The purpose of the project is to investigate the main reasons and mechanisms of embryo developmental disturbance and the abortion of the flowers and immature common buckwheat (*Fagopyrum esculentum*) seeds. These processes significantly affect seed yield. Buckwheat produces plants of two types of flowers: Pin and Thrum, varying in the length of the pistils and stamens. In the Pin flowers pistils are low, while stamens are high and in Thrum type the proportions are reversed. The fertilization is only possible after cross-pollination between the two types of flowers. A single plant produces a very large number of flowers (500 to 2000), but only a small part of them produce seeds. Buckwheat blooms throughout the vegetation period, which results in the competition of still produced flowers with already-formed seeds for assimilates (mainly sugars), produced by the leaves. This leads to flower abortion, poorly filling seeds or falling off immature seeds. In addition, buckwheat is very sensitive to ground frost, drought or high temperatures, which increase the percentage of falling flowers and buds. Buckwheat is a cold-sensitive plant, so it can only be sown when the soil in the top layer has a temperature of 8-10 °C. Buckwheat is usually sown between May 15 and 25, so its vegetative season in Poland is relatively short and lasts 70-90 days.

The research hypothesis assumes that high temperature negatively affects the development of female and male gametes in pistils and pollen of buckwheat flowers by quantitative and qualitative changes of plant hormones and proteins. Another important limiting factor for effective buckwheat yield is the trophic (alimentary) stress, consisting of disturbed assimilates' distribution to the flowers and seeds. It is assumed that the removal of some of the generative organs (lateral ramifications with flowers or parts of racemes) will increase the percentage of well-developed embryo sacs and will reduce the degree of natural abortion of flowers and immature seeds.

Planned studies will be carried out on plants of two Polish genotypes of common buckwheat, varying in the degree of embryo sac degeneration as well as yield of mature seeds. In the flowers of plants grown at 28°C (heat stress) and 20°C (control), the development of embryo sacs (eggs) and pollen grains (microspores) and the accumulation of heat shock proteins that protect other proteins from destructive high temperature effects, will be analysed. In addition, the quantitative and qualitative composition of the other proteins synthesised under high temperature stress and plant hormones involved in the flowering and embryogenesis process under high temperature will be determined.

In order to verify the hypothesis that immaturity of embryo sacs is also a result of competition for assimilates, the second experiment will be carried out on the pistils isolated at very early developmental stage of green flower buds and cultivated under sterile conditions on media. One part of the pistils will be cultivated on media providing all the nutrients necessary for their development, while the other part on media containing two-fold less components. In these pistils the embryological development will be analyzed. The effect of trophic stress on the development of gametes will also be investigated under an open foil tunnel where pollinating insects have access. In order to ensure sufficient assimilates to the developing embryos and seed filling, the lateral ramifications or part of the flowers will be removed. In the remaining flowers the embryogenic development and hormonal composition will be analyzed. In this experiment the ripe seed set will also be determined.

The use of two main stresses, i.e. high temperature and trophic disorders will allow to indicate the most important cause of faulty generative development and flower abortion. Identified proteins of different accumulation levels under heat stress conditions could be used as the markers of the buckwheat response to high temperature. In addition, the results will give the answer whether the creation of new buckwheat forms characterized by shorter flowering phase and time-separated from the seed maturation period, would reduce the number of degenerated embryo sacs and the degree of abortion of the flowers and immature seeds.

The planned investigations are complex and the various analyses such as analysis of embryological development in terms of hormonal changes, quantitative and qualitative changes of the proteins in the flowers and leaves of the two buckwheat genotypes differing in the degree of developmental disturbance of the embryo sacs and the flower abortion make them innovative character. In addition, the results of these studies can be of great economic importance in many countries around the world. Buckwheat is a plant cultivated due to the very good chemical composition of the seeds, especially the very high content of lysine and other amino acids. The seeds also contain starch, which is free of gluten, i.e., a protein that causes a various allergic disorders in both children and adults. Buckwheat nectar is valued by beemasters, and buckwheat honey contains many valuable health-promoting ingredients. Because of the unstable yield, in a temperate climate where vegetative season for buckwheat is relatively short, the farmers reluctantly decide to cultivate this plant species. Recognition of the mechanism of abortion of the flowers and immature seeds, as well as the possibility of limiting abnormal generative development could contribute to increasing the stability of yield and thus increase the area of buckwheat cultivation and its profitability.