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RESEARCH CONCERNING THE QUALITY OF FRUITS OF SOME ANCIENT APPLE TREE VARIETIES IN CONDITIONS OF WESTERN PART OF ROMANIA

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Abstract

The hilly area of Banat represents one of our country's areas where there can be still found a plentiful ancient apple varieties, both in gardens and in the fields which deserve to be studied, multiplied and preserved such that to be brought again into attention the valuable genotypes which eroded or which have been lost from out of neglect. Many of the old apple varieties studied presented special features of fruits especially regarding their taste, commercial aspect and storage duration in natural conditions, as well an unexpected resistance to pests and diseases. The current work presents the results regarding the biometry of the fruits in case of 15 ancient apple varieties identified in a handful of locations in the Caraş Severin, Hunedoara and Timiş counties. As well, the resistance of the varieties in case of pests and diseases has been observed, altogether with the storage duration in almost natural conditions.

Key words*: apple, ancient varieties, biometry of fruits, pests and diseases, storage conditions.*

INTRODUCTION

The oldest and probably the most loved of the earth fruits, the apple represents the temperate climate fruit tree species which has stirred up and still sparks the attention of the horticulturalists.

The apple tree represents one of the oldest fruit tree species cultivate in our country, having a major economical importance due to fruits nutritive value used for fresh consumption or as primary matter for food and pharmaceutical industries. The apples have a complex chemical composition and a very low degree of residue (Drăgănescu, 1996). They are used to make a diverse range of products, but remain par excellence used as fresh fruits for desert. Apple consumption has a beneficial effect to the overall health of a person.

Romania has one of the richest and most varied apple germplasm, ancient varieties being found all over the country (Botu & Botu 2000), varieties which have a good adaptability to soil and climate conditions (Barbu et al., 2011), with resistance to pest and diseases (Ghena et al., 2003; Iordănescu et al., 2007; 2012;).

Although ancient varieties come with a series of deficiencies concerning the character variability, high vigor character variability (White, 1999), sometimes deficient aspect of the fruits, sensitivity to pest and diseases, however the scholars which have studied them have found aspects which counteract them and deserve to be taken into account (Drăgănescu, 1996; Barbu, 2012; Iordănescu et al., 2011; 2013; Sasu, 2015).

MATERIALS AND METHODS

In order to achieve the objectives were studied ancient apple tree varieties from most representative areas in Banat: Timiş county with settlements Berini and Sudriaş; Hunedoara county with settlements Zeicani, Peşteniţa and Ohaba Ponor; Caraş Severin county with settlements Vârciorova, Mehadia, Cornereva and Bărbosu.

Selected genotypes have been encoded through letters and numbers, *the letter* represents the county and settlements were from collected biological material and *the number* represents private gardens (excepting material collected in the field).

There were selected 15 ancient apple tree varieties cultivated and known in these areas, as follows: TM.B.18 ′Măr dulce-amărui′, HD.Z.55′Pietros′,HD.P.57′Domnesc′,HD.Z.55 ′Bănățenesc′, HD.PTA.86 ′Curcubătoase′, HD. O.P. ′Poinic′, HD.PTA 86 ′Vițate′, HD.PTA 86 ′Botu Oii′, HD.Z.55 ′Pătul′, HD. O.P.P. ′Mustoase′, HD.O.P.′Florănești′, CS.M. 254 ′Jonathan de munte′, CS.V.44 ′Caslere′, CS.V.44 ′Aore′ and CS.V.44 ′Crețesc′.

Morphological characterization of fruits supposed determination of external features of fruits: shape, size (big diameter, small diameter, fruit′s height), color and aspect of the skin and determination of internal features visually appreciated (color and aspect of the pulp) and through taste (taste, flavor and pulp consistency).

The duration of the fruit preservation implied the establishment of the number of storage days, from the harvesting of the fruits to the depreciation of the fruits under normal conditions (cellars or ponds with natural ventilation).

The pest and diseases resistance supposed tracking attack by *Venturia* sp. (scab), *Podosphaera leucotricha* (mildew) *Monilinia* sp. (monilia) concerning diseases and attack by *Cydia pomonella* concerning pests.

All the data were statistically processed using variance analysis, as the experiment control being used the varieties average.

RESULTS AND DISCUSSIONS

The obtained results regarding the external features of fruits of ancient apple varieties are present in table 1-4 and Figure 1.

Big diameter of fruits of apple varieties studied ranged between 97.43 mm in ′Pătul′ variety and 47,33 mm in ′Botu Oii′ variety with an experiment average by 72.16 mm. (Table 1).

The biggest fruits were obtained in ′Pătul′, ′Aore′, ′Jonathan de munte′ and ′Florănești′ varieties, all four being very significant positive towards the control value, followed by ′Mustoase′ variety who was distinct significant positive and ′Caslere′ variety who was significant positive towards the control value.

The smallest fruits were obtained in ′Botu Oii′ and ′Măr dulce-amărui′ varieties, both being very significant negative towards the control value, followed by ′Poinic′ and ′Vițate′ varieties who were distinct significant negative and finally ′Bănățenesc′ and ′Crețesc′ varieties who were only significant negative.

Table 1. Big diameter of fruits of apple varieties

Variety	Big diameter mm	Relative value %	Difference towards the control value	Significance
TM.B.18 Măr dulce-amărui	56.42	78.19	-15.74	000
HD.Z.55 Pietros	69.66	96.54	-2.50	-
HD.P. 57 Domnesc	69.39	96.17	-2.77	-
HD.Z.55 Bănățenesc	65.83	91.24	-6.32	0
HD.PTA.86 Curcubătoase	69.80	96.73	-2.36	-
HD. O.P. Poinic	63.47	87.97	-8.68	00
HD.PTA 86 Vițate	61.86	85.73	-10.29	00
HD.PTA 86 Botu Oii	47.33	65.60	-24.82	000
HD.Z.55 Pătul	97.43	135.03	25.28	XXX
HD. O.P.P. Mustoase	80.38	111.40	8.23	XX
HD.O.P.Florănești	86.83	120.33	14.67	XXX
CS.M. 254 Jonathan de munte	87.24	120.90	15.08	XXX
CS.V.44 Caslere	71.9	99.64	-0.25	X
CS.V.44 Aore	90.76	125.79	18.61	XXX
CS.V.44 Crețesc	64.06	8.78	-8.09	0
Experiment average	72.16	100.00	0.00	control

DL5% = 6.00 mm DL1% = 8.11mm DL0.1% = 10.80 mm

Small diameter of fruits of apple varieties studied ranged between 94.58 mm to ′Pătul′ variety and 45.77 mm to ′Botu Oii′ variety with an experiment average by 69.03 mm.

Four of the studied varieties have exceeded the average diameter experience as following: ′Pătul′, ′Aore′ and ′Jonathan de munte′ were very significant positive towards the control value and ′Florănești′ variety was distinct positive towards the control value.

On the opposite side, ′Botu Oii′ and ′Dulce-amărui′ varieties were very significant negative and ′Viţate′ variety distinct significant negative (Table 2).

Table 2. Small diameter of fruits of apple varieties

Variety	Small diameter mm	Relative value %	Difference towards the control value	Significance
TM.B.18 Măr dulce-amărui	51.39	74.44	-17.64	000
HD.Z.55 Pietros	66.67	96.58	-2.36	-
HD.P. 57 Domnesc	67.67	98.03	-1.36	-
HD.Z.55 Bănățenesc	62.23	90.16	-6.79	-
HD.PTA.86 Curcubătoase	67.20	97.35	-1.83	-
HD. O.P. Poinic	60.15	87.15	-8.87	-
HD.PTA 86 Vițate	55.65	80.63	-13.37	00
HD.PTA 86 Botu Oii	45.77	66.30	-23.26	000
HD.Z.55 Pătul	94.58	137.02	25.56	XXX
HD. O.P.P. Mustoase	73.24	106.11	4.22	-
HD.O.P.Florănești	83.15	120.46	14.12	XX
CS.M. 254 Jonathan de munte	85.67	124.12	16.65	XXX
CS.V.44 Caslere	67.5	97.78	-1.52	-
CS.V.44 Aore	85.86	12.39	16.84	XXX
CS.V.44 Crețesc	68.73	99.57	-0.29	-
Experiment average	69.03	100.00	0.00	control

DL5% = 9.21 mm DL1% = 12.45mm DL0.1% = 16.58 mm

The height of the fruit varied between 88.19 mm for the ′Pătul′ variety and 45.03 mm for the ′Dulce-amărui′ variety, with an average experience of 61.69 mm.

Four of the varieties studied exceeded the average value of the experience, respectively: ′Pătul′, ′Jonathan de munte′ and ′Aore′ – very significant positive compared to the control, while six varieties had values below that of the witness, thus: ′Dulce-amărui′ and ′Poinic′ – very significant negative, ′Domnesc′, ′Vițate′, ′Botu Oii′ and ′Crețesc′– significant negative compared to the control (Table 3).

Tabelul 3. Height of the fruit of apple varieties

Variety	Fruit height mm	Relative value %	Difference towards the control value	Significance
TM.B.18 Măr dulce-amărui	45.03	73.00	-16.66	000
HD.Z.55 Pietros	57.33	92.94	-4.36	-
HD.P. 57 Domnesc	54.40	88.18	-7.29	0
HD.Z.55 Bănățenesc	57.20	92.72	-4.49	-
HD.PTA.86 Curcubătoase	59.93	97.15	-1.76	-
HD. O.P. Poinic	47.63	77.21	-14.06	000
HD.PTA 86 Vițate	54.01	87.55	-7.68	0
HD.PTA 86 Botu Oii	53.03	85.97	-8.66	0
HD.Z.55 Pătul	88.19	142.95	26.50	XXX
HD. O.P.P. Mustoase	66.33	107.52	4.64	-
HD.O.P.Florănești	72.42	117.40	10.73	XX
CS.M. 254 Jonathan de munte	75.12	121.77	13.43	XXX
CS.V.44 Caslere	62.0	100.50	0.31	-
CS.V.44 Aore	78.4	127.08	16.71	XXX
CS.V.44 Crețesc	54.38	88.15	-7.30	0
Experiment average	61.69	100.00	0.00	control

DL5% = 7.29 mm DL1% = 9.85mm DL0.1% = 13.13 mm

The fruit weight ranged between 52.67 g in the ´Botu Oii´ variety and 172.10 g in the ´Florăneşti´ variety, with an average of 102.79 g.
The varieties which have exceeded the value of the experience: ´Florăneşti´ variety – very significant positive and ´Caslere´ variety – distinct significant positive, followed by: ´Curcubătoase´, ´Pietros´, ´Domnesc´ and ´Pătul´ varieties, which were not statistically assured.
The varieties which had values below that of the control: ´Botu Oii´ and ´Dulce-amărui´– very significant negative; ´Mustoase´– significant negative, followed by: ´Vițate´, Poinic´ ´Jonathan de munte´, ´Aore´ and ´Crețesc´ which were not statistically assured (Table 4).

Table 4. The weight of the fruit of apple varieties

Variety	The weight g	Relative value %	Difference towards the control value	Significance
TM.B.18 Măr dulce-amărui	54.83	53.35	-47.95	000
HD.Z.55 Pietros	126.55	123.12	23.77	-
HD.P. 57 Domnesc	116.00	112.86	13.21	-
HD.Z.55 Bănățenesc	99.00	96.32	-3.79	-
HD.PTA.86 Curcubătoase	134.77	131.11	31.98	-
HD. O.P. Poinic	90.33	87.88	-12.45	-
HD.PTA 86 Vițate	82.00	79.78	-20.79	-
HD.PTA 86 Botu Oii	52.67	51.24	-50.12	000
HD.Z.55 Pătul	115.67	112.53	12.88	-
HD. O.P.P. Mustoase	76.33	74.26	-26.45	0
HD.O.P.Florăneşti	172.10	167.44	69.32	XXX
CS.M. 254 Jonathan de munte	93.65	91.11	-9.13	-
CS.V.44 Caslere	137.33	133.61	34.54	XX
CS.V.44 Aore	93.22	90.69	-9.56	-
CS.V.44 Crețesc	97.43	94.79	-5.35	-
Experiment average	102.79	100.00	0.00	control

DL5% = 24.64 g DL1% = 33.29g DL0.1% = 44.35 g

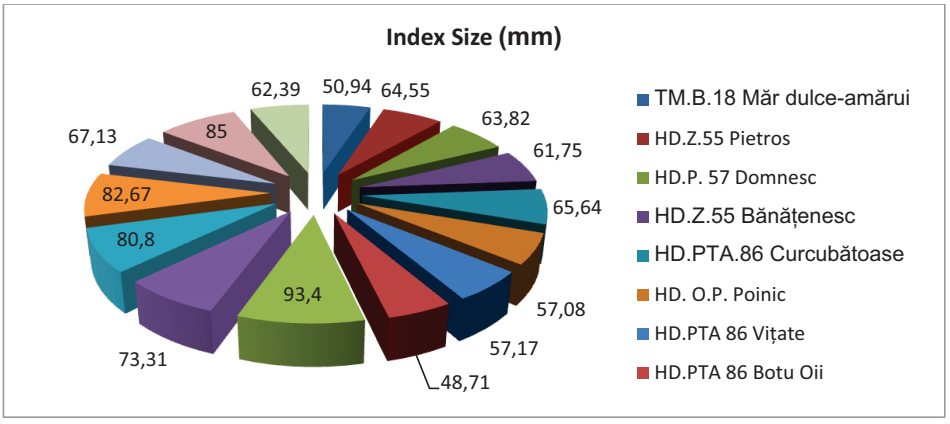

Figure 1. Index size of old apple tree varieties

The value of the apple-size index of the varieties studied falls within the following groups:

- small: ´Botu Oii´ ´Dulce-amărui´ ,´Vițate´ ,´Poinic´ , ´Florăneşti´
- middle: ´Bănățenesc´, ´Domnesc´, ´Pietros´, ´Caslere´, ´Crețesc´, ´Curcubătoase´
- big: ´Pătul´, ´Aore´, ´Jonathan de munte´, ´Florăneşti´

The external appearance of the fruits, the fruit production and apple´s destinations and storage duration are presented in Table 5- 6 and Figures 2-9.

Table 5. External appearance of the fruit

Variety	The fruit shape	The color		Taste	Commercial aspect
		The skin of the fruit	The pulp of the fruit		
TM.B.18 Măr dulce-amărui	spherical flattened	yellow with red on the sunny side	white	good	yes
HD.Z.55 Pietros	spherical flattened	green with red on the sunny side	whiteish green	good	yes
HD.P. 57 Domnesc	flattened	yellow with red stripes	white	good	yes
HD.Z.55 Bănățenesc	spherical flattened	green with red stripes	whiteish green	middling	no
HD.PTA.86 Curcubătoase	spherical	green with red stripes	white	middling	no
HD. O.P. Poinic	spherical flattened	yellow	white	Very good	yes
HD.PTA 86 Vițate	spherical irregular	green with red on the sunny side	whiteish green	Very good	no
HD.PTA 86 Botu Oii	cylindrical	yellow with ½ red stripes	white	middling	no
HD.Z.55 Pătul	spherical flattened	yellow-red on the sunny side	white	good	yes
HD. O.P.P. Mustoase	flattened	yellow with red stripes	yellowish white	good	yes
HD.O.P.Florănești	spherical flattened	yellow with red stripes	whiteish green	good	no
CS.M. 254 Jonathan de munte	spherical flattened	green with dark red	greenish	middling	yes
CS.V.44 Caslere	spherical flattened	yellow with red stripes	white	good	yes
CS.V.44 Aore	flattened	yellow	white	middling	yes
CS.V.44 Crețesc	spherical flattened	yellow with red stripes	white	good	yes

From the fifteen apple varieties studied, ten had a pleasant commercial appearance, but most of them were distinguished by their special, balanced taste and can be used for fresh consumption (HD.Z.55 ´Pietros´, HD.PTA 86 ´Botu Oii´, CS.M. 254 ´Jonathan de munte´, CS.V.44 ´Caslere´ and CS.V.44 ´Aore´) but also for processing under the most diverse forms (Table 5).

Regarding the storage duration in empirical conditions (cellars or pans with natural ventilation, straw storage or stratified) the winter varieties are noticeable: CS.M. 254 ´Jonathan de munte´, CS.V.44 ´Caslere´ and HD.PTA 86 ´Botu Oii´-5 months; but also the autumn-winter varieties: HD.Z.55 ´Pietros´, HD.Z.55 ´Bănăţenesc´, HD.Z.55 ´Pătul´ and HD.O.P. ´Florăneşti´-6 months, in all cases the varieties studied retaining their special taste characteristics. (Table 6)

Regarding the resistance to diseases and pests (Table 7), three of the studied varieties have proven good resistance both to the scab attack, mildew and monilia, and to the worm attack, respectively: HD.Z.55 ´Pătul´, HD.PTA 86 ´Botu Oii´, CS.M. 254 ´Jonathan de munte´, the last of which surpasses all expectations, knowing that the ´Jonathan" variety is susceptible both to scab and to mildew.

HD.Z.55 ´Bănățenesc´ variety was also noteworthy proving to be resistant to all three diseases but had a middle resistance to worm attack.

Two of the varieties studied have partial resistance to diseases and pests, namely CS.V.44 ´Aore´– middle resistant to scab but resistant to mildew, monilia and worms and CS.V.44 ´Crețesc´ variety- resistant to scab, mildew and worm but medium resistant to monilia.

Also consider the HD. O.P. ´Poinic´ variety – resistant to scab and medium resistant to mildew, monilia and apple worms, as well as HD.O.P. ´Florănești´ variety – middle resistant to diseases but apple worm-sensitive.

Table 6. Fruit productions and their destination

Variety	Fruit production kg/tree	Harvest period	Storage duration	Destination
TM.B.18 Măr dulce-amărui	50	July I	July III	current consumption, processing
HD.Z.55 Pietros	200	September III	April	current consumption
HD.P. 57 Domnesc	100	September I	November	current consumption, processing
HD.Z.55 Bănățenesc	200	September III	March	processing, current consumption
HD.PTA.86 Curcubătoase	200	September I	December	processing
HD. O.P. Poinic	250	September I	November	current consumption, processing
HD.PTA 86 Vițate	350	September I	December	processing, current consumption
HD.PTA 86 Botu Oii	100	October II	April	current consumption
HD.Z.55 Pătul	200	September II	March	current consumption
HD. O.P.P. Mustoase	150	September I	October	processing, current consumption
HD.O.P.Florănești	250	September III	February	current consumption
CS.M. 254 Jonathan de munte	200	October III	May	current consumption
CS.V.44 Caslere	150	October III	May	current consumption
CS.V.44 Aore	100	August II	September	current consumption
CS.V.44 Crețesc	200	September I	November	current consumption, processing

Table 7. Pests and diseases resistance

Variety	The main diseases			The main pests
	Scab *Venturia inequalis*	Monilia *Monilinia laxa*	Mildew *Podosphaera leucotricha*	Apple worm *Cydia pomonella*
TM.B.18 Măr dulce-amărui	middle resistant	resistant	middle resistant	sensible
HD.Z.55 Pietros	resistant	middle resistant	middle resistant	middle resistant
HD.P. 57 Domnesc	resistant	middle resistant	middle resistant	middle resistant
HD.Z.55 Bănățenesc	resistant	resistant	resistant	middle resistant
HD.PTA.86 Curcubătoase	sensible	middle resistant	middle resistant	sensible
HD. O.P. Poinic	resistant	middle resistant	middle resistant	middle resistant
HD.PTA 86 Vițate	middle resistant	sensible	sensible	sensible
HD.PTA 86 Botu Oii	resistant	resistant	resistant	resistant
HD.Z.55 Pătul	resistant	resistant	resistant	resistant
HD. O.P.P. Mustoase	sensible	sensible	Sensibil	sensible
HD.O.P.Florănești	middle resistant	middle resistant	middle resistant	middle sensible
CS.M. 254 Jonathan de munte	resistant	resistant	resistant	resistant
CS.V.44 Caslere	middle resistant	middle resistant	middle resistant	middle resistant
CS.V.44 Aore	middle resistant	resistant	resistant	resistant
CS.V.44 Crețesc	resistant	resistant	middle resistant	resistant

Figure 2. Pietros variety

Figure 6. Botu Oii variety

Figure 3.Domnesc variety

Figure 7. Jonathan de munte variety

Figure 4. Bănățenesc variety

Figure 8. Pătul variety

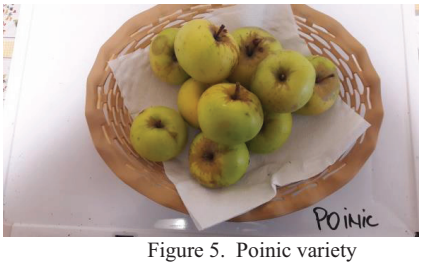

Figure 5. Poinic variety

Figure 9. Creţesc variety

CONCLUSIONS

Concerning the fruit size and the aspect which recommends them especially for fresh consumption, the following varieties stood out: ´Pătul´, ´Aore´ and ´Jonathan de munte´.

Concerning the storage duration in natural conditions, the following varieties stood out: winter apple varieties (CS.M. 254 ´Jonathan de munte´, CS.V.44 ´Caslere´ and HD.PTA 86 ´Botu Oii´) – with a storage duration of 5 months; but also the autumn-winter varieties (HD.Z.55 ´Pietros´, HD.Z.55 ´Bănățenesc´, HD.Z.55 ´Pătul´ and HD.O.P. ´Florănești´) with a storage duration of 5-6 months.

Concerning pest and diseases resistance, three of the studied varieties proved a good resistance to both scab, mildew and monilia attack and apple worm attack: HD.Z.55 ´Pătul´, HD.PTA 86 ´Botu Oii´ and CS.M. 254 ´Jonathan de munte´.

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