Nylund Göran M. 2005. Chemical mediation of fouling in seaweeds. Department of Marine Ecology, Göteborg University, Tjärnö Marine Biological Laboratory, 452 96 Strömstad, Sweden.

Abstract: Many seaweed species have a large surface area and constitute an important substrate for settlement by a wide array of organisms. The fouling organism can affect seaweeds negatively, and thus exert selection for deterring properties against fouling. Over the last decade, a significant number of studies have focused on antifouling effects of seaweed metabolites. However, few studies have demonstrated that secondary metabolites produced by seaweeds function as natural antifoulants.

This thesis focused on identifying seaweed species with ecologically relevant antifouling metabolites. The natural distribution of fouling organisms on seaweeds was investigated in field surveys, and naturally low-fouled seaweeds were extracted for ecologically relevant concentrations of metabolites. These substances were tested against different fouling organisms in both laboratory and field experiments in order to determine possible chemical antifouling mechanisms. The results from these experiments showed that the red alga *Bonnemaisonia hamifera* produces a secondary metabolite, 1,1,3,3-tetrabromo-2-heptanone, which inhibits bacterial growth at natural concentrations. Furthermore, it was shown that *B. hamifera* has a significantly lower epibacterial abundance compared to the co-existing alga *Chondrus crispus*. Studies on the brown seaweed *Fucus vesiculosus* showed that intact fronds of this seaweed deter settlement by barnacle larvae of *Balanus improvisus* and that phlorotannins exuded from *F. vesiculosus* may potentially reach sufficient concentrations under natural conditions to inhibit larval recruitment.

This thesis also focused on developing techniques for the extraction of ecologically relevant concentrations of antifouling substances in seaweeds. We extended the dipping technique previously developed for extracting surface associated metabolites of the red alga *Delisea pulchra* to a variety of other seaweeds. Protocols for extraction of non-polar surface associated metabolites from seaweeds were developed and the ecological relevance of the obtained extracts was determined by a combination of laboratory and field experiments. The results from these experiments showed that the dipping technique, using species-specific mixtures of hexane and dichloromethane (DCM), could be used in combination with ecologically relevant bioassays as a general method for studies on natural antifouling roles of non-polar seaweed metabolites. Alternatively, the simpler and faster technique of extracting pieces of fresh seaweeds in DCM for a short time period can be used in initial screening studies. Finally, it was also shown that bioassays with whole cell extracts generally are of little use if the objective is to explore the chemical mediation of interactions between seaweeds and fouling organisms.

In conclusion, the present thesis provides evidence that some of the investigated seaweed species produce secondary metabolites that function as natural antifoulants, suggesting that chemical mediation of fouling may be a common, but not a global phenomenon in seaweeds.

Keywords: Antifouling, antimicrobial activity, bacterial attachment, biofouling, bioassay-guided fractionation, *Bonnemaisonia hamifera*, chemical defence, *Chondrus crispus*, cuticle peeling, *Dilsea carnosa*, Epibiosis, epiphytes, *Fucus vesiculosus*, secondary metabolites.

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