

## EVALUAREA UNOR SOIURI DE MĂR DIN COLECȚIA NAȚIONALĂ DE LA SCDP VOINEȘTI

### EVALUATION OF SOME APPLE VARIETIES FROM THE NATIONAL COLLECTION FROM RSFG VOINEȘTI

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#### Abstract

Between 2019 and 2022, observations and determinations were made regarding the blooming phenology, productive potential, harvest maturity and fruit quality for a number of 35 apple varieties from the National Collection located at Research Station for Fruit Growing Voinești, in order to identify potential parents, useful for the breeding program and sustainable development of apple growing. The national apple collection was released gradually, being permanently supplemented with new varieties of autochthonous and foreign origin. Currently, it has 696 genotypes, with a great variability and diversity of pomological characteristics. The planting distance is 4 m between row and 3 m between trees, the trees are grafted on 'M26' rootstock, with 3 trees / genotype. As a result of this study, a large variability of characters with significant differences was recorded. Example: the beginning of blooming varied from early to late and very late blooming; the average fruit weight (values between 75.25 g and 259.5 g); the dry matter varied from 10.62 to 16.83%; fruit firmness (between 5.66 and 12.63 kgf/cm<sup>2</sup>); the fruit ripening period (July-August for summer varieties till December-April for winter varieties). The paper recommends some cultivars with positive characteristics to use as parents in breeding work.

**Cuvinte cheie:** colectie, soiuri de măr, caracteristici pozitive, părinți.

**Key words:** national collection, apple varieties, positive characteristics, parents.

#### 1. Introduction

The establishment of the germplasm fund, for use in the breeding programs, was achieved gradually, being permanently enlarged with new varieties, collected and preserved both from the autochthonous and the international germplasm fund.

Currently, the national apple collection from Research Station for Fruit Growing (RSFG) Voinești includes about 700 genotypes, grouped according to some characteristics into: species; varieties with genetic resistance to diseases; autochthonous genotypes from which local selections and bred varieties; foreign genotypes.

Due to some valuable characteristics, such as production, high quality and storage capacity, resistance to diseases, numerous varieties ('Prima', 'Priam', 'Priscilla', 'Pionier', 'Voinea', 'Florina', 'Sir Prize') have been repeatedly used in hybridization schemes.

Taking in account that the release of new apple varieties is oriented towards obtaining disease-resistant varieties, studies and research have focused on identifying parents that show disease resistance, productive potential and fruit quality.

#### 2. Material and methods

The research presented was carried out at RSFG Voinești, in the period 2019 – 2022 within the National Apple Collection, where the planting distance is 4/3m with trees grafted on 'M26' rootstock, 3 trees/genotype each.

Observations were made at a number of 35 apple varieties (autochthonous and foreign), and the following determinations were noted: flowering phenology, behaviour to the apple scab (*Venturia inaequalis*) and powdery mildew (*Podosphaera leucotricha*), productive potential, harvest maturity and fruit quality characteristics.

Observations regarding the fruiting phenophases in apple, referred to: the beginning and end of flowering; intensity and duration of flowering. The intensity of flowering was scored from 1 to 5 (1 = very few flowers; 5 = abundant flowering).

Behaviour to apple scab and powdery mildew attack was phenotypic evaluated. Fruit production was recorded per tree during 2019 – 2022 periods. The average weight was determined using a balance

and expressed in g. The dry matter contained in the fruits was determined refractometrically and expressed in percentages, and the firmness of the fruits with a penetrometer expressed in kgf/cm<sup>2</sup>.

### 3. Results and discussions

#### Evaluation of apple flowering phenology

Observations regarding the fruiting phenophases in apple, referred to: the beginning and end of flowering; intensity and duration of flowering.

##### The beginning of flowering

Following the observations made in the period 2019 - 2022, regarding the beginning of flowering, it is observed that: due to the thermal regime during the spring of studied period the beginning of flowering was started approximately in the same period - on April 12<sup>th</sup> - 13<sup>th</sup> in 2019, respectively April 11<sup>th</sup> - 12<sup>th</sup> in 2020. In 2021, the beginning of flowering was started on April 21<sup>st</sup> - 23<sup>rd</sup>, with 10 days later than in 2020. In 2022, the beginning of flowering was started on April 22<sup>nd</sup> - 23<sup>rd</sup>, the same period as in 2021.

From all 35 apple varieties studied, early flowering ('Dany', 'Auriu de Cluj', 'Doina', 'Luca', 'Salva', 'Codrene', 'Chindia'), late flowering ('Urdoase', 'Tare de ghindă', 'Roșii de Stetin', 'Șovari') and very late varieties ('Verzișoare') were identified. The other varieties have an intermediate flowering date.

**The flowering period** is influenced by climatic conditions and hereditary factors.

In 2019, the flowering period was extended for quite a long period due to cool and rainy days during the flowering. This was between 13 days ('Gustav durabil') and 22 days ('Nova Easigro', 'Mere tari'), with many varieties being 17-18 days.

In 2020, the flowering period extended for quite a long time, in several varieties that flowered on the annual branches (a little later). Example: 'Alex', 'Salva', 'Pionier', 'Romus 2', 'Urdoase', 'Șovari', 'Tare de ghindă', 'Romus 1', 'Romus 3', being between 13 days ('Mc Free', 'Ciprian') and 19 days ('Urdoase', 'Șovari', 'Tare de ghindă', 'Dacian', 'Salva', 'Doina', 'Auriu de Cluj', 'Alex').

In 2021, the flowering period varied between 13 days ('Voinea' variety) and 21 days ('Pionier' variety).

In 2022, the flowering period was between 11 days for 'Călugăresc', 'Urdoase', 'Șovari', 'Tare de ghindă' cvs. and 19 days for 'Romus 3', 'Salva', 'Auriu de Cluj', 'Cidor' cvs.

During 2019 - 2022 periods, it was between 11 days ('Călugăresc', 'Urdoase', 'Șovari', 'Tare de ghindă' cvs.) and 22 days ('Nova Easigro', 'Mere tari' cvs.).

**Flowering intensity** was differentiated between varieties, from 2 (with few flowers) at 'Mere tari' and 'Poinic' cvs. in 2020 to 5 (with abundant flowering).

A high intensity to extremely high flowering intensity were observed annually for many varieties 'Chindia', 'Pionier', 'Generos', 'Sir Prize', 'Romus 1', 'Romus 2', 'Romus 3', 'Prima', 'Salva', 'Codrene'.

##### Disease susceptibility assessment

During 2019 - 2022 period, in the field, observations regarding the susceptibility of the 35 varieties to the attack of apple scab (*Venturia inaequalis*) and powdery mildew (*Podosphaera leucotricha*) were made.

According the data presented in table 1, 'Prima', 'Priam', 'Priscilla', 'Pionier', 'Voinea', 'Florina', 'Chindia', 'Dacian', 'Luca', 'Salva' cvs. are resistance to apple scab and 'Generos', 'Romus 2', 'Călugăresc', 'Gustav durabil', 'Auriu de Cluj', 'Cidor' cvs. are tolerant. The most sensitive to apple scab are autochthonous cvs: 'Urdoase', 'Verzișoare', 'Codrene'.

The varieties 'Salva', 'Pionier', 'Luca', 'Prima', 'Romus 1' were noted for resistance to powdery mildew.

##### Production potential

The recording of fruit production during 2019 - 2022 period shows that the highest value corresponds to the 'Prima' cv. (56.2 kg/tree), followed by 'Florina' cv. (53.3 kg/tree), 'Pionier' cv. (46.5 kg/tree), 'Sir Prize' cv. (43.6 kg/tree), 'Generos' cv. (41.5 kg/tree), 'Doina' cv. (40.6 kg/tree), 'Romus 3' cv. (38.5 kg/tree), 'Salva' cv. (38 kg/tree) (Table 1).

Among the 35 apple varieties studied with a high productivity every year, the varieties stood out: 'Prima', 'Pionier', 'Romus 3', 'Chindia', 'Sir prize', 'Salva', 'Generos', 'Florina', 'Romus 1'.

The value of the variation coefficient shows a very high variability (more than 40%) within the apple collection regarding the production capacity, and therefore the possibility to identify valuable potential genitors for future hybridizations.

##### Time of fruit ripening for harvest

According with harvest maturity and consumption period, 35 apple varieties studied, are classified as follows:

- summer (July-August): 'Romus 1', 'Romus 2', 'Romus 3', 'Estival', 'Auriu de Cluj';
- autumn (September - November): 'Prima', 'Voinea', 'Pionier', 'Productiv de Cluj', 'Priam', 'Codrene', 'Chindia', 'Luca' and others;

- winter (December – April): 'Generos', 'Florina', 'Dacian', 'Nova Easigro', 'Tare de ghinda', 'Mere tari', 'Călugăresc', 'Poinic' and others.

#### **Fruit qualitative attributes**

Regarding the *average weight of the fruits*, it was found that the highest weight has 'Dacian' cv. (259.5 g), followed by 'Alex' cv. (247.5 g). There are other varieties with a large weight, such as: 'Urdoase' (208.2 g), 'Productiv de Cluj' (203.7 g), 'Voinea' (196.2 g), 'Doina' (197.5 g), 'Chindia' (186.0 g), 'Florina' cvs. (185.5 g) (Table 2).

A low weight was recorded 'Romus 2' (95.0 g) and 'Romus 1' (95.5 g) cvs. The lowest weight has 'Verzișoare' cv. (75.2 g). The other varieties had intermediate values.

The value of the variation coefficient shows a high variability (26.73%) within the apple collection regarding the average fruit weight.

*Dry matter.* From the data presented in table 2, the average of dry matter is different for each variety, as follows: the highest value was recorded 'Cidor' (16.8%), followed by 'Mc Free' (15.9%), 'Sir Prize' (15.5%); 'Generos' (14.8%); 'Călugăresc' (14.8%); 'Priscilla' (14.6%); 'Voinea', 'Urdoase' (14.6%) cvs. The lowest values were recorded 'Estival' (10.6%), 'Romus 2' (10.7%), 'Romus 1' (11.0%), 'Dany' (11.5%), 'Auriu de Cluj' (11.7%) cvs.

*Fruit firmness.* The average data, regarding flesh firmness ( $\text{kgf/cm}^2$ ), indicate the highest values for 'Mere tari' ( $12.6 \text{ kgf/cm}^2$ ) and 'Tare de ghindă' ( $12.4 \text{ kgf/cm}^2$ ) cvs., followed by 'Călugăresc' ( $10.9 \text{ kgf/cm}^2$ ), 'Poinic' ( $10.5 \text{ kgf/cm}^2$ ) and 'Priscilla' ( $10.1 \text{ kgf/cm}^2$ ) cvs. (Table 2).

Lower values are found in the varieties: 'Codrene' ( $5.6 \text{ kgf/cm}^2$ ); 'Alex' ( $6.7 \text{ kgf/cm}^2$ ); 'Pionier' ( $6.8 \text{ kgf/cm}^2$ ).

It should be noted that, in terms of average weight, dry matter and fruit firmness, many varieties fall within the commercial standards of the fruit market.

#### **4. Conclusions**

Considering the objectives of the breeding program, among the 35 apple varieties studied, the following varieties can be used in hybridizations:

- late flowering varieties: 'Urdoase', 'Tare de ghindă', 'Roșii de Stetin', 'Șovari' and very late 'Verzișoare';

- genetic resistance to apple scab: 'Prima', 'Priam', 'Priscilla', 'Pionier', 'Voinea', 'Florina', 'Chindia', 'Dacian', 'Luca', 'Salva', 'Sir Prize', 'Mc.Free', 'Ciprian', 'Dany', 'Doina', 'Alex' cvs.;

- resistance to powdery mildew: 'Prima', 'Pionier', 'Salva', 'Romus 1', 'Luca' cvs.;

- high productivity: 'Prima', 'Florina', 'Pionier', 'Sir Prize', 'Generos' cvs.;

- fruit quality: 'Luca', 'Voinea', 'Chindia', 'Sir prize', 'Salva', 'Generos', 'Romus 3', 'Alex', 'Doina' cvs.;

- different harvest and consumption period: summer (July-August): 'Romus 1', 'Romus 2', 'Romus 3', 'Estival', 'Auriu de Cluj'; autumn (September – November): 'Prima', 'Voinea', 'Pionier', 'Productiv de Cluj', 'Priam', 'Codrene', 'Ciprian', 'Chindia', 'Luca' and others; winter (December – April): 'Generos', 'Florina', 'Dacian', 'Nova Easigro', 'Tare de ghinda', 'Mere tari', 'Călugăresc', 'Poinic'.

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## Tables and Figures

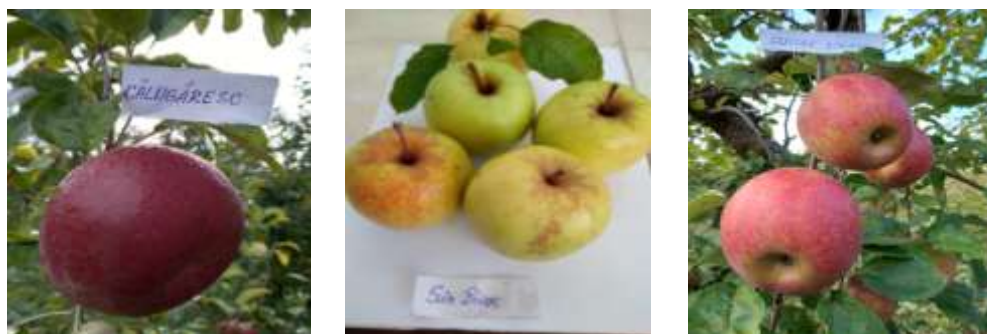


Fig. 1. Some apple varieties from national collection

Table 1. Disease susceptibility, fruit production and harvest maturity of the apple varieties studied

No.	Variety	Disease susceptibility		Fruit production (kg/tree) 2019 - 2022	Ripening time
		Apple scab ( <i>Venturia inaequalis</i> )	Powdery mildew ( <i>Podosphaera leucotricha</i> )		
1	Prima	Resistant	Resistant	56.2	Beginning of September
2	Priam	Resistant	Increased resistance	35.5	September
3	Priscilla	Resistant	Increased resistance	33.0	September
4	Sir Prize	Resistant	Partially resistant	43.6	September
5	Pionier	Resistant	Resistant	46.5	September
6	Voinea	Resistant	Increased resistance	15.2	Beginning of Sept.
7	Generos	Tolerant	Increased resistance	41.5	September
8	Romus 1	Resistant	Resistant	34.5	July
9	Romus 2	Tolerant	Partially resistant	29.8	July-August
10	Romus 3	Resistant	Partially resistant	38.5	August
11	Florina	Resistant	Partially resistant	53.3	End of September
12	Mc. Free	Resistant	Partially resistant	27.5	End of September
13	Nova Easigro	Resistant	Partially resistant	14.5	End of September
14	Călușăresc	Medium resistant	Partially resistant	16.3	September
15	Mere tari	Slightly sensitive	Increased resistance	30.8	End of September
16	Poinic	Slightly sensitive	Tolerant	22.0	September
17	Gustav durabil	Tolerant	Tolerant	7.8	September
18	Roșii de Stetin	Medium resistant	Increased resistance	14.5	September
19	Urdoase	Sensitive	Tolerant	13.3	September
20	Șovari	Medium resistant	Tolerant	19.6	End of September
21	Tare de ghindă	Medium resistant	Medium	16.8	End of September
22	Verzișoare	Sensitive	Increased resistance	5.6	September-October
23	Ciprian	Resistant	Increased resistance	36.0	September
24	Chindia	Resistant	Medium	34.2	September
25	Dacian	Resistant	Increased resistance	27.3	End of September
26	Luca	Resistant	Increased resistance	31.7	End of September
27	Salva	Resistant	Very resistant	38.0	End of September
28	Dany	Resistant	Tolerant	21.2	End of September
29	Doina	Resistant	Tolerant	40.6	End of September
30	Auriu de Cluj	Tolerant	tolerant	35.0	August
31	Productiv de Cluj	Tolerant	Medium	35.0	September
32	Alex	Resistant	Tolerant	24.3	End of September
33	Cidor	Tolerant	Tolerant	20.0	Beginning of September
34	Codrene	Medium sensitivity	Medium	27.0	September
35	Estival	Tolerant	Tolerant	29.7	July
<b>Average</b>				<b>29.04</b>	
<b>Standard deviation</b>				<b>12.17</b>	
<b>Coefficient of variation (%)</b>				<b>41.91</b>	

**Table 2. Fruit quality parameters – average (2019 – 2020)**

No.	Variety	Fruit weight (g)	Dry matter (%)	Firmness of the flesh (kgf/cm <sup>2</sup> )
1	Prima	136.2	12.9	9.0
2	Priam	133.7	13.7	8.8
3	Priscilla	143.0	14.6	10.1
4	Sir Prize	162.7	15.5	7.2
5	Pionier	121.2	12.3	6.8
6	Voinea	196.2	14.6	9.8
7	Generos	167.0	14.8	8.7
8	Romus 1	95.5	11.0	8.3
9	Romus 2	95.0	10.7	8.6
10	Romus 3	105.2	12.0	8.7
11	Florina	185.5	13.0	8.1
12	Mc. Free	137.2	15.9	9.2
13	Nova Easigro	158.5	13.7	9.0
14	Călugăresc	147.5	14.8	10.9
15	Mere tari	108.3	13.2	12.6
16	Poinic	125.0	12.9	10.5
17	Gustav Durabil	145.2	12.9	9.7
18	Roșii de Stetin	150.0	14.0	8.3
19	Urdoase	208.2	14.6	8.3
20	Șovari	173.2	13.9	9.6
21	Tare de ghinda	114.5	13.1	12.4
22	Verzișoare	75.2	14.5	7.3
23	Ciprian	144.0	12.2	9.8
24	Chindia	186.0	12.3	7.9
25	Dacian	259.5	12.8	7.5
26	Luca	176.2	12.9	7.1
27	Salva	181.2	13.3	7.0
28	Dany	184.0	11.5	8.9
29	Doina	197.5	13.4	7.6
30	Auriu de Cluj	166.5	11.7	7.2
31	Productiv de Cluj	203.7	12.7	7.4
32	Alex	247.5	13.8	6.7
33	Cidor	107.5	16.8	9.5
34	Codrene	143.7	11.9	5.6
35	Estival	152.5	10.6	8.4
	<b>Average</b>	<b>155.25</b>	<b>13.27</b>	<b>8.64</b>
	<b>Standard deviation</b>	<b>41.49</b>	<b>1.43</b>	<b>1.53</b>
	<b>Coefficient of variation (%)</b>	<b>26.73</b>	<b>10.78</b>	<b>17.66</b>