Biotic and abiotic stress elicitors as modulators of isoquinoline alkaloid profile towards specific antimicrobial properties of medicinal plants from the Papaveraceae

The aim of the project is to learn about the phenomenon of a complex isoquinoline alkaloid composition in medicinal plants of the species *Chelidonium majus*, *Fumaria officinalis* and *Glaucium flavum*. We are looking for an answer to the question why do different plant species, even closely related, accumulate so varied amounts and usually complex mixture of structurally related substances that exhibit specific biological activities?

The research will be carried out on three species of plants from the Papaveraceae family, which have been selected on the basis of their previously described content of isoquinoline alkaloids. The species are an important source of herbal raw material in Poland and other countries of Central and Eastern Europe. The analysis of alkaloid composition have been previously performed in some of these and related plant species, however the influence of exogenous factors on changes in the profile of accumulated alkaloids with regard to a specific *in vitro*-derived plant material response, which is antimicrobial activity, has never been comprehensively studied. Within the main classes of isoquinoline alkaloids such as benzylisoquinoline, phthalide-isoquinoline, proto-berberine, spiro-isoquinoline a large variety of derivatives was observed. This huge diversity resulting from the extraordinary plasticity of plant metabolome is a great scientific challenge both, in terms of explaining the reasons for the production of such a complex composition, as well as their role in the formation of biological properties to combat pathogens. Analytical techniques allow only to evaluate the identity and content of substances in the plant material under study, but they do not add anything about the causes of the formation and degradation of compounds. As for the isoquinoline alkaloids, the greatest difficulty in recognizing the pathway of their formation is the large number of closely related structures, with often similar physicochemical properties, sometimes quite challenging from the analytical point of view. Using biotechnological approach, based on experiments with different plant species, where influence of uncontrolled/ambient environmental factors is minimized, it is possible to obtain plant material with a specific composition of bioactive metabolites.

In our project, we want to use the natural interspecific variation present within one botanical family (Papaveraceae) and plant tissue culture approach to learn about the impact of selected biotic and abiotic factors on both the phytochemical composition and the resulting antimicrobial properties.