GÖTEBORGS UNIVERSITET

# Seaweed Invasions and Novel Chemical Defences

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**Abstract.** Biological invasions pose a risk to the biodiversity and the functioning of ecosystems in invaded areas. The reasons why some introduced species become dominant and widespread in their new environments is still largely an unsettled question. It has commonly been predicted that introduced plants will invade when they are less affected by herbivores, since this will provide the introduced species with a competitive advantage over native plants. Furthermore, it has been suggested that introduced species with chemical defences that are novel to native herbivores in the new range are most likely to become successful invaders.

The scope of this thesis was to investigate ecological processes that underlie the successful invasion of plant/seaweed species and how chemical compounds mediate these processes, using the filamentous red alga *Bonnemaisonia hamifera* as a model organism. Having its origin in the Northwest Pacific, this alga has invaded large parts of the North Atlantic rocky shores and became dominant in many seaweed communities. Feeding preference experiments showed that native generalist herbivores explicitly preferred native seaweeds to the invader (paper I). Using a bioassay-guided fractionation, *B. hamifera* was found to be chemically defended against native herbivores by producing 1,1,3,3-tetrabromo-2-heptanone as the main feeding deterrent compound (paper I). The production of this compound was demonstrated to be costly, but also to increase the fitness of the invader by reducing the impact of pathogenic bacteria (paper IV) in addition to the shown reduced herbivory. Resource allocation to a chemical defence may also explain the relatively poor performance (in terms of growth) of *B. hamifera* in direct interactions with native seaweeds when herbivores were absent in experimental algal communities (paper II, III). In the presence of herbivores, however, the abundance of *B. hamifera* increased in the community as a result of both consumption of neighbouring algal competitors and an enhanced performance of the invader (paper III). In return, the invasive species was found to provide a superior refuge to herbivores from fish predation compared to native seaweeds, which may explain the previously observed rich species diversity and abundance of invertebrates associated with the alga. Overall, these results suggest that the invasion of *B. hamifera* has been facilitated by refuge-mediated apparent competition (paper III).

In conclusion, *B. hamifera* provides a remarkable example of how a novel chemical defence can drive different ecological processes in the new community and how this jointly contributes to the invasiveness of the introduced species. The further development of the invaded community is difficult to predict and depends on the ability of the native species to adapt to the chemical defence of the invader, as well as on the potential of the invader to respond to the novel selection regimes in the invaded area. Sufficient genetic variation is generally considered essential for the potential of adaptations. In Swedish waters, *B. hamifera* mainly propagates asexually by fragmentation, which suggests that the alga should be highly clonal with low genetic diversity within these introduced populations. Preliminary results from 83 amplified fragment length polymorphism markers analysed for 44 individuals indicated reduced genetic diversity in Swedish populations compared to populations from the native range in Korea. No clones were found in the Swedish population, although the low degree of differentiation and high similarity between the Swedish individuals suggests that the individuals belong to a single clonal lineage, that is well intermixed by fragment dispersal (paper V).

***Key words:*** *Biological invasions, enemy release, increased competitive ability, novel weapon, chemical defence, plant-herbivore interactions, competition, seaweeds, Bonnemaisonia hamifera*