Abstract

Apomixis (asexual reproduction by seeds) has the considerable potential in agriculture and crop breeding due to its ability to produce genetically identical progenies in a form of persistent propagules, i.e. seeds. However, the processes laying behind the origin of apomixis and connected molecular mechanisms are still unknown. Despite the fact, that apomicts are considered to be an evolutionary dead-ends, they are often more widely distributed than their sexual relatives (this phenomenon is commonly referred to as geographical parthenogenesis (GP). Although this phenomenon is studied for decades, its causes are still not fully understood. Importantly, several recent studies pointed out that apomicts with limited genetic variability can at some extent react to changing environment through changes in gene transcription by epigenetic modifications.

It is generally assumed, that hybridisation and polyploidization played a crucial role in the emergence of apomixis. For this reason, presented studies test the putative origin of selected polyploid apomicts and if the interspecific hybridisation between diploid sexuals triggers polyploidization using predominantly polyploid and apomictic genus *Hieracium* s. str. Surprisingly, the presented study demonstrates the hybrid origin of almost all investigated polyploid apomicts, some of which were originally considered as autopolyploids (based on morphology). Moreover, interspecific hybridisation between diploid taxa unexpectedly showed low production of neopolyploids in both, interspecific and intraspecific crosses. In contrast to parental diploid species (0.22%), neopolyploids produced higher amount of various polyploids (68.7%). Thus, it can be assumed that new unstable polyploid cytotype could be diploidised in following generations or that polyploidy can be fixed by bypassing meiosis and switch to apomictic reproduction. This pattern would correspond to strict sexuality in diploids and strict apomixis in polyploids of *Hieracium* s.str. observed in natural conditions.

Majority of the genus *Hieracium* s.str. is formed by polyploid apomicts while diploid sexuals are rare and geographically isolated (as suggested by GP theory). Presented study deals with Metapopulation hypothesis which can explain GP distribution pattern by the negative effect of inbreeding in the population of sexuals compared to genetically stable apomicts. In detail, the presented study showed inbreeding depression in sexuals of *H. alpinim*, which can limit their dispersal potential and thus contribute to GP in this species, according to Metapopulation hypothesis.

Despite the lack of genetic variation, clonal plants can in some extent react to changing environment by changes in DNA methylation. Importance of DNA methylation was already

tested twice in *H. alpinum* using experimental demethylation with no/little effect on plants performance. For this reason, the presented study aims to determine the best methodological approach for experimental demethylation and test the temporal stability of induced changes in DNA methylation.

Future research should focus on unstable neopolyploids of *Hieracium* s.str. which can be produced by various types of crosses. Because new and unstable polyploid cytotype could be theoretically fixed by bypassing meiosis and apomictic reproduction, a close examination of this process could finally identify mechanisms laying behind apomixis. Understanding this mechanism can theoretically simplify the production of such crops as cowpea or sorghum by capturing hybrid vigour through apomictic reproduction. Furthermore, the best methodological approach of the experimental demethylation of *H. alpinum*, which is described in this thesis, can be used to close examination of the role of DNA methylation in the adaptability of clonal plants.