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SOUR CHERRY GERMPLASM RESOURCES AND BREEDING IN ROMANIA

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Abstract

In Romania, after 1970, identification, conservation and evaluation of fruit genetic resources activities were started in order to limit the loss of the biodiversity due to erosion and genetic vulnerability. Regarding the sour cherry germplasm, there is a rich fund, located in Research Institute for Fruit Growing Pitești, Romania with 170 accessions, representing wild species, local population, cultivars and selections. In the breeding work de main objectives are: self fertility, productivity, tolerance / resistance to diseases, fruit quality for fresh market, ripening season extension. Taking into account these objectives, over time were used different genitors from genetic resources fund: 'Timpurii de Cluj', 'Timpurii de Pitești', 'Țarina', 'Bucovina', 'Scuturător', 'Amada', 'Stelar', 'Dropia', 'Ilva' for resistance/tolerance to Monilia and anthracnose; 'Pitic', 'Bucovina', 'Vrâncean', 'De Botoșani', 'Rival', 'Amada' for late blooming; 'Timpurii de Cluj', 'Crișana 2', 'Sătmărean', De Botoșani', 'Rival', 'Amada', 'Stelar' for fruit quality; 'Rival, 'Țarina', 'Stelar' for productivity; Ilva', 'Nana', ' Vrâncean', 'Bucovina', 'Sătmărean', 'Pitic' for self fertility. Using a different methods (selection, crossing, open pollination) 19 cultivars were registered with a very good agrobiological characteristics, many of them are propagated and spread in the Romanian orchards ('Timpurii de Pitești', 'Țarina', 'Ilva', 'Pitic', 'Bucovina', 'Vrâncean', 'De Botoșani', 'Rival').

Key words*: sour cherry, germplasm, breeding, genitors, cultivars.*

INTRODUCTION

In Romania, the area cultivated with sour cherry in 2022 was 2,570 ha, which ensured a production of 28,970 tons (FAOSTAT, 2024). This fruits production ranks Romania on the seven places in Europe, after Russia, Poland, Ukraine, Serbia, Hungary and Belarus. The sour cherry culture is spread in most areas of our country, especially in the hilly area both in industrial plantations and in small areas around households.

Like in the other countries, traditionally, the fruits are used mainly for processing: juices, jam canning, bakery products and spirits (Budan et al., 2005; Schuster, 2019).

The new objectives for sour cherry breeding program, carried out in 11 countries around the world, include excellent fruit characteristics, high production, resistance or tolerance to climatic stress, diseases and pests, mechanical harvesting capacity and the extension of the ripening period (Apostol, 1996; Budan and Gradinariu, 2000; Schuster et al., 2014; Schuster et al., 2017; Schuster, 2019; Zurawicz et al., 2019). Currently, there is a major interest in sour cherry breeding for fresh consumption, with larger fruit size, firmness and good taste (Quero-Garcia et al., 2017; Quero-Garcia, 2019).

Despite the variability, there are no configurations that favorably combine the high frost resistance of the sour cherry and the sugar taste of the sweet cherry. The scientific progress registered in the case of fruit research allows that by using modern biotechnological practices to overcome some limitations of conventional breeding methods, thus achieving the evolution and diversity of the sour cherry variety, improving qualitative and quantitative properties, increasing production and modern technologies (Branişte et al., 2006).

Local and foreign varieties, provide enough genetic material to ensure that the objectives in terms of fruit physical characteristics (color, weight, caliber, the length of the peduncle) and chemical (sugar content and acidity). The sour cherry breeding programs in different countries are related to the performance of the

traditionally varieties grown in the different regions and the new varieties are tested in comparison with the standard ones (Grafe et al., 2009).
Romanian is a country located in South East part of Europe which has good environmental conditions for many fruit species including sour cherry (Butac et al., 2019).
In Romania, after 1970, identification, collection, conservation and evaluation of fruit genetic resources activities were started in order to limit the loss of the biodiversity due to erosion and genetic vulnerability (Butac et al., 2019).
Regarding the sour cherry germplasm, there is a rich fund, located in two centers: Research Institute for Fruit Growing Pitești and Research Station for Fruit Growing Iasi, with over 200 accessions, representing wild species, local population, cultivars and selections.
The genetic resources preserved by *ex situ* methods are very important value and can be use for breeding new cultivars. The success of any breeding program depends on the existence of a rich and valuable germplasm fund (Budan and Gradinariu, 2000).
The aim of this paper is to present a situation of the sour cherry genetic resources from Romania, of their use in the breeding program according to the objectives pursued and of the cultivars registered so far.

MATERIALS AND METHODS

Romanian sour cherry genetic resources have started to be methodically collected since 1967. At present there are a total of 238 sour cherry accessions held in duplicate at the Research Institute for Fruit Growing Piteşti-Mărăcineni and Research Station for Fruit Growing Iaşi. Three sour cherry trees per genotype (1 tree = 1 replication) grafted onto 'Mahaleb' seedlings are planted in each location, spaced at 4 x 3 m in Pitești center and 5 x 4 m in Iași center.
Collections contain foreign and autochthonous cultivars, selections, clones, local varieties and landraces. All accessions are evaluated for morphological and biological characteristics as well as agronomic traits according to the IBPGR *Prunus* descriptors updated by the ECP/GR *Prunus* Working Group members (Militaru et al., 2018). At this time, the main objective is to systematize collected data from the two institutions like plant and fruit use, harvest period, blooming time, fruit size, fruit shape, fruit skin color, juice color, fruit taste, fruit cracking susceptibility, susceptibility to diseases and pests.
The main methods used in Romanian breeding program were clonal selection in the landraces 'Crișana', 'Mocănești', 'Oblacinska', control crossing and repeated positive selection in all developing stages of hybrids (Budan et al., 2005; Schuster et al., 2019).

RESULTS AND DISCUSSIONS

Situation of sour cherry genetic resources

In Pitești and Iași centers there are totally 238 accessions, of which: 1 species, 105 autochthonous accessions and 132 foreign cultivars (Table 1). All accessions belong to *Prunus cerasus* L., syn. tart cherry.

Table1. Situation of *ex situ* sour cherry collections

Center	Total accessions	Species	Local accessions	Foreign accessions
RIFG Pitești	145	1	55	89
RSFG Iași	93	0	50	43
Total	**238**	**1**	**105**	**132**

Regarding the genetic resources, one of the Romanian breeder's objectives is to enrich germplasm fund by exchange the biological material with similar institutions, exploring the spontaneous flora and identify valuable genitors for breeding work depending on the objectives pursued.
In Romanian sour cherry breeding program the main objectives are: self-fertility, red fruits (epidermis, pulp, juice) for fresh market, tolerance to specific diseases, upright growth, high productivity, ripening season extension.

Situation of genitors used in the breeding program

Taking into account these objectives, over time in the breeding activity were used different genitors: Nana, Schattenmorelle, Oblacinska, Pitic for high productivity, low vigour, self fertility, early bearing, and frost resistance; Erdi Nogygyumolcsu, Țarina, Timpurii de Osoi, Timpurii de Pitești, Engleze timpurii, Mari timpurii, Meteor Corai for ealy ripening; Scuturător, Crișana, Engleze timpurii, Erdi Nogygyumolcsu, Favorit, Meteor Corai,

Țarina, De Botoșani, Granatnaia for fruit quality; Timpurii de Cluj, Spanca, Spaniole, Mari timpurii – for resistance to diseases, etc. (Table 2).

Table 2. Genotypes used in the breeding wotk of sour cherry cultivars

Objectives	Genitors
High productivity	Nana, Schattenmorelle, Oblacinska, Pitic, Meteor, Sumdinka, Breznița, Mocănești 16, Bucovina, Engleze timpurii
Low vigour	Nana, Schattenmorelle, Oblacinska, Pitic, Northstar, Kelleriis 16, Vrâncean
Self-compatibility	Nana, Oblacinska, Schattenmorelle, Bucovina, Meteor, Montmorency, Pitic
Late blooming	Pitic, Schattenmorelle, Vladimirskaia, Sumdinka
Early ripening	Erdi Nogygyumolcsu, Țarina, Timpurii de Osoi, Timpurii de Pitești, Engleze timpurii, Mari timpurii, Meteor Corai
Late ripening	Pitic, Liubskaia, Grossa, Gamba, Pandy 114, De Botoșani, Schattenmorelle, Vladiminskaia
Fruit quality	Scuturător, Crișana, Engleze timpurii, Erdi Nogygyumolcsu, Favorit, Meteor Corai, Țarina, De Botoșani, Granatnaia
Resistance/tolerance to diseases	Timpurii de Cluj, Spanca, Spaniole, Mari timpurii
Early bearing	Oblacinska, Pitic, Northstar, Nana, Schattenmorelle, Țarina
Frost resistance	Schattenmorelle, Oblacinska, Ilva, Pitic, Northstar, Grossa Gamba, Mocănești 16, De Botoșani

Situation of cultivars registered in Romania

In sour cherry breeding program, started 55 years ago, using different methods (controlled hybridization, open pollination, selection of natural clonal populations of Crișana, Mocănești and other landraces), were created 19 new cultivars. Some of these new cultivars have improved characteristics and other did not record positive traits (Table 3). For example, most of cultivars have larger fruits than old cultivars, designated for fresh consumption, early or late ripening and resistance to special diseases: Țarina, Rival, Amada, Stelar, etc.

Similar results were reported by Budan and Butac (2008), Budan et al. (2009), Schuster et al. (2017).

Table 3. Sour cherry cultivars created in Romania between 1967-2023*

No.	Cultivar/year of registration/parents	Genetic gain – trait modified
1	Timpurii de Cluj / 1969 / [(Spaniole x *Pr. fruticosa*) x (Anglaise hative x *Pr. fruticosa*)]	Earliness, large fruit, resistance to diseases
2	Crișana 2 / 1975 / Local selection	Large and dark red fruit, resistance to diseases
3	Mocănești 16 / 1975 / Local selection	Designated for processing
4	Nana / 1977 / Crișana - open pollination	Low vigour
5	Pitic / 1978 / Plodorodnaia Miciurina – open pollination	Lateness, for processing
6	Dropia / 1982 / Vladimirscaia 33/2- open pollination	Resistance to diseases
7	Ilva / 1982 / Local selection	Resistance to diseases
8	Timpurii de Pitești / 1982 / Local selection	Earliness, resistance to diseases
9	Timpurii de Tg. Jiu / 1982 / Local selection	Earliness
10	Țarina / 1984 / Engleze timpurii x Vișin tufă	Earliness, large fruit, for fresh market
11	Bucovina / 1985 / Local selection	Resistance to diseases
12	Scuturător / 1985 / Local selection	Resistance to diseases
13	Vrâncean / 1985 / Local selection	Lateness, large and dark red fruit
14	Timpurii de Osoi / 1990 / Local selection	Earliness, resistance to diseases
15	Sătmărean / 1994 / Engleze timpurii x Vișin tufa	Earliness, large fruit, resistance to diseases
16	De Botoșani / 1994 / Local selection	Lateness, large fruit
17	Rival / 2004 / Griot Moscovski x Nana	Lateness, large and red fruit, for fresh market, resistance to anthracnose
18	Amada / 2005 / Local selection in Suceava area	Lateness, large and dark red fruit, resistance to diseases
19	Stelar / 2008 / Mocănești 16 x Engleze timpurii	Earliness, large fruit, for fresh market, resistance to diseases

Butac et al., 2018

CONCLUSIONS

The success of any breeding program is closely related to the existence of a rich and valuable germplasm fund.

Genetic sour cherry resources preserved *ex situ* offer different and valuable genitors for creating and registering new cultivars.

As a results of breeding activity, 19 new cultivars were registered so far, some of them being widespread in the modern sour cherry orchards from Romania.

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