Hollander, Johan 2005. Evolution of reproductive barriers in *Littorina saxatilis*. Department of Marine Ecology, Göteborg University, Tjärnö Marine Biological Laboratory, 452 96 Strömstad, Sweden

***Abstract*:** To understand the process of speciation we need to understand the evolution of reproductive barriers, and part of this is to understand what causes divergence within species. The long-standing view that species evolve during physical isolation of populations (allopatric speciation), are currently being complemented by new theories arguing for non-allopatric modes of speciation. These models rely on ecological factors producing local adaptation and population divergence without physical barriers to gene flow. Non-allopatric models, such as sympatric and parapatric speciation, are currently gaining a great deal of attention, being supported by theoretical models and empirical data.

The marine gastropod *Littorina saxatilis* is a viviparous and polymorphic species with locally adapted ecotypes confined to discrete habitats. Genetic studies strongly suggest that populations of ecotypes originate repeatedly by parallel evolution in separate areas. Along the Swedish west coast two ecotypes of *L. saxatilis* are formed, each possessing phenotypic characters that substantially increases the survival in its specific habitat. In this thesis *L. saxatilis* is used as a model species to study the evolution of reproductive barriers between ecotypes, as we assumed this must be the initial stage of non-allopatric speciation.

Using genetic markers and morphometric analysis we show that gene flow between ecotypes is reduced over hybrid zones indicating the presence of a partial reproductive barrier. Laboratory experiments supported this conclusion by showing that males copulated significantly longer time with females of their own ecotype than with females of the opposite ecotype, size seemed to be the most important cue for assortative mating.

In an experimental study we show that a mechanism explaining at least part of the assortative mating is mucus trail-following. Males distinguished between trails laid by own and alien markers, although they could not distinguish male and female trails.

In addition to important inherited differences in shell size and shape, we found differences in the ontogenetic developmental patterns between ecotypes. Females, in particular showing biphasic allometry responding to different trade-offs during juvenile and adult stages.

Besides genetic variation contributing to local adaptation, snails exhibited significant levels of phenotypic plasticity which tended to support local adaptation. Taken together these results indicate various strategies to develop local adaptation in a species living in a heterogeneous habitat. As a by-product of strong local adaptation, assortative mating and an impeded gene flow evolve, possibly being the initial step in non-allopatric speciation.

***Keywords*:** *adaptation, allometry, assortative mating, biphase allometry, ecological speciation, ecotype, gastropod, gene flow, geometric morphometrics, heterogeneous environment, hybrid zone, isometry, landmark morphometrics,* Littorina saxatilis, *parapatric speciation, pedal mucus, phenotypic plasticity, phenotypic variation, prezygotic isolation, rocky shore, size, sympatric speciation, speciation.*