EVALUATION OF AGROBIOLOGICAL POTENTIAL OF PLUM SELECTIONS IN ORDER TO IMPROVE NATIONAL ASSORTMENT

EVALUAREA POTENŢIALULUI AGROBIOLOGIC AL UNOR SELECŢII DE PRUN ÎN VEDEREA ÎMBUNĂTĂŢIRII SORTIMENTULUI NAŢIONAL

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Abstract. *Genetic breeding of plum varieties is a basic concern of fruit research activity in Romania, given the importance of this species, which owns more than 40% of the total fruit production of the country. Taking into account that a permanent renewal of plum assortment is needed, aiming the consumers and farmers requirements, we proposed in this paper the study of 9 plum selections, regarding their phenology, yielding potential, fruit quality and susceptibility to Plum pox virus, in order to improve the actual plum assortment. The results show that, the HL 12/9 P selection has high productions, good fruit quality and tolerance to Plum Pox Virus and was registered at the State Institute for Variety Testing and Registration (ISTIS) to be named.*

Key words: plum, selections, evaluation.

Rezumat. *Ameliorarea genetică a soiurilor de prun este o preocupare de bază a cercetătorilor pomicultori din România, dată fiind importanţa acestei specii, care deţine peste 40% din producţia totală de fructe a ţării. Ţinând cont de faptul că se cere o înnoire permanentă a sortimentului de prun, în funcţie de cerinţele consumatorilor, precum şi ale producătorilor, în această lucrare ne-am propus studiul a nouă selecţii de prun din punct de vedere al parcurgerii fenofazelor de fructificare, potenţialului agroproductiv, calităţii fructelor şi susceptibilităţii la Plum Pox Virus în vederea completării sortimentului actual. În urma observaţiilor şi determinărilor efectuate în microcultura de concurs, din cadrul laboratorului de Genetică şi Ameliorare s-a evidenţiat selecţia HL 12/9 P prin producţii mari şi constante, fructe de calitate superioară şi toleranţă la Plum Pox Virus şi a fost înscrisă la Institutul de Stat pentru Testarea şi Înregistrarea Soiurilor în vederea omologării.*

Cuvinte cheie: prun, selecţii, evaluare.

INTRODUCTION

In Romania, the plum is the major fruit species owing to its high ecological adaptation expressed by the rusticity of the local and bred cultivars and by the various ways of fruit marketing (Cociu, 1997).

The local varieties used mainly in the distillation industry were predominantly but however valuable cultivars with mixed utilization such as 'Tuleu gras', 'Grase romanesti', 'Vinete romanesti' were also grown (Dragoi, 1999, 2000).

The higher market requirements imposed the modernization and improvement of the plum assortment by developing new autochtonous cultivars and introducing foreign cvs. with superior organoleptic features. Therefore, to reach such objectives, the breeding work was started in the 1950's and it is still going on.

In the long run of the plum genetic breeding, over 60 years, more than 2,000,000 flowers were pollinated resulting thousand hundreds of hybrids which thanks to their genetic variability allowed us to select new valuable genotypes for the commercial use. As a result, 37 newly bred autochtonous plum cultivars were registered. It can be still possible to select new genotypes with valuable traits having in view the large amount of biological material in the selection fields, microcrops and field trials (Butac, 2008).

Taking into account that a permanent renewal of the plum assortment is needed aiming at the consumers and farmers needs we have studied 9 plum selections with regard to their phenology, yielding potential, fruit quality and Plum Pox Virus susceptibility, in order to enrich the present assortment.

MATERIAL AND METHOD

The investigations were carried out during 2007 – 2009, involving the following 9 promising plum selections: H 12/9, H 5/40, H 3/15, H 8/13, H 5/44, H 67/28, H 2/73, H 9/11, H 17/77 versus the control, Anna Späth cv. All these selections are in the plum microfield trial within the Genetic and Breeding Lab. at Research Institute for Fruit Growing Pitesti. There are 6 year old trees grafted on wax cherry tree, 10 trees per selection, planted at 4 m spacing between rows and 2 m between trees along the row, trained as free palmette, and designed as linear blocks.

The blooming phenophases were assessed according to Fleckinger system (Fleckinger, 1960). Thus, in full blooming, it was recorded: blooming start – when the first flowers open; blooming end – when the petals had fallen from the last flowers; blooming length – days from the beginning till the end; blooming intensity – on a scale from 0 (none) to 5 (very plentiful). To be statistically measured the data of blooming release were turned in number of days from the first of February, the approximate date for deep dormancy end, to the blooming start (Drăgoi, 1996). There were regarded the following statistical points: average, amplitude, mean deviation and variation coefficient.

To determine the fruit production, the yield in kg per tree was recorded over the 3 year period and then the average was calculated.

The morphological and chemical features of fruit were assessed according to the mean samples of 25 fruit, each, as follows: fruit weight by weighing all fruit of a sample and then calculating the mean weight (g/fruit); the fruit dry weight was determined by means of the digital refractometer (Brix grades); the fruit and flesh colour was visually settled by means of some colour codes.

The results were statistically measured by the variance analysis (Botu, 1997).

The plum cultivars response to Plum Pox Virus was ranked on the scale (after Genres 61 Project; EPDB descriptors), as follows: 1 – resistant; 2 – very slightly susceptible; 3 – slightly susceptible; 5 – intermediate; 7 – susceptible; 8 – very susceptible; 9 – extremely susceptible.

RESULTS AND DISCUSSIONS

The „blooming start" phenophase has yearly the same evolution regardless the climatic conditions at the beginning of growing season, being a genetic trait which is not connected to the ripening season. Even if the blooming period was earlier or later, the blooming order of the studied selections was the same, all of them showing the same changes. Thus, the earliest blooming selection was H 12/9 and the latest ones were H 3/15 and H 17/77 – all these blooming at the same time with the control cultivar, Anna Späth (table 1).

The average date of blooming start in case of the 9 selections (Maracineni area – table 2) was April 11, almost normally for this area which is mid April. In 2008, following rather high temperatures in February and March, it was recorded an earlier blooming, early April (2 – 9). The variation of blooming date was low, the standard deviation being 1.47 and the variation coefficient had also low values ranging between 1.36% (2009) and 3.22% (2008) proving that this phenophase is homogenously for all the studied selections. On average, the earliest blooming period during 2007 – 2009 in Maracineni area was on April 2, 2008 and the latest on April, 15, 2007 and 2009, having an amplitude of 13 days meteorologically determined while the average amplitude (2007 – 2009) related to varieties was only 4.67 days (table 2). The blooming length of these selections was 7 – 8 days (table 1). Over the investigation period, the blooming intensity was high, the selections getting 4 and 5 grades, namely plentiful and very plentiful (table 1).

Table 1

The phonological stages studied at Pitesti, Maracineni (2007 – 2009)

No.	Genotype	Blooming start (date)			Blooming end (date)			Blooming length average	Blooming intensity (note)
		2007	2008	2009	2007	2008	2009		
1	H 12/9	11.04	2.04	12.04	20.04	10.04	20.04	8	5
2	H 5/40	13.04	5.04	13.04	21.04	11.04	21.04	7	4
3	H 3/15	15.04	9.04	14.04	22.04	15.04	23.04	7	5
4	H 8/13	15.04	8.04	14.04	22.04	13.04	22.04	7	4
5	H 5/44	13.04	5.04	14.04	21.04	11.04	23.04	7	5
6	H 67/28	13.04	5.04	14.04	22.04	11.04	23.04	8	5
7	H 2/73	14.04	6.04	15.04	22.04	12.04	23.04	7	5
8	H 9/11	14.04	6.04	15.04	21.04	12.04	23.04	7	4
9	H 17/77	15.04	8.04	15.04	22.04	13.04	23.04	7	4
10	Anna Späth - Control	15.04	8.04	15.04	22.04	13.04	23.04	7	3

Table 2

Statistical indexes regarding „blooming start" phenophase for the plum selections studied (2007 – 2009)

Years/Statistical value	2007	2008	2009	Average (2007 – 2009)
Arithmetic average				
As days	72.8	65.2	73.1	70.37
As dates	14.04	6.04	14.04	11.04
Minimum (the earliest blooming value)				
As days	70	61	71	67.34
As dates	11.04	2.04	12.04	8.04
Maximum (the latest blooming value)				
As days	74	68	74	72.00
As dates	15.04	9.04	15.04	13.04
Amplitude between the minimum and maximum (days)	4	7	3	4,67
Variation coefficient (%)	1.80	3.22	1.36	2.13
Standard deviation	1.31	2.10	0.99	1.47

Regarding the fruit ripening season, one can see that all the studied hybrids were earlier than Anna Späth control, the fruit ripening 21 -44 days earlier. Thus the earliest selections were: H 67/28, H 8/13 and H 12/9 (table 3).

The 10 genotypes under study showed that under the some climatic conditions, the average yield varied from one selection to another and only 3 of the 9 selections were more productive than Anna Späth control, namely: H 12/9, H 9/11 and H 3/15 (9.87 kg/tree; 9.50 kg/tree and 8.40 kg/tree versus 8.00 kg/tree with Anna Späth, the yield differences being statistically unmeasured (table 3).

Table 3

Ripening season and fruit yield of the studied selections (Pitesti, Maracineni; 6 years old trees; 2007-2009)

No.	Genotype	Ripening time	Difference compared to control (days)	Fruit yield (kg/tree)*	Difference compared to control *
1	H 12/9	1.08	-33	9.87	+1.87
2	H 5/40	8.08	-25	5.73	-2.27
3	H 3/15	8.08	-25	8.40	+0.40
4	H 8/13	23.07	-41	2.18	-5.82
5	H 5/44	12.08	-21	3.50	-4.50
6	H 67/28	20.07	-44	5.34	-2.66
7	H 2/73	30.07	-34	6.00	-2.00
8	H 9/11	25.07	-39	9.50	+1.50
9	H 17/77	5.08	-28	3.44	-4.56
10	Anna Späth (Control)	2.09	-	8.00	-

* 5% LSD = 6.737 kg/tree; 1% LSD = 9.155 kg/tree; 0.1% LSD = 12.410 kg/tree.

The mean fruit weight of these genotypes varied from 38.13 g (H 5/44) to 60.60 g (H 17/77). Among the hybrids studied have noted the following: H 17/77 (60.60 g), H 2/73 (59.40 g) and H 12/9 (58.73 g), between these hybrids and control exist very significant differences. Soluble dry weight content varied from 13.5% (H 5/40) to 23.3% (H 5/44), most selections present a higher content than controls (table 4).

Table 4

Fruit weight and soluble dry weight of the studied selections (Pitesti, Maracineni; average 2007 - 2009)

No.	Genotype	Fruit weight (g)	Soluble dry weight (%)
1	H 12/9	58.73 **	16.4
2	H 5/40	52.87 *	13.5 ^{o}
3	H 3/15	38.50	15.2
4	H 8/13	43.04	16.2
5	H 5/44	38.13	23.3 ***
6	H 67/28	54.50 *	18.9 **
7	H 2/73	59.40 **	17.6 **
8	H 9/11	41.27	14.7
9	H 17/77	60.60 ***	15.6
10	Anna Späth (Control)	43.17	15.2

Fruit weight: 5% LSD = 9.081 g; 1% LSD = 12.340 g; 0.1% LSD = 16.729 g.
Soluble dry weight: 5% LSD = 1.706 %; 1% LSD = 2.319 %; 0.1% LSD = 3.143 %.

We had in view the major fruit physical characteristics such as: shape, skin and flesh colour, stone adherence. Regarding the fruit shape of these genotypes they showed various shapes like: ovoid, spherical, ellipsoidal. The skin colour varied from reddish (H 5/40) to blue with the most of genotypes meeting the consumers preferences. The flesh of the most genotypes was yellow coloured and free stone (table 5).

Table 5

Major fruit physical features of the studied selections (Pitesti, Maracineni)

No.	Genotype	Fruit shape	Fruit colour	Flesh colour	Stone adherence
1	H 12/9	Ovoid	Dark blue	Yellowish	Free stone
2	H 5/40	Spherical	Reddish	Yellowish	Free stone
3	H 3/15	Ellipsoidal	Blue	Greenish	Free stone
4	H 8/13	Ovoid	Reddish blue	Yellowish	Free stone
5	H 5/44	Spherical	Light blue	Yellowish	Clingstone
6	H 67/28	Ovoid	Dark blue	Yellowish	Semi clingstone
7	H 2/73	Ovoid	Dark blue	Yellowish	Free stone
8	H 9/11	Ellipsoidal	Blue	Whitish	Free stone
9	H 17/77	Ovoid	Blue	Yellowish	Free stone
10	Anna Späth-Control	Spherical	Reddish	Verzuie	Free stone

The genotypes response to Plum Pox Virus is mainly related by their heredity but it may also be influenced into a certain extent by the cultural management of the orchard. Comparing the response of these selections to PPV attack, one can see that only one (H 3/15) showed a more severe attack versus the control (5 – mid attack), the other ones being slightly damaged or at all. As regards the fruit damage, these genotypes showed no symptoms (table 6).

Table 6

Selections response to Plum Pox Virus (Pitesti, Maracineni)

No.	Genotype	Response to PPV	
		Damage on leaves	Damage on fruit
1	H 12/9	1	1
2	H 5/40	1	1
3	H 3/15	5	1
4	H 8/13	1	1
5	H 5/44	1	1
6	H 67/28	2	1
7	H 2/73	3	1
8	H 9/11	3	1
9	H 17/77	3	1
10	Anna Späth (Control)	3	1

Note: 1 – resistant; 2 – very slightly susceptible; 3 – slightly susceptible; 5 – intermediate; 7 – susceptible; 8 – very susceptible; 9 – extremely susceptible.

CONCLUSIONS

1. H 12/9 selection came off by its high yield, large qualitative fruit and PPV tolerance; it is proposed for registration at the State Institute for Variety Testing and Registration.

2. The other selections will be utilized as genitors in the further breeding work, as follows: H 3/15 – for high productivity; H 67/28, H 8/13, H 9/11 – for earliness; H 5/40, H 67/28, H 2/73 – for the fruit size; H 5/40, H 8/13, H 5/44 – for PPV tolerance.

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