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Efficiency of barley (*Hordeum vulgare* L.) androgenesis.

The arrangement of the manuscripts encompassing the PhD thesis

Doctoral thesis carried out in the Department of Plant Biotechnology and Cytogenetic, Plant Breeding and Acclimatization Institute, National Research Institute in Radzikow, under the supervision of PhD, ScD professor Janusz Zimny and auxiliary supervisor PhD Sylwia Oleszczuk.

Abstract

In cereals doubled haploid (DH) plants are usually obtained via androgenesis. This process is used in both biological research and plant breeding. The usefulness of androgenic cultures (anther culture and microspore culture) and as a breeding and research technique is hampered by its low effectiveness understood as a low yield of regenerated green DH plants.

The dissertation presents results in three areas of androgenesis efficiency which relate to the genotype of donor plants, inhibition of albinism and improvement of plant regeneration.

The genotype of donor plant is the most important factor which determinates the effectiveness of DH regeneration. We studied a large number of spring and winter hybrids of barley and showed that the vernalisation requirement correlates with the success of plant regeneration. Winter genotypes reached a higher regeneration levels of green plants and a lower level of albinism compared to spring genotypes. Among the winter and spring genotypes, there was no difference in the level of spontaneous chromosome doubling.

Albinism is defined as a plant's inability to produce chloroplasts and thus carry out the process of photosynthesis. In the anther and microspore *in vitro* culture it is a serious problem which reduces the regeneration efficiency. The dissertation contains a review article on the phenomenon of albinism, including frequencies in androgenic plants in various barley genotypes, the cause of albinism in androgenesis-derived plants, known external factors and culture techniques that inhibit albino plants regeneration.

The research also presents the effect of additional supplementation of copper sulphate at the induction stage on the reduction of albino plants regeneration. The results do not support the hypothesis that addition of copper reduces albinism in barley microspore culture, however, it increased the regeneration of green plants.

Another factor frequently observed in barley androgenic cultures that negatively impacts the efficiency is low a level of regeneration from androgenic structures. We tried to improve embryo formation and the conversion rate into plants by supplementation of the induction medium with gum arabic. Gum arabic is a source of arabinogalactan proteins, which are involved in the induction, maintenance and restoration of the embryogenic potential of cells in *in vitro* culture. The results showed the gum arabic improves microspore viability, accelerates cell division in the first day of culture and enhances plant regeneration efficiency. However, it did not reduce the number of albino plants.