



GÖTEBORGS UNIVERSITET

Seagrass Wasting Disease
Impact of abiotic factors and chemical defense

Stina Jakobsson-Thor

Institutionen för marina vetenskaper
Naturvetenskapliga fakulteten

Akademisk avhandling för filosofie doktorsexamen i marina vetenskaper, som med tillstånd från Naturvetenskapliga fakulteten kommer att offentligt försvaras fredag den 15 december, 2017 kl. 10.00 i hörsalen, Institutionen för marina vetenskaper, Tjärnö, Hättebacksvägen 7, Strömstad.

ISBN 978-91-629-0372-5 (PRINT)

ISBN 978-91-629-0373-2 (PDF)

Tillgänglig via <http://handle.net/2077/54176>

ABSTRACT

Eelgrass, *Zostera marina*, is the dominant seagrass species in the northern hemisphere, and forms large meadows that provide several important ecosystem services. In the 1930s about 90% of the *Z. marina* populations in the Atlantic Ocean were killed in an epidemic caused by the wasting disease pathogen *Labyrinthula zosterae*. Despite the devastating impact of this disease the host-pathogen interaction is still poorly understood, and there is limited knowledge about factors that influence the disease. In this thesis I study how abiotic factors can impact the relationship between *Z. marina* and *L. zosterae*, and investigate if the seagrass can defend itself against the pathogen through production of inhibitory compounds.

In two field studies I investigated if laboratory results, showing that low salinity mitigate *L. zosterae* infection, can be translated to the field. Surveys along the salinity gradient of the Swedish coast show that *L. zosterae* infection is high in high salinity areas (20 - 25 PSU), and that infection generally decreases or disappears at low salinity (<10 PSU). These findings suggest that low salinity areas can act as a refuge against seagrass wasting disease. However, in contrast to previous studies, salinities as low as 6 PSU do not always exclude infection in *Z. marina* meadows. The disease was detected, in low concentrations through DNA-based methods, in several meadows in the Baltic proper. Thus, it is possible that a *L. zosterae* strain has adapted to the low salinity environment of the Baltic Sea. This could lead to an increased distribution of the pathogen in areas previously considered to be protected from the pathogen, and potentially result in wasting disease outbreaks also in low salinity *Z. marina* meadows.

One way for *Z. marina* to withstand infection by *L. zosterae* is to be chemically defended through the production of secondary metabolites. All *Z. marina* shoots investigated in this thesis produced chemical compounds that inhibited *L. zosterae* growth. Laboratory experiments implied that the production is not induced by a high pathogen pressure, as previously suggested, but rather that *Z. marina* contains inhibitory compounds that function as a constitutive defense. Chemical analyses further detected three partially purified inhibitory fractions against the pathogen, and characterization of the compounds showed that these are new, yet unknown, compounds from *Z. marina*.

A laboratory infection experiment was performed to investigate how individual and interactive effects of extrinsic factors affect *L. zosterae* infection in *Z. marina*. The results showed a complex host-pathogen interaction, with several interactions between light, temperature, tissue damage, and infection that affected growth, production of inhibitory compounds, and gene expression in *Z. marina*. Overall, light intensity had the strongest effect on wasting disease, where reduced light intensity resulted in a significant increase in lesion coverage.

KEYWORDS: Seagrass wasting disease, *Zostera marina*, *Labyrinthula zosterae*, eelgrass, chemical defense, host-pathogen interaction, abiotic factors, infection.