

Application of genetic resources and markers in breeding of potato resistant to late blight

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Potato (*Solanum tuberosum* L.) is the fourth most important crop plant worldwide and its economically most important disease, late blight, is caused by an Oomycete, *Phytophthora infestans* (Mont.) de Bary. Breeding potatoes resistant to this disease is a valid and environment-friendly alternative to the currently applied intensive chemical control. The pathogen is fast-evolving and can quickly adapt and infect new resistant cultivars of the host. Therefore new strategies of using late blight resistance (*Rpi*) genes in improving durability of the resistance are developed. They are all based on the access to multiple broad-spectrum *Rpi* genes. In Plant Breeding and Acclimatization Institute – National Research Institute, Młochów Research Centre, four *Rpi* genes were identified and introduced into potato pre-breeding program: *Rpi-phul* from *S. phureja* from International Potato Center (CIP), *Rpi-rzcl* from *S. ruiz-ceballosii* and *Rpi-mch1* from *S. michoacanum* from Vavilov Collection (St. Petersburg, Russia) as well as the *Rpi-Smiral* gene from the cultivar Sárpo Mira. The genes were mapped on a potato genetic map and markers are used for marker-assisted pyramiding of the genes. The *Rpi-phul* has been cloned and sequenced and we use gene-derived marker for selection, while for other genes we use closely linked markers. Spectrum and durability of provided resistance is monitored in the Polish population of *P. infestans* in virulence detached leaflet tests. The effect of pyramiding is tested both in the laboratory and in the field tests. Using qPCR we test the expression of the *Rpi-phul* gene and the corresponding effector during the host-pathogen interaction for better understanding of virulence/avirulence. The first cultivar with the *Rpi-phul* gene has been registered in Poland by the Zamarte Potato Breeding Ltd. Group IHAR in 2018, ca 48 years after arrival of gene donor from CIP to Poland which demonstrates that introgression breeding is a long, laborious and challenging process.

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