The European Journal of Plant Science and Biotechnology ©2007 Global Science Books

Collecting, Preserving and Using Gene Sources from Germplasm Found in Peach (*Prunus persica* L. Batsch.) Breeding in Romania

Antonia Ivascu* • **Adriana Stinga**

Research Station for Fruit Tree Growing Baneasa, Bucharest, Bd. Ion Ionescu de la Brad, no 4, 013813, Bucuresti, Romania

Corresponding author: * **ant_iva@yahoo.com**

ABSTRACT

The collection, preservation and use of peach genetic resources from the germplasm found in SCDP-Baneasa is focused on disease and pest resistance (especially to *Taphrina deformans*, *Sphaerotheca pannosa* var. *persicae*, *Monilinia*, *Cytospora cincta*, *Myzus persicae*, *Cydia molesta*, and *Anarsia lineatella*), fruit quality (especially taste and flavour), seasonality (with a ripening calendar that exceeds 3-4 months), adaptability of cultivars and rootstocks to adverse environmental conditions and also on high yield potential. The use of different sources of genes, including germplasm from China, or other areas with a large biodiversity confers resistance to diseases of the new peach and nectarine varieties bred and created in Romania. Open pollination, hybridizations and back-crosses have been used as breeding methods, and have been combined with screening of progenies in the juvenile stage in greenhouse to reduce selection cycles and evaluation time.

Keywords: back-cross, patented, pest resistance, screening, varieties

CONTENTS

INTRODUCTION

New fruit typologies such as: Congres (flesh colour), Victoria (ripening date), Triumf (texture), Alexia (ripening date), Amalia (flesh colour), Antonia (texture), Tina (storability), Dida (storability), Eugen (texture) and Mihaela (storability) have been released, patented and promoted in Romania in the last 5 years.

Peach (*Prunus persica* L. Batsch) is a very important temperate fruit with high agronomic value: high and constant yields, early fruiting, adaptability to different climatic conditions, all dependent on the selection of the variety and on the technology employed (Liverani *et al*. 1995).

Peach is one of the fruits whose culture is most widespread throughout the world (Byrne 2001), and for which breeding activity has been the most intense in the public and private sectors (Bassi and Liverani 1995). The rapid evolution of peach varieties, their diversification (fresh market peaches, nectarines, pavias or clingstone – peaches for canning), prolongation of the ripening periods with extra-early and extra-late ripening varieties, as well as increasing the variety conveyer to 8-10 years, are all factors that force peach growers to quickly create new cultivars and to adapt to the pedoclimatic conditions of the regions where the cultivars have been obtained.

This mini-review summarizes the collection, preservation and use of Romanian peach genetic resources.

Evolution of peach culture in Romania

Peach cultures in Romania are traditional in the southeastern part of the country (Dobrogea region), around Bucharest and in the southern counties (Ilfov, Ialomita, Teleorman, Dolj, Mehedinti), as well as in the Western Plain (Arad-Oradea region), as shown in **Fig. 1**.

Peach is a well-know fruit in Romania (from 1781), having spread from vineyard areas through local biotypes propagated by seeds. Nectarine culture only spread after 1970. Dobrogea, on the seaside of the Black Sea, is one of the most popular areas for peach culture (from the Carasu Valley to Ostrov, Mangalia town), especially for the favorable climatic conditions. Transylvania (Oradea area), Banat (Timisoara and Arad zone) and also Moldova (Targu-Ocna) are promoting the culture of this fruit, with profitable perspectives.

At this moment Romania has many possibilities for developing peach and nectarine culture around large cities such as Bucureşti (Bucharest), Constanţa, Craiova, Galaţi, Timişoara, Arad, Oradea, and Braila and to promote the new Romanian varieties (Ivascu 2001; Ivascu *et al.* 2001).

Peach germplasm found in Romania

The preservation of peach germplasm at SCDP-Baneasa, Bucharest started in 1977 and presently consists of 955

Received: 24 September, 2006. Accepted: 26 October, 2006.

Invited Mini-Review

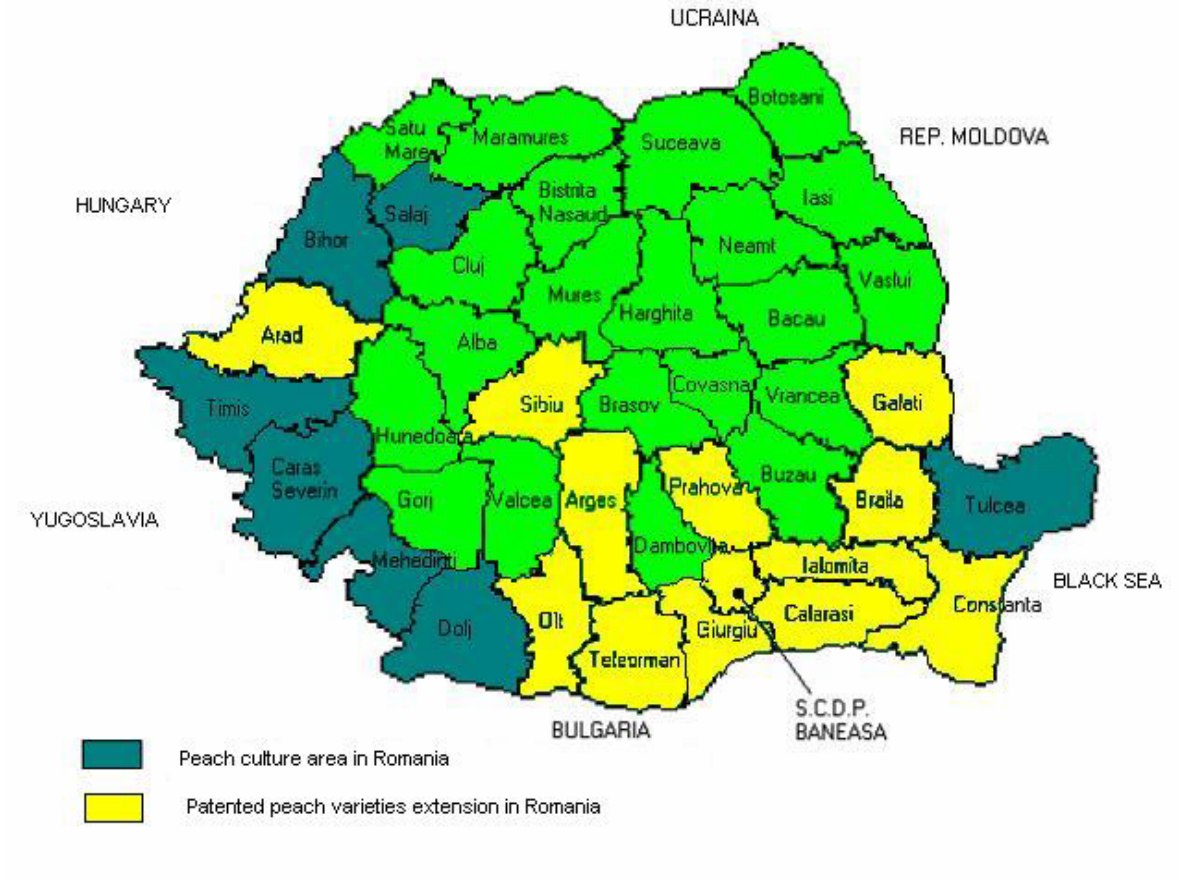

Fig. 1 Distribution of peach culture in Romania.

Table 1 Classification of genotypes according to their origin.

№	Continent or Country	№ varieties	Peach	Nectarine	Clingstone	Rel. %
EUROPE						
1.	France	72	58	9	5	7.53
2.	Italy	68	51	10	7	7.12
3.	Spain	15	15	-	-	1.57
4.	Romania	277	220	38	19	29.0
5.	Hungary	14	13	-	1	1.46
6.	England	9	7	2	-	0.94
7.	Bulgaria	7	7	-	-	0.73
8.	Greece	14	12	-	2	1.46
9.	Germany	11	11	-	-	1.15
Total		**487**	**394**	**59**	**34**	**50.96**
NORTH AMERICA						
1.	USA	312	158	72	82	32.67
2.	Canada	35	25	5	5	3.66
Total		**347**	**183**	**77**	**87**	**36.33**
SOUTH AMERICA						
1.	Argentina	35	28	7	-	3.66
ASIA						
1.	Russia	33	17	7	9	3.45
2.	Turkey	9	9	-	-	0.94
3.	China	17	17	-	-	1.78
4.	India	3	3	-	-	0.31
5.	Japan	11	11	-	-	1.15
6.	New Zealand	13	13	-	-	1.36
Total		86	70	7	9	8.99
Overall Total		**955**	**675**	**150**	**130**	**100**

genotypes (*ex situ* collections).

Morphological, biochemical, pathological and biological observations were made on the initial biologic material for selecting progenitors for hybridization, the primary purpose of the breeding program. The cultivars studied in the collection are the result of 63% hybridization (63%), open-pollination (16%), mutations (7%), while 14% have no known origin.

The studied varieties are from public, International institutions (55%), from private programs (42%), while only 3% were made by unknown authors (Ivascu 1997; Bellini and Scaramuzzi 1999).

From all cultivars about 60% are peach for the fresh market, 30% are nectarines and only 10% clingstone. From these 28% are white flesh and 72% yellow flesh peaches, and 5% white flesh nectarines and 95% yellow flesh nectarines.

A classification of genotypes cultivated in Baneasa Research Station in 2006 according to their origin is made in **Table 1**.

Working methods

Crossings were made between valuable hybrids obtained in F2 (Baneasa hybrid – HB 7-35, HB 5-45, HB 9-46, HB 9/9, HB 12/3, HB 9/25) and "backcross" type hybridizations using autofecundation (ARK 128, Armgold, Halberta Geant, Harvester, Magnific 79, Cardinal, Olinda, Capucci 2, Sudanel, July Elberta) and physical and chemical mutagenesis (Redskin, Flacara, Harbrite, Jerseyland) as methods for the creation of new varieties (Amalia, Congres, Triumf, Victoria, Antonia, Alexia, Tina, Mihaela).

The use of dialel hybridization (Harbrite × HB 5-14, Redskin × HB 11-46, HB 11-11 × Redskin, Loadel × HB 26-65, Monroe × Fayette, Iris Rosso × Corell) led to the increase of variability within the selected material.

The selection of germplasm found in the whole world genitor for desired characteristics and their use in the hybridization schemes was one of the basic methods of peach improvement, with controlled crossings being the most utilized method for the creation of new Romanian varieties, while induced mutations were less frequently used.

At the beginning of the breeding program, a series of autofecundations were carried out in order to assess the genetic potential of the cultivars and especially the degree of homozygotism against monogenic traits. Based on the results obtained, cultivars with a high capacity of

propagation of positive traits were considered.

One of the main concerns of peach research in Romania was to enlarge the genetic base, to collect vast and valuable biological material and to start an improvement program of dwarf nectarine and peach trees.

Each genotype is represented in the collection by 3-5 trees grafted onto franc peach, planting distances are 4/4m or 3/4 m and the crown shape is vase or palmete.

Tree vigour, blossoming time and flower type, intensity of flowering, ripening period, self-pollinization percentage, yield per tree, resistance to main diseases and frost hardiness, fruit weight and quality (dry substance %, vitamin C, acidity), taste and storage period were the principal characteristics studied in the collections.

By evaluating the genetic material existing in the germplasm found at SCDP-Baneasa, we selected important genes utilized as genitors during the last few years in hybriddization (Ivascu 1997; Ivascu and Balan 1997).

Beginning in 1990, an extensive peach improvement program was conceived. At SCDP-Baneasa the program included a collection of 670 varieties and elites, over 2500 F1 hybrids, 1250 auto-pollinations, 412 F2 descendants and 625 M1 mutants.

Objective aims

Between 1990 and 2000 the breeding objectives were:

- Collecting, preserving and studying the existing germplasm found representing four different geographical areas and detecting potential genitors;
- Obtaining cultivars resistant to the main stable diseases of the peach tree that cause prejudices to the production of this species in Romania: *Taphrina deformans*, *Cytospora cincta*, *Sphaerotheca pannosa* var. *persicae*, *Plum-pox*, *Monilinia laxa* (D'Ercole *et al*. 1993; Cantoni *et al*. 1995);
- Diversifying the fruit type: white peaches and nectarines having a firmer flesh, clingstone type nectarines for processsing, clingstone peaches for canning;
- Extending the consumption season mostly by creating extra-early cultivars.

Between 2000 and 2006 the study included 955 genotypes and the objectives were focused on creating new varieties using germplasm resources for:

- Improving fruit quality (highly energetic, rich in nutrients, spherical, beautifully colored and flavored fruits, resistant to transport and conservation);
- Creating highly productive cultivars, adaptable to specific environmental conditions, without alternating fruit production;
- Improving resistance to frost and spring temperature fluctuations or late frosts;
- Obtaining early ripening cultivars;
- Improving tree architecture by reducing height through selection of dwarf genotypes and hybridizations (i.e. dwarfing).

CONCLUDING REMARKS

Characteristics of the selected genotypes in research plots Baneasa Station between 2003 and 2005, from the germplasm found and country of origin are shown in **Table 2**.

Selected genes for different characteristics are to be induced in the new varieties:

Frostproof genes:

- Peach: Congres, Triumf, Amalia, Alexia, Amsden, Miss Lolo, Hardyred, Canada 55111, Herastrau, Alex;
- Nectarine: Harko, ARK 151.

Genes for high productivity:

Table 2 Characteristics of the selected genotypes from the Romanian germplasm found and country of origin.

Characteristics	Peach		Nectarine		Clingstone	
	Country	№	Country	№	Country	№
Frostproof	Romania	2	USA	1	USA	2
	USA	2	Canada	2		
	Canada	3	Romania	1		
Dwarf habit	Italy	2	Russia	1	USA	1
	USA	3	USA	2		
	China	2				
	France	1				
Resistance to *Taphrina deformans*	Romania	1	Italy	1	Canada	1
	China	1			USA	1
	Russia	1				
	Canada	1				
	USA	4				
	France	1				
Resistence to *Cytospora cincta*	Romania	2	Italy	2	USA	2
	USA	4	USA	1		
Self-compatibility	Romania	2	USA	3		
	Italia	1	France	1		
	USA	3				
	France	1				
Productivity	Romania	2	USA	2	Canada	1
	USA	4	France	2	USA	1
	Italia	2				
Fruit quality	Romania	2	Romania	2	France	1
	Italia	1	USA	2		
	USA	4	France	2		
	Canada	1				

- Peach: Flacara, Victoria, Corell, Congres, Triumf, Cardinal, Alex, Amalia, Red top, Madison,
- Nectarine: Crimsongold, Flavortop, Tina, Romamer II.

Genes for high fruit quality:

- Peach: Baladin, Early Scarlet, Brighton, Iris Rosso, Harvester, Harbrite, Splendid, Superba de Toamna, Sunfree, Cullinan, Antonia;
- Nectarine: Romamer I, NJN 58, ARK 125, Tina.

Genes for reducing the habitus:

- Peach: Albertina, Compact 774310, KW 77104, Hui Hun Tao, Gan San Cao, Compact Redhaven, Compact Elberta.

Genes for different ripening periods:

- Peach: very early maturity (Primerose, Mayred, Springold, Valeria, Earlyred, Amalia, Alexia) and very late maturity (Flacara, Jerseyqueen, Superba de Toamna, O'Henry, Fayette);
- Nectarine: very early maturity (ARK 107).

Genes for resistance to diseases against:

- *Cytospora cincta*:
  Peach: Cullinan, Cardinal, Hamlet, Onakita Gold, Triumf, Superba de toamna, Anderson;
  Nectarine: Weinberger;
  Clingstone: NJF 3;
- *Stigmina carpophila*:
  Peach: Armgold, Stark Early Blaze, Cardinal, Congres;
  Nectarine: ARK 109;
- *Taphrina deformans*:
  Peach: Madeleine Pouyet, Cumberland, Harbelle, Indian Blood, Sulivan, Victoria, Zafrani, Pekin, Naradnji Ranhii

Genes for late blossoming:

- Peach: Redskin, Splendid, Candoka, Harbrite;
- Nectarine: ARK 145;
- Clingstone: NJC 84.

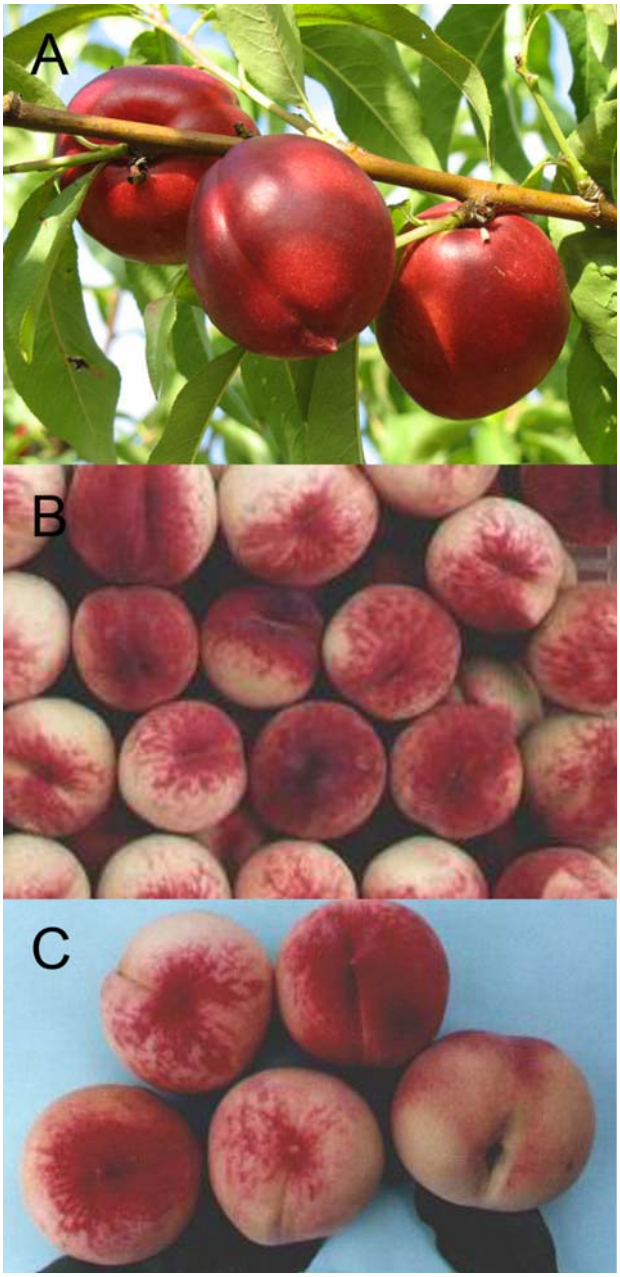

Fig. 2 Some Romanian peach varieties. (**A**) Tina, (**B**) Amalia, (**C**) Antonia.

Genes for high percent of flowering:

- Peach: Congres, Favorita Morettini 1, Corell, Alex;
- Nectarine: Crimsongold, Mihaela, Tina.

Genes for self-fertility:

- Peach: Rosired, Splendid, Fertilia 1, Cardinal, Triumf, Merill Gem;
- Nectarine: Independence, Crimsongold, ARK 125.

Genes for high level of sugar:

- Peach: Emilia, Fairlane, Hamlet, Eureka, Flacara, Collins, Redtop, I.H.Hale, Charles Ingouf, Antonia, Alex.
- Genes for high level of vitamin C:
- Peach: Congres, Victoria, Sunglo, Elberta, Jungerman, Sulivan, Rogami Gon;

Genes for good taste:

- Peach: Splendid, Collins, Redhaven, Cardinal, Congres, Sunfree, Alex, Amalia, Antonia,
- Nectarine: NJN 58, NJN 21, Cora, Delta

Between 2000 and 2006, 17 peach and nectarine varieties were obtained by using germplasm resources at SCDP-Baneasa and were included in the Official List of the Romanian Agricultural Ministry for extension in private farms.

Six of them are patented (with an asterisk below) and also recognized abroad for their superior characteristics: fruit quality, productivity and tolerance to important diseases and atractiveness. Flacara, Splendid, Congres*, Victoria*, Triumf*, Superba de Toamna, Alexia*, Amalia*, Antonia*, Dida, Eugen, Alex, Herastrau peaches; Tina, Mihaela nectarrines and Titan and Bucur rootstocks for peach completes the Romanian varietal range of peach fruit that is now 70% represented by Romanian varieties.

REFERENCES

Byrne DH (2001) Peach breeding trends: A world wide perspective. *Acta Horticulturae* **592**, 49-59

Cantoni L, Bassi D, Rizzo M (1995) Metodi per la velutazione della sensibilita dei frutti di pesco a Monilia (*Monilinia laxa*) approcii sperimentali. *Proc. XXII Convegno Peschicolo*, 28-30 Sept. 1995, Cesena, pp 156-161

D'Ercole N, Bassi D, Liverani A, Mirotti A (1993) Metodi di indagine per la ricerca di fonti di resistenza al cancro del pesco da *Cytospora*. *Proc. XXI Convegno Peschicolo*, Lugo (Ravenna) 27-28 Aug. 1993, pp 87-93

Ivascu A (1997) Peach genetic resources in Romania. *Acta Horticulturae* **465**, 251-259

Ivascu A (2001) New trends of peach tree growing in Romania. *Acta Horticulturae* **465**, 251-259

Ivascu A, Balan V (1997) The peach breeding programme at Research Station for Fruit Tree Growing Baneasa, Romania. *Acta Horticulturae* **465**, 129-136

Ivascu A, **Lazar V, Petrisor C, Popescu M, Vlaicu I** (2001) Color variability correlated with fruit quality at different peach genotypes. *Acta Horticulturae* **592**, 501-506

Liverani D, Calisesi F, Bendansi C (1995) Il miglioramento genetico del pesco per la resistenza a Monilia. *Proc. XXII Convegno Peschicolo*, 28-30 Sept. 1995, Cesena, pp 103-106