

## CHARACTERIZATION OF SOME LOCAL TOMATOES (*SOLANUM LYCOPERSICUM*) ASSORTMENTS BASED ON ASCORBIC ACID CONTENT

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### Abstract

A diet rich in fruits and vegetables is associated with a lower incidence of degenerative diseases (such as cardiovascular disease and certain types of cancers). The biochemical components variability in fruits and vegetables is relatively high, due to the many varieties of each species, to the applied technology and not least due to environmental conditions.

Tomato (*Solanum Lycopersicum*) is known as a rich source of bioactive compounds. Nutraceutical properties of fruits can be correlated with their ascorbic acid content and its capacity to neutralize free radicals responsible for oxidative damage at the cellular level. A "nutraceutical" can be considered a food product, or a part of a food, which can be represented by isolated nutrients, herbal products, or dietary supplement that can provide health benefits.

This study aimed to evaluate differences in nutritional (dry matter, soluble solids content, total mineral content (ash) and total acidity) and bioactive values (ascorbic acid) of tomato genotypes harvested from native populations in Romania from areas with tradition in cultivation of tomatoes (Dolj and Timis counties).

**Key words:** tomato fruit, chemical properties, vitamin C

Romania is one of the richest European countries in terms of plant diversity, due to its specific geographic position in South-East Europe and characteristic ecological, climatic and geomorphologic conditions.

Tomato fruits are fleshy fruits, commonly consumed in fresh and processed forms.

Tomato is the second-most important vegetable in the world after potato (Kalogeropoulos *et al*, 2012; Lenucci *et al*, 2013; Dávila-Aviña *et al*, 2014; Torbica *et al*, 2016). This horticultural crop constitutes an excellent source of health-promoting compounds due to the balanced mixture of minerals and antioxidants including vitamins C and E, lycopene, b-carotene, lutein and flavonoids such as quercetin (Dorais *et al*, 2008).

Tomatoes are horticultural crop with an annual production of around 122.9 million tones of fresh weight (FW) (FAO, 2005), and are a high source of carotenoids. Tomato is consumed mostly as fresh fruit, but also after processing into various products such as tomato juice, paste, sauce, puree and ketchup (Lenucci *et al*, 2013).

The popularity of this horticultural crop may arise not only because of the taste, but also from the growing public awareness of tomato products' health benefits. The beneficial effects on human health are due to the balanced mixture of minerals

and antioxidants including ascorbic acid and vitamin E, lycopene, b-carotene, lutein and flavonoids such as quercetin (Dorais *et al*, 2008). Vitamin C (ascorbic acid) is an important phytochemical of tomato fruit, while being a most effective antioxidant in plants (Smirnoff, 1996). The limited caloric supply, relatively high fibre content, and provision of minerals, vitamins, and phenols such as flavonoids make the tomato fruit an excellent "functional food" providing additional physiological benefits as well as meeting basic nutritional.

In the present study, physicochemical investigations have been undertaken in order to reveal the chemical composition, nutritional values and antioxidant potentials (content of acid ascorbic) of the tomato species in Romania.

### MATERIAL AND METHOD

#### Reagents and procedure

All reagents employed in this study were of analytical grade and were purchased from Sigma-Aldrich (Germany).

As working parameters we have chosen optimum parameters according to the apparatus description.

The burning operation in order to determine ash content was made in an oven Nabertherm

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model 6/11 with automated programming and electronic display.

### Collection and preparation of tomato fruit samples

Seven common farmer' varieties of tomato widely cultivated in rural communities from Dolj and Timis counties (Romania), were chosen according to the morphological and sensorial characteristics which determine their use, as defined by our informants (*table 1a*). The tomato varieties were: round tomato (CM, MRI, MRP, AB, MAB, CATSG), long tomato (MRP, CATSR) and heart tomato (MRI), yellow tomato (CATSG).

The tomato fruits were collected from different Dolj and Timis county farmers in the summer-autumn of 2015. Treatments consisted of washing fruit under tap water and gently drying with blotting paper. Then, tomato fruits were selected according to uniformity of shape and color, and then stored in polyethylene bags at 4 °C (up to 1-2 days) until analysis. For each variety (seven) it was taken fruits from 5 individual plants, two fruits per plant. Fruit weight, moisture, total dry weight and acidity were determined by using fresh fruit samples.

### Determination of basic properties: fruit weight, moisture, total solid content, ash, total acidity and ascorbic acid content

The following basic nutritional parameters of harvested fruits were determined: total dry matter, moisture, total acidity and total mineral content (ash).

Average fruit weight (g) was measured by using a digital balance with a sensitivity of 0.001 g. For each determination, three replications have been considered – each one obtained from analyzed fruits.

The moisture of samples has been determined by drying at  $100 \pm 5$  °C until they reached constant weight (AOAC, 2002). Total solid content can be determined from moisture content, as shown below:

$$\text{Total solids (Dry matter)} = 100 - \% \text{ Moisture}$$

Ash content (total mineral content) was determined using 5 g of fruit sample in an oven at 500°C in two sessions of 4 h each.

The acidity determination was performed by titrimetric method, used 0.1N NaOH. Acidity is expressed in degrees of acidity.

### Ascorbic acid determination

Ascorbic acid was determined following a procedure previously described by the authors (Bordean *et al*, 2006) with 2,6-dichloro-indophenol by titration method.

### Statistical analysis.

All determinations were performed in triplicate, calculating their arithmetic mean of three separate determinations. The data were

statistically analyzed using the program Microsoft Excel and PAST.

## RESULTS AND DISCUSSIONS

The results physical–chemical characteristics of tomato fruits: fruit weight, moisture, total dry weight (TDW) contents and total acidity of tomato species are given in Table 2. The fruit weight of tomato species ranged between 6.49 g and 374.6 g, with AB variety having the biggest fruit. Fruit weight is dependent on the species and on the soil. It is noted that the total acidity range is tight, the values ranged from 3.10 to 6.7. CM tomato variety has the higher value of acidity, and the lower value is for AB variety.

The ash content (%) is an indicator of the mineral content as a quality criteria that is offering information about analysed fruits origin. The variability in the fruit ash content could be due to harvesting processes and storage conditions (Kaur and Das, 2011). From our data presented in Table 1 it can be observed that the higher ash content in case of analysed fruits was found in CATSR tomato cultivar 2.04 % and the lowest in CM tomato variety 0.52%.

We can observe that the moisture contents of analysed fruits were of 89.57% (CATSR cultivar) up to 93.49% (AB cultivar). From the analysed data presented above, the highest value of the total solid content was found in CATSR cultivar.

According to these results, tomato *fruits* may be recommended for fresh fruit production, since they have an attractive fruit, and *also* may be recommended for processing, due to their higher TDW contents.

The ascorbic content in fruit of tomato species was determined and the results are provided in Table 2. The ascorbic acid content of the tomato variety were found to range from 5.1 mg /100g FW (CATSG variety) to 10.13 mg /100g FW (MRI variety) (Table 2).

The obtained data are in accordance with George *et al*, 2004 (ascorbic acid content ranged from 8–56 mg/100 g in the skin, and 8–32 mg/100 g in the pulp of Indian tomatoes.), Toor and Savage, 2005 (6-18 mg/100 g fw;) and Pinela *et al*, 2012 (10.85-18.56 mg/100 g fw- Portuguese tomato varieties) but lower than the values found in Czech Republic (21.7-25.8 mg/100 g fw, Kotkov *et al*, 2011), Spanish (39-63 mg/100 g fw; Guil-Guerrero and Rebollosa-Fuentes, 2009).

Table 1

Several morphologic characteristics and description of eight different tomato Romanian farmer' varieties

Variety (Abreviation)	Predominant fruit shape	Fruit size	Fruit weight (average)	Exterior colour of mature fruit	Seeds number
CM	Rounded shape	Intermediate (3.1–6 cm)	62.1	Red	High
MRI	Heart-shaped	Intermediate (4.1–8 cm)	146.2	Pink - red	small
MRP	Ellipsoid (plum-shaped)	Intermediate (3.1–6.5 cm)	47.4	Orange/red	Intermediate
AB	High rounded potato-shaped	Very large (>10 cm)	374.6	Red	Small
MAB	High rounded shaped	large (5.1–6.1 cm)	276.5	Red	Small
CATSR	Ellipsoid (plum-shaped)	Small (3–5 cm)	14.5	Red	Intermediate
CATSG	Flattened (oblate)	Small (3–5 cm)	6.49	Yellow	High
Average of 10 fruits from different plants					

**Legend:** AB and MAB = tomatoes originated from Timis county; MRI, MRP, AB, MAB, CATSG, CATSR = tomatoes originated from Dolj county

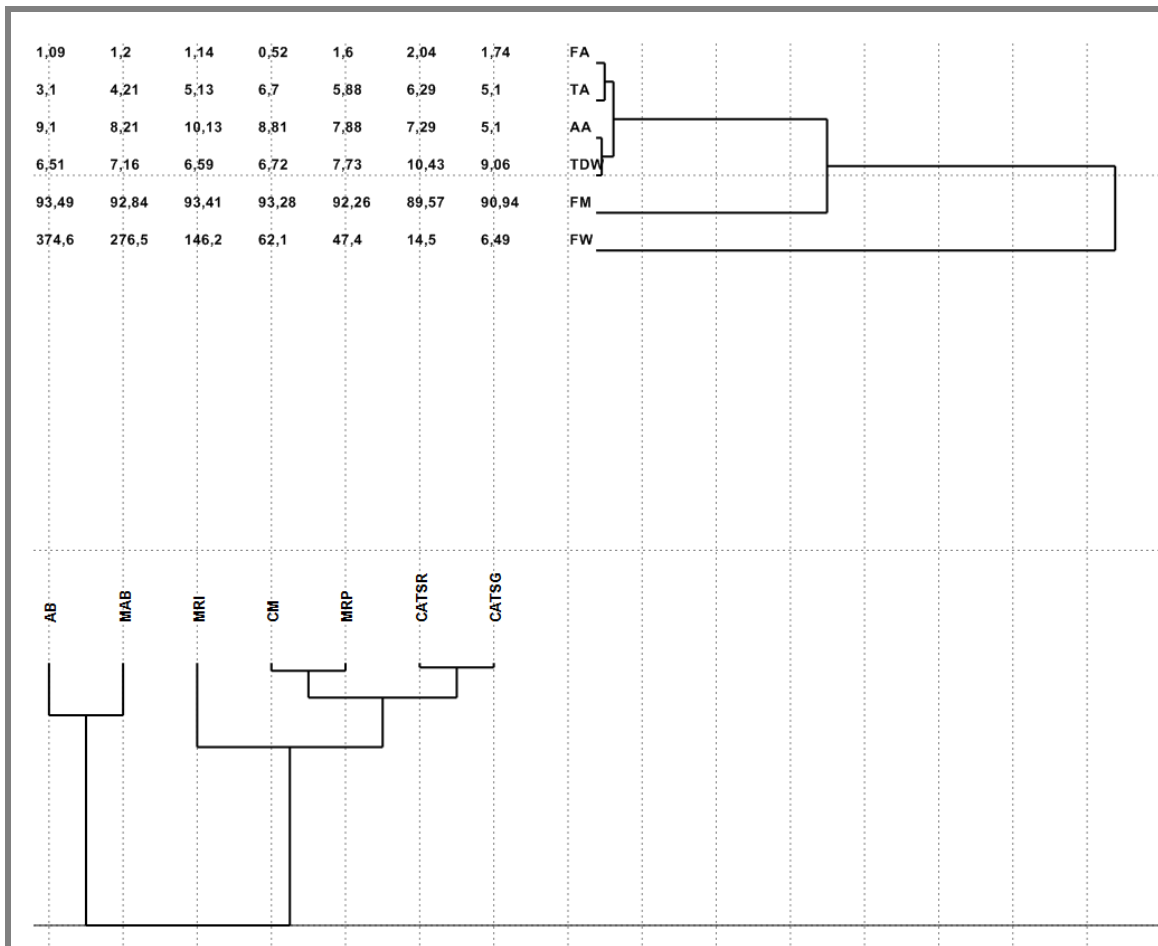


Figure 1 Graphical representation of cluster analysis

**Legend:** AB, MAB = tomatoes originated from Timis county; MRI, MRP, AB, MAB, CATSG, CATSR = tomatoes originated from Dolj county; FW= Fruit weight [g]; FM= Moisture [g/100g FW]; TDW= total dry weight content [%]; FA= Ash [g/100g FW], TA = Total acidity [° acidity], AA= Ascorbic acid content [mg /100g FW].

**Fruit weight, total dry weight, moisture, total acidity and ascorbic acid of tomato cultivars fruits**

Cultivar	Fruit weight (g)	Moisture (g/100g FW)	TDW (%)	Ash (g/100g FW)	Total acidity [° acidity]	Ascorbic acid content (mg /100g FW)
CM	62.1	93.28	6.72	0.52	6.7	8.81
MRI	146.2	93.41	6.59	1.14	5.13	10.13
MRP	47.4	92.26	7.73	1.60	5.88	7.88
AB	374.6	93.49	6.51	1.09	3.10	9.10
MAB	276.5	92.84	7.16	1.20	4.21	8.21
CATSR	14.5	89.57	10.43	2.04	6.29	7.29
CATSG	6.49	90.94	9.06	1.74	5.10	5.10

TDW: total dry matter content weight; tomato variety, FW- fresh weight

**Legend:** AB and MAB = tomatoes originated from Timis county; MRI, MRP, AB, MAB, CATSG, CATSR = tomatoes originated from Dolj county

## CONCLUSIONS

Tomato fruits are a source of vitamin C, having beneficial properties for health. All the differences observed in the content of vitamin C of tomato varieties are related to genotype, but also to several factors such as ripening stage, cultivation practices (water availability, mineral nutrients), and climatic environment (mostly light and temperature).

The present indications lead us to the conclusion that tomato fruit is a potential candidate for bioactivity study as well as functional fruit development.

The results indicate that tomato fruits are a valuable horticultural product, based on their rich and beneficial nutrient composition and may be useful in a balanced diet. In addition, this study brings numerous arguments in order to use these fruits as potential healthy foods for different health issues and it's recommended for patients with cardio and neurodegenerative diseases.

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