Genetics of climate adaptation in Arabidopsis and forage grasses

Abstract:
Temperature and photoperiod are main environmental cues that influence key adaptive traits like cold acclimation and flowering time which enable plants to synchronize their life cycle to the seasonal changes in climate. Adaptation to environmental factors varying along geographic gradients should in principle lead to phenotypic and/or genetic clines. In this talk I will give a summary of two areas of research associated with climate adaptation that we are conducting in my research group at the Norwegian University of Life Sciences at Ås in Norway (www.umb.no). The first is studies of flowering time as affected by vernalization and photoperiod sensitivity of a unique collection of Arabidopsis thaliana accessions from Norway representing the most northern distribution of this species in the world (68°N). Results of detailed phenotypic screening followed by investigations of sequence variation in selected candidate genes, microarray analyses of contrasting accessions, and SNP analyses to study population structure will be presented. The second part deals with cold acclimation and freezing tolerance in the cool-season grass species meadow fescue (Festuca pratensis), perennial ryegrass (Lolium perenne) and the hybrid between them (Festulolium). Physiological cold acclimation (or hardening) is a prerequisite for obtaining sufficient freezing tolerance to survive winters, and cold acclimation induce massive changes in gene expression and metabolism that is only partly understood. I will summarize work that have been doing in recent years to link phenotypic responses in artificial freezing tests to differential gene expressions and identification of candidate genes during cold acclimation. The goal has been to develop markers for breeding by QTL mapping and association mapping using allelic shifts in candidate gene SNPs during selection.