Clarification of nutritional and physiological respondence to abiotic conditions *in situ* of temperate orchids by –omics methods; ORCHIDOMICS project

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Orchids belong to one of the biggest plant families (Orchidaceae) with more than 27 000 species. They evolved specific biological interactions with pollinators and mycorrhizal fungi (MF). The latter play a key role during plants' growth and development. Due to restricted amount of nutritional reserves in minute orchid seeds, the germination and further development of seedlings in nature depends on symbiotic relationship with MF. They provide nutrients, especially carbon as the energy source to the germinating seeds in heterotrophic nutrition called mycoheterotrophy. Young seedlings remain mycoheterotrophic until the first green leaf is developed and photosynthesis starts. Then the plantlets form their own sugars and exchange them with MF against mineral salts and water. Yet some orchid species from shady forest environment remain fully or partially mycoheterotrophic (the latter nutrition is called mixotrophy) in adulthood. Mycoheterotrophic and mixotrophic orchids illustrate an evolution of the basic plant physiology that adapt to living in shady forests. They are good models to study developmental and evolutionary plasticity of plant nutrition. The aim of my PhD programme is to understand mycorrhizal functioning in diverse plant nutritional types and diverse abiotic conditions *in situ* during the orchid lifecycle. My study encompasses sampling of nine temperate orchid species (*Cephalanthera damasonium*, *Dactylorhiza majalis*, *Epipactis atrorubens*, *Epipactis helleborine*, *Epipactis palustris*, *Epipogium aphyllum*, *Listera ovata*, *Neottia nidus-avis*, *Platanthera chlorantha*) representing the three nutritional types. We combine transcriptomic (RNA-Seq) and metabolomic (nd GC-MS) methods to get an integrated view of plant metabolism.

The first step of my study apart of selecting suitable orchid populations was to obtain germinating seeds (protocorms). In autumn 2016 we collected the seeds of studied orchid species *in situ* in order to sow them in their respective populations. We tested the progress in germination after eight months. Early stages of germination were observed only for *D. majalis*, *L. ovata*, and *E. palustris*. However, the germination success seems to be site-dependent. Further progress in germination will be monitored during two following growth seasons. Since May 2017, we started sampling of leaves and roots of studied orchid species for the –omics studies. The research material has been collected in 34 populations *in situ* in the southern part of Poland.