

Abstract: The main focus of this thesis is in situ hybridization method and its impacts in modern cytology. The first chapter of the thesis describes the method itself and its types, defines and enumerates fundamental terms of the method, describes the steps of preparation and actual experiments in detail and explains the process of evaluation and interpretation of results. Following chapter describes several cases studies on plants performed using ISH. It describes use of ISH to recognize introgression lines among hybrids and to determine their fertility, to study polyploids and evolution of the nonaploids and to study repetitive sequences in telomeres of lily plants. In the next chapter the thesis describes *Vicia cracca* agg. from morphological but mainly systematical point of view. The thesis is concluded by suggestion of possible utilization of genomic in situ hybridisation in order to reveal the pregenitors of tetraploid *V. cracca* and the evolution within the aggregate.