Panova, Marina (2007) Genetics of differentiation in the marine snail *Littorina saxatilis,* with consideration of microsatellite genotyping errors. Department of Marine Ecology, Göteborg University, Tjärnö Marine Biological Laboratory, SE-452 96, Strömstad, Sweden.

ABSTRACT: Genetic divergence and, in particular, polymorphism of adaptive traits within a species might be a first step in the process of ecological speciation. Species showing strong local adaptation are therefore interesting objects for studies of speciation. The marine snail *Littorina saxatilis* has evolved locally adapted morphs (ecotypes) in different intertidal environments. The aim of my thesis was to increase the understanding of how and why genetic differentiation evolve within this species, and if this differentiation promotes ecological speciation.

A striking example of a genetic polymorphism within *L. saxatilis* is the different forms (allozymes) of the enzyme aspartate aminotransferase found in snails living at different shore levels. This polymorphism is likely to be an adaptation formed by strong selection since it is stable and present at different geographic regions. Differences in activity between the two enzyme forms, which support their adaptive role, are presented in this thesis. Strong differentiation at this locus does not, however, affect gene flow between low and high shore snails, as was also shown by analysing neutral genetic markers. Thus, in this case strong selection does not promote evolution of reproductive isolation.

However, the ecotype polymorphism with small and fragile snails living on cliffs and large and robust snails confined to boulders, results in assortative mating where ecotypes overlap in distribution. Here we show that this creates a partial reproductive barrier between ecotypes, and this might be a first step towards speciation. Notably, studies included in this thesis also provide evidence for independent evolution of the ecotypes at different islands. This is one of few good examples of an evolution of reproductive barriers due to strong ecological selection without geographic isolation.

While selection is an important factor at local scales (between habitats), population genetic structure of *L. saxatilis* at somewhat larger distances (between islands) is mainly affected by random processes. Thus differentiation between populations in two neutral genetic markers (allozymes and microsatellites) increases with geographic distances. Despite the fact that *Littorina saxatilis* lacks pelagic larvae and has a poor dispersal of adult snails, the species has colonized even remote islands by occasional rafting. Such colonization is successful because adult female snails can carry up to two hundreds embryos, and thus a single female can start a new population. Furthermore, we found that females may simultaneously carry offspring with up to 12 different males, and multiple paternity is an efficient way of storing genetic variation in a founder group that consists of a single female.

Finally, we encountered a technical problem called "null alleles" when we used microsatellites as genetic markers. To improve future estimates based on microsatellites we analyzed the occurrence of the null alleles in *Littorina*, and we also assessed their general statistical effects. We showed that null alleles are unlikely to violate overall conclusions in population structure analysis.

Thus this thesis contributes to our understanding of mechanisms behind differentiation and speciation in natural populations by, for example, showing a) that in some cases ecological selection maintains polymorphism in the presence of gene flow while in other cases ecological divergence leads to reproductive isolation that might evolve repeatedly at local sites, and b) that the relative roles of selection and random genetic processes may shift with geographic scale.

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