



Spring barley / Photo. Agata Daszkowska-Golec

Geneticists from the University of Silesia are looking for new barley crop forms which will show a better reaction to various stress factors, such as long-term water shortage. Their research has significant potential for application. This type of cereal is ranked at fourth position with regard to the cultivated area and can be used for the production of groat or flakes, in the brewing industry, and as animal feed.

The best type of barley should have a high yield, good grain quality, and be resistant to plant pests, various environmental and weather-related conditions, including drought, excessive precipitation, or frost. Scientists are looking precisely for these types and, as a first step, analyze the plant's genetic code. Some genes are responsible for its reaction to various stress factors, whereas other ones indirectly determine yield or seed value defined as the amount of nutrients present in the plant.

– At first, the genes linked to the plant's response to e.g. drought stress must be identified. Subsequently, we check how mutilations of these genes could contribute to the improvement of the tolerance indicator e.g. to long-term water shortages. We also compare them to the performance of the control group, that is, the genes without mutations, says Dr. Agata Daszkowska-Golec, who studies defense mechanisms with regard to drought stress in barley (*Hordeum vulgare*) and in the thale cress (*Arabidopsis thaliana*).

Although the described actions may seem simple, they are extremely complicated and time-consuming. In general, a mutation of any gene also influ-

ences other parameters. Varieties that are more tolerant to pests can have a lower seed quality or yield, whereas high-yield varieties are frequently more sensible to flooding stress. Therefore, the new forms developed by scientists are introduced to cross-breed programs.

– In practice this means that we will cross plants with a high tolerance to drought with elite, high-yield varieties recommended by growers, says the geneticist from the University of Silesia.

So far, two barley varieties with the following gene mutations have been described: CPB20 (Cap-Binding Protein 20) and ERA1 (Enhanced Response to ABA1). Both forms show a better tolerance to drought stress in the plant.

– The next step will be a more detailed examination of the regulatory role of these genes in situations in which a response to water shortage is required.

Barley mutants are thus an interesting tool to analyze the functions of particular genes, however, it should be borne in mind that the genetic engineering techniques with regard to this crop are complicated.

– We are very experienced in the use of mutagenesis techniques on barley and have a worldwide unique HORTILLUS population, an extensive collection of barley mutants. Scientists working at institutes from all over the world ask us to generate a mutation in a specific barley gene. We are of course open to such a cooperation, says Dr. Daszkowska-Golec, who is also the leader of the Polish team conducting research within the framework of the project “Advanced Tools for Breeding BARley for Intensive and SusTainable Agriculture under Climate Change Scenarios” (BARISTA), in which scientists from Poland, Italy, Finland, Spain, Germany, Denmark, Britain, and Estonia are involved.

So far, research findings are promising, and thanks to the cooperation with the growing station DANKO Hodowla Roślin, the sowing phase of new barley varieties has already begun. Over the course of several years, the newly obtained barley genotypes will be observed in their natural habitat, so that the knowledge acquired in laboratories and controlled greenhouse conditions can be verified in practice.



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CEREALS RESISTANT TO DROUGHT STRESS