

Conifers are important both ecologically and socioeconomically, however, some parts of their biology are not that well researched. This includes genetics and breeding and partly even physiology. Because quantitative genetic analyzes applied in breeding necessitate an analysis of a large number of samples, and conventional methods of analysis are quite time-consuming, certain parameters describing e.g. the activity of photosynthetic electron-transport chain (ETC) are considered for such use. Several methods of the measurement of the activity of photosynthetic ETC exist, but there are some problems with their usage in conifers. I studied this issue from different points of view in three parts of this thesis. 1) I compared the photosynthetic ETC activity in 8 species of conifers using chlorophyll (Chl) fluorescence measurements on intact needles and polarographic measurements in isolated chloroplasts. Each method brought different information. 2) I measured Chl fluorescence parameters, reflectance spectra and pigment content in 536 genetically defined trees of *Pinus sylvestris* L. Many parameters showed relatively high genetic variability and heritability. I have also determined the suitability of various reflectance indices to estimate pigment and water content of needles. 3) I have optimized the spectrophotometric method for the measurement of the activity of Photosystem II with inhibited oxygen evolution complex and checked its applicability for conifers.