

Tetraploid potato collection at Polish in vitro gene bank - collection, maintenance, and use.



Dorota Michałowska, Włodzimierz Przewodowski, Dominika Białokórska, Bartosz Płóciennik
Plant Breeding and Acclimatization Institute - National Research Institute, Bonin 3, 76-009 Bonin, Poland
d.michalowska@ihar.edu.pl



The resources gathered in the bank are described and valorized in terms of botanical, functional, and genetic characteristics in the field during the identification of genotypic persistence and varietal purity. Individual objects are identified every 4-5 years. The description is based on: good distinctive features (color of flower crown, color of light shoot, color of flesh and skin), features of slight variation (presence and shape of wings, arrangement of stems, shape of leaves, arrangement of inflorescences, arrangement and color of stamens, length of the pistil neck, anthocyanin discoloration of stems) and features of high variability (color of leaves, stems, leaf concentration, general bush habit, depth of the eyes). The data obtained from the observations are compared with catalog descriptions or data provided by the breeder.

Results

The potato gene bank resources are the starting base for Polish potato breeding and research. Each year individual accessions are taken from the collection to prepare in vitro plants, minitubers, and microtubers. Next, reproduces genetic materials are transferred to breeding and scientific institutions and used in breeding and research. The in vitro collection is used, among others, by units engaged in the creative breeding of new varieties. On the other hand, in conservative breeding, using pathogen-free in vitro material improves seed potatoes' health and shortens the field production cycle to obtain the appropriate amount of seed tubers. This is especially important for newly zoned potato cultivars. Furthermore, in conservative breeding, the accessions can be used with equal success to reactivate old cultivars that, for various reasons, are of interest to consumers. At the same time, breeders provide their breeding lines to remove viruses and introduce them for long-term storage to ensure restorative material for propagation.

Summary

The method of long-term storage of plants in vitro allows for:

- long-term storage of material free from contamination with pathogens important for the potato,
- quick multiplication of the desired cultivars,
- preparation of healthy starting material for creative and conservative breeding and seed production,
- the possibility of reactivating old varieties,
- use of the material in research supporting breeding.

The work funded the Ministry of Agriculture and Rural Development under the Targeted Subsidy for 2022 Area 1: Protection of plant genetic resources for agricultural plants task 1.2 "Ex-situ conservation of agricultural crop plant genetic resources," Theme: "Ex-situ conservation of tetraploid potato genetic resources." No 2-1-04-0-02.

Introduction

Bonin Division of the Plant Breeding and Acclimatization Institute - National Research Institute keeps the in vitro gene bank of potatoes, which is part of the National Center for Plant Genetic Resources. The bank's primary goal is to collect and store potato tetraploid genotypes in the in vitro collection and introduce new valuable materials as part of an exchange with other research and breeding units. Currently, the collection comprises over 1,621 in vitro accessions from 23 countries. In addition, the gene bank holds all 288 accessions of Polish cultivars registered in the country after 1945, constituting 20% of the collection. The oldest Polish cultivars are Marius from 1894 and Świtez from 1902. The newest are those entered in the National Cultivar Register in 2022: Karat, Lenka, and Meluzyna.

Methodology

New cultivars and prospective lines obtained from breeders are introduced to the in vitro bank annually. The starting materials are potato tubers tested for quarantine bacteria: *Clavibacter sepedonicus* comb. Nov and *Ralstonia solanacearum*. Plants obtained from tubers free of these pathogens are subjected to thermotherapy, i.e., high temperatures of 38°C day, and 33°C night, to remove viruses.

In the third week of thermotherapy, genotypes are tested for Potato spindle tuber viroid (PSTVd). Only quarantine pathogens-free plants are further processed. Subsequently, from the top and side buds of plants, meristems of 0.1-0.2 mm in size are isolated and placed in test tubes on Murashige-Skooga (1962) medium with agar, and added sugar (30 g / l), gibberellin (0.1 mg / l) and kinetin (0.04 mg / l) for 4-18 weeks. Meristem-grown plants are checked 2-3 times by ELISA test for PVA, PVX, PVS, PVM, PVY, and PLRV. Finally, pathogen-free plants are introduced into the in vitro collection.

Plants in the in vitro potato gene bank are kept under low light (approx. 500 lx) and low temperature (6 -10°C) with a daily cycle of 16 hours day / 8 hours night. Long-term storage media contain the addition of growth inhibitors (ABA abscisic acid) and osmotic compounds (mannitol). Such conditions enable long-term storage of cultures without renewing them frequently. Depending on the variety, in vitro plants are kept in the same medium for one year (Sputnik, Warszawianka, Vistula) to 6 years (Perkoz). In addition, up to 30 plants from each genotype are stored from several clones, i.e., from several starting tubers.

