also be compromised by high temperatures. Intolerance is therefore recorded as low. Physiological processes should quickly return to normal when temperatures return to their original levels so recoverability is recorded as very high.

Decrease in temperature Low Very high Very Low Low

Lüning (1990) records that *Ceramium virgatum* (as *rubrum*) survives at temperatures from 0 to 25°C with optimal growth at about 15°C. The species is therefore likely to be tolerant of lower temperatures than it experiences in the seas around Britain and Ireland. No information has been found of the effects of very cold conditions but, since the species is not immersed for a significant length of time, adverse effects are not expected directly. Sub-optimal temperatures may delay or slow reproduction so an intolerance of low is suggested.

Increase in turbidity Tolerant Not relevant Not sensitive Very low

Hily *et al.* (1992) found that, in conditions of high turbidity, *Ceramium virgatum* (as *C. rubrum*) (and *Ulva* sp.) dominated sediments in the Bay of Brest, France. It is most likely that *Ceramium* thrived because other species of algae could not. Whilst the field observations in the Bay of Brest suggests that an increase in abundance of *Ceramium virgatum* might be expected in conditions of increased turbidity, populations where light becomes limiting will be adversely affected. In shallow depths, *Ceramium virgatum* may benefit from increased turbidity whilst, near its lower depth limit, it may decline. The available information is therefore equivocal. In the absence of an intolerance assessment of 'equivocal', 'tolerant' is suggested, albeit with a very low confidence.

Decrease in turbidity Tolerant Not relevant Not sensitive

A decrease in turbidity would result in greater light availability for *Ceramium virgatum* and potentially potential benefit from the factor. However, the work of Hily *et al.* (1992) suggests that other species might out-compete *Ceramium virgatum as nodulosum* in lower turbidity situations. In the absence of an intolerance assessment of 'equivocal', 'tolerant' is suggested, albeit with a very low confidence.

Increase in wave exposure Intermediate Very high Low Moderate

Ceramium virgatum occurs in extremely wave sheltered conditions (for instance, it is characteristic in the biotope '*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock - SIR.Lsac.Ldig' (Connor *et al*. 1997a) and is recorded in some of the most sheltered parts of Hardangerfjord in Norway (Jorde & Klavestad, 1963). Strong wave action is likely to cause some damage to fronds resulting in reduced photosynthesis and compromised growth. Furthermore, individuals may be damaged or dislodged by scouring from sand and gravel mobilized by increased wave action (Hiscock, 1983). Mortality of at least a part of the population is likely due to increased wave exposure and so intolerance is assessed as intermediate. Recovery is expected to be very high: see additional information below.

Decrease in wave exposure Tolerant Not relevant Not sensitive High

Ceramium virgatum occurs in extremely wave sheltered conditions (for instance, it is characteristic in the biotope '*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock - SIR.Lsac.Ldig' (Connor *et al*. 1997a) and is recorded in some of the most sheltered parts of Hardangerfjord in Norway (Jorde & Klavestad, 1963). Decrease in wave exposure is therefore unlikely to be an adverse factor.

Noise Tolerant Not relevant Not sensitive High

Algae have no mechanisms for detection of sound and, therefore, would be not sensitive to disturbance by noise.

Visual Presence Tolerant Not relevant Not sensitive High

Algae have no visual acuity and, therefore, would not be affected by visual disturbance.

Abrasion & physical disturbance High Very high Low Moderate

Filamentous algae generally have delicate thalli (F. Rindi, pers. comm.) and can therefore be expected to be sensitive to abrasion. In addition, the fronds appear loosely attached and would not be expected to be resistant to physical impacts. Furthermore, individuals may be damaged or dislodged by scouring from sand and gravel mobilized by increased wave action (Hiscock, 1983) and abrasion at the level set in the benchmark is likely to have a similar effect. Physical abrasion would therefore probably result in destruction of at least erect parts of the plant and loss of some whole plants. Intolerance is assessed as high. For recoverability, see additional information below.

Displacement High Very high Low Moderate

It is unlikely that the holdfast would survive removal from the substratum and be able to reattach to a new substratum. Intolerance is therefore assessed as high. Recoverability is recorded as very high (see additional information below).

Chemical Pressures

Intolerance Recoverability Sensitivity Confidence

Synthetic compound contamination High Very high Low Moderate

Ceramium virgatum seems to be intolerant of at least some synthetic chemicals. In studies of the effect of chromated copper arsenate wood preservative, Brown *et al*. (2001) found that a significantly higher coverage of *Ceramium nodulosum* occurred on untreated wood after four weeks. Hardy (1993, cited in Holt *et al*., 1995) observed that *Ceramium nodulosum* (as *Ceramium rubrum*) was lost between 1923 and 1991 from the mouth of the (polluted) Tees Estuary. Inferences may also be drawn from the sensitivities of red algal species generally. O'Brien & Dixon (1976) suggested that red algae were the most sensitive group of algae to oil or dispersant contamination, possibly due to the susceptibility of phycoerythrins to destruction. They also report that red algae are effective indicators of detergent damage since they undergo colour changes when exposed to relatively low concentration of detergent. Smith (1968) reported that 10 ppm of the detergent BP 1002 killed the majority of specimens of *Ceramium virgatum* (as *Ceramium rubrum*) in 24hrs in toxicity tests. Laboratory studies of the effects of oil and dispersants on several red algal species concluded that they were all sensitive to oil/ dispersant mixtures, with little difference between adults, sporelings, diploid or haploid life stages (Grandy, 1984, cited in Holt *et al*., 1995). Cole *et al*. (1999) suggested that herbicides , such as simazine and atrazine were very toxic to macrophytes. The evidence suggests that in general red algae are very intolerant of synthetic chemicals. Intolerance of *Ceramium virgatum* is therefore recorded as high. Recoverability is recorded as very high (see additional information below).

Heavy metal contamination Not relevant Not relevant

Bryan (1984) suggested that the general order for heavy metal toxicity in seaweeds is: Organic Hg > inorganic Hg > Cu > Ag > Zn > Cd > Pb. Cole *et al*. (1999) reported that Hg was very toxic to macrophytes. The sub-lethal effects of Hg (organic and inorganic) on the sporelings of an intertidal red algae, *Plumaria elegans*, were reported by Boney (1971). 100% growth inhibition was caused by 1 ppm Hg. No information was found concerning the effects of heavy metals on *Ceramium nodulosum* specifically, and therefore an intolerance assessment has not been attempted.

Hydrocarbon contamination High Very high Low Moderate

Smith (1968) records that *Ceramium virgatum* (as *Ceramium rubrum*) was killed during the Torrey Canyon oil spill. O'Brien & Dixon (1976) suggested that red algae were the most sensitive group of algae to oil or dispersant contamination, possibly due to the susceptibility of phycoerythrins to destruction. Laboratory studies of the effects of oil and dispersants on several red algal species concluded that they were all sensitive to oil/ dispersant mixtures, with little difference between adults, sporelings, diploid or haploid life stages (Grandy, 1984, cited in Holt *et al*., 1995). Recoverability is recorded as very high (see additional information below).

Radionuclide contamination Not relevant Not relevant

No evidence was found concerning the intolerance of *Ceramium nodulosum* to radionuclide contamination.

Changes in nutrient levels Tolerant* Not relevant Not sensitive* High

Hily *et al*. (1992) found that, in conditions of high nutrients, *Ceramium virgatum* (as *Ceramium rubrum*) (and *Ulva* sp.) dominated sediments in the Bay of Brest, France. *Ceramium* spp. are also mentioned by Holt *et al*. (1995) as likely to smother other species of macroalgae in nutrient enriched waters. Fletcher (1995) cites Johnston (1971/72) as associating *Ceramium nodulosum* (as *Ceramium rubrum*) with eutrophicated waters. It therefore seems that populations of

Ceramium virgatum are likely to benefit from nutrification.

	Intolerance	Recoverability	Sensitivity	Confidence
Increase in salinity	Not relevant	Not relevant	Not relevant	High

Ceramium virgatum occurs in full salinity conditions. Although no information has been found on survival in hypersaline conditions, *Ceramium virgatum* occurs in rockpools where evaporation may occasionally lead to higher than normal salinities. However, occurrence of the species in full salinity, leads to an intolerance assessment of not relevant.

	Intolerance	Recoverability	Sensitivity	Confidence
Decrease in salinity	Low	Very high	Very Low	High

Ceramium virgatum occurs over a very wide range of salinities. The species penetrates almost to the innermost part of Hardanger Fjord in Norway where it experiences very low salinity values and large salinity fluctuations due to the influence of snowmelt in spring (Jorde & Klavestad, 1963). It is likely therefore that the benchmark decrease in salinity would not result in mortality, but photosynthesis would not be optimal and so growth and reproduction may be compromised. Intolerance is therefore assessed as low. Physiological processes should quickly return to normal when salinity returns to original levels, so recoverability is recorded as very high.

	Intolerance	Recoverability	Sensitivity	Confidence
Changes in oxygenation		Not relevant		Not relevant

The effects of reduced oxygenation on algae are not well studied. Plants require oxygen for respiration, but this may be provided by production of oxygen during periods of photosynthesis. Lack of oxygen may impair both respiration and photosynthesis (see review by Vidaver, 1972). A study of the effects of anoxia on another red alga, *Delesseria sanguinea*, revealed that specimens died after 24 hours at 15°C but that some survived at 5°C (Hammer, 1972). Insufficient information is available to make an intolerance assessment for *Ceramium virgatum*.

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of microbial pathogens/parasites		Not relevant		Not relevant

No information has been found.

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of non-native species	Tolerant*	Very high	Not sensitive*	Low

The habitat preferences of the gametangial phase of the non-native species *Asparagopsis armata* and of *Ceramium virgatum* are likely to overlap and *Asparagopsis armata* may displace some of the population of *Ceramium virgatum*. However, no evidence has been found to confrim displacement. In contrast, F. Rindi (pers. comm.) has noted that *Ceramium virgatum* is frequently epiphytic on *Codium fragile subsp. Tomentosoides* and therefore it can be facilitated rather than inhibited by this introduced species. Accordingly, tolerant* has been recorded but with low evidence.

	Intolerance	Recoverability	Sensitivity	Confidence
Extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant

There is no extraction of *Ceramium virgatum* known to occur.

	Intolerance	Recoverability	Sensitivity	Confidence
Extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant

No species are known to be extracted that might lead to loss of *Ceramium virgatum*.

Additional information

Recoverability is likely to be very high as settlement and growth appears to be rapid at least at appropriate times of year. Brown *et al*. (2001) found that the alga had settled onto panels within four weeks of their placement in Langstone Harbour. Recolonization may, however, be delayed if the hydrodynamic regime does not allow a supply of spores from distant populations.

Importance review

Policy/legislation

- no data -

Status

National (GB) importance	-	**Global red list (IUCN) category**	-

Non-native

Native	-		
Origin	-	**Date Arrived**	-

Importance information

The filamentous structure of *Ceramium virgatum* most likely provides a habitat for small molluscs and crustaceans.

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