

Representatives of the buckwheat (*Fagopyrum*) genus are dicotyledonous plants that belong to the Polygonaceae family. The genus includes 26 species, both annual and perennial, which grow mainly in the Eurasian highlands. The two most important cultivated species are common buckwheat (*F. esculentum*) and Tartary buckwheat (*F. tataricum*). Considering the recent vogue for leading a healthy lifestyle, one of the trends is an increasing interest in the consumption of so-called healthy foods. *F. tataricum* and *F. esculentum* can play an important role in a wide range of natural products that act beneficially on the human body. This is primarily due to the high content of various phenolic compounds in this plant, rutin and quercetin, as well as C-glycosylflavones such as orientin, isoorientin and vitexin. The positive therapeutic or dietary action of these biologically active compounds is due to their strong antioxidant properties, which have a beneficial effect on blood vessel elasticity and help to prevent the cardiovascular diseases that are currently one of the most serious diseases of affluence. Compared to the buckwheat species that is widely grown in Poland, *F. esculentum*, *F. tataricum* contains more phenolic compounds in each part of the plant and during the various stages of its life cycle. The content of proteins in buckwheat is higher and their quality is better than in the case of the cereals that belong to the grass family such as wheat, rice, maize and sorghum.

The biggest problem with cultivating *F. esculentum* is the short life of its single flower. In addition, buckwheat has a very short growing period (70-90 days). It is also sensitive to ground frost, high temperatures and drought all of which may cause strong flower and embryo abortions. A cross-pollination of the buckwheat *F. homotropicum* with *F. tataricum* or *F. tataricum* with *F. esculentum* was done in order to transfer the genes that have a greater resistance to frost and a higher seed yield. Because of the strong barriers that prevent cross-pollination between different species, these studies have been unsuccessful. The seed set is insufficient as it only amounts to 15-53% depending on the genotype and growth conditions. Among the most important reasons for the low yield are (1) self-incompatibility, (2) insufficient fertilisation, (3) embryo abortion, (4) sensitivity to heat and drought stress and (5) a deficiency of assimilates that occurs in aging plants.

Protoplast fusion and subsequent *in vitro* plant regeneration, which lead to somatic hybridisation, offer opportunities for transferring entire genomes from one plant into another regardless of the interspecific crossing barriers. A callus is a shapeless mass of undifferentiated and rapidly dividing cells. It can be derived from almost every plant tissue by treating it with a mixture of plant hormones (for example, auxins and cytokinins). Our great experience working with tissue cultures has demonstrated that *F. esculentum* and *F. tataricum* are good models for analyses starting from gene regulation to the characterisation of the molecular players both inside and outside a cell.

In this project, we aim to identify and analyse the key changes that occur during the development of buckwheat somatic hybrids.

This project will be realised in collaboration with an institution in France. The primary rationale for the international research collaboration under this proposal is to combine our expertise with *F. esculentum* and *F. tataricum* tissue cultures with the unique expertise of Dr Elisabeth Jamet's group in the area of cell wall proteomics (the large-scale study of proteins) and bioinformatic analyses. Another important point of this collaboration is the use of a proteomic facility that is located in Toulouse and Paris, France. This proteomic facility is unique and has extensive experience in analysing plant proteins. No such facility exists in Poland. The mutual complementary experience and skills of the research teams in Katowice and Toulouse will create the intellectual, methodological and infrastructural foundation that is required to successfully conduct the planned research and will also provide opportunities for future fruitful cooperation.