

Comparative study of heirloom tomato varieties

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Summary: The study examined the health status, growth type, berry morphology, berry quality, and gastronomic value of 60 heirloom tomato lines. In the middle of June, the level of virus infection was medium in the plant stock according to the assessments. 21% of the lines did not show symptoms of virus infection. During the vegetation period, the major fungal diseases were *Alternaria* by the middle of August and *Phytophthora* from the beginning of September. In spite of the fact that no fungicides were applied, 13% of the lines were healthy and 36% showed medium infection at the end of August. Half of the lines had a strong, 23% of the lines had a medium growth vigour. The majority (74%) of the lines showed strong or medium lateral shoot growth and only 7% of them proved to be less prone to branching. In spite of the rapid growth, 20% of the lines had a weak main stem, the majority of the lines had a main stem medium strength. The different shapes occurred in different colours, in addition to the traditional red colour (53%), there were orange, yellow, wine-red (blackish), lilac, green, almost white or multicoloured varieties. Unfortunately, most of the lines were prone to longitudinal or circular cracking of the berries. Based on the first experiences, all tested variety types had more favourable utilization characteristics than the traditional tomatoes. Varieties with a thick flesh and harmonic acid/sugar ratio such as some of the ox-heart varieties are especially valuable. For drying, the elongated types proved to be the best. The hollow tomato is the most special type which can be utilized most diversely. It is especially suitable for making white tomato soup and „Concassé” due to its easily removable placenta rich in jelly materials and its thick flesh. In addition, it can be used for preparing stuffed tomato.

Key words: heirloom, tomato, varieties, lycopene

Introduction

Tomato is the most important vegetable species worldwide, it is grown on more than 4 million hectares and the produces amount exceeds 120 million tons.

The major reason of its popularity is its favourable physiological effect. Its total antioxidant capacity is high, which has tight correlation with its lycopene, polyphenol and vitamin C content (Helyes & Lugasi, 2007). It can be diversely utilized in gastronomy. The harmonic taste of tomato is ensured by the proper sugar-acid ratio. Sugars (glucose and fructose) and organic acids (citric acid and malic acid) constitute 1.7–4 % and 0.3–0.69% of its fresh weight (Pogonyi et al., 2007). In addition to its industrial utilization, it is one of the most important basic materials in mediterranean and subtropical cuisine. In these regions, the grown varieties have diverse shape and they have numerous utilization forms in gastronomy. It has been proved that the different shapes indicate different inner content values. For example, cherry tomatoes contain more lycopene while refraction is generally higher in plum-shaped tomatoes (Helyes et al., 2002). The number of vegetable seed collections is increasing worldwide, where the varieties not grown intensively due to the conquer of industrial, intensive production are collected, maintained and made available to

growers. These heirloom collections are suitable for exploring the biodiversity of a species, for testing them under specific conditions and for selecting those types which are suitable for renewing the domestic vegetable variety assortment.

Material and method

In 2007, 60 tomato lines from heirloom collections were studied under field conditions at the University of Debrecen, Department of Horticultural Science and Plant Biotechnology. The tomatoes selected from the collection of Tomato Growers Supply Company (Florida, USA) were very diverse in shape (Figure 1).

According to their growth type, they were continuously growing, however, they were very diverse regarding clustering and the size, shape and color of the fruit. They were planted under field conditions in the demonstration garden of the department between 20–25 June. During soil preparation, 10–15 kg/ m² peat compost was applied to the brown sandy loam soil and the area was covered with agrotexile (polypropylene). The cover preserved the favourable soil condition and prevented the emergence of weeds. Plants were planted next to a support system,

between-row and within-row distances were 150 cm and 30 cm, respectively. Plants were tied and pruned to one main stem. During the vegetation period, regular foliar fertilization was applied with 0.3%-os Volldünger Linz 14-7-21 fertilizer and green insecticides were used against pests (*Trialeurodes vaporariorum*). The plants were irrigated with drip-irrigation.



Figure 1 Heirloom tomato varieties

The tomato lines were evaluated as follows:

- Health status – field assessment
 – infection of lines by viruses and fungiscale from 1 to 5, where
- 1 = 91–100% of the plants are infected
 - 2 = 76–90% of the plants are infected
 - 3 = 51–75% of the plants are infected
 - 4 = 26–50% of the plants are infected
 - 5 = 0–25% of the plants are infected.
- ELISA test (CMV, PVY)
- Growth type – growth vigour
 – formation of lateral shoots
 – growth of the main stem
- Berry morphology – shape
 From 1 to 10, where:
- 1 = flattened
 - 2 = slightly flattened
 - 3 = flattened, round
 - 4 = elongated
 - 5 = slightly elongated
 - 6 = elongated angular
 - 7 = round
 - 8 = heart-shaped
 - 9 = pear-shaped
 - 10 = crescent-shaped
- ribbing
 – colour
 – colour intensity
- Berry quality – longitudinal crack
 – circular crack
 – uniform ripening
 – dynamics of ripening

We have also contacted the Hungarian Association of Gastronomy. In the case of several lined the experts of the association tested the gastronomical value of tomatoes, how they meet the requirements of modern cooking and whether they can renew Hungarian culinary.

We started research to determine the antioxidant activity of 60 tomato lines. The antioxidant capacity of water- and lipid-soluble materials was determined by a PHOTOCHEM^R chemiluminometer.

Results

Health status of tomato lines

In the middle of June, the level of virus infection was medium in the plant stock according to the assessments. 21% of the lines did not show symptoms of virus infection. The ELISA tests (CMV, PVY) also confirmed that 21% of the plants were virus-free, however, only 40% of these were free of symptoms. Based on our observations, it is worth testing the heirloom lines with provocation virological tests and to determine their virus resistance.

During the vegetation period, the major fungal diseases were *Alternaria* by the middle of August and *Phytophthora* from the beginning of September. In spite of the fact that no fungicides were applied, 13% of the lines were healthy and 36% showed medium infection at the end of August (Figure 2)

Growth vigour of tomato lines

For growing a tomato variety and for selecting the proper production technology, its growth type and vigour should be known. The studied lines were of continuous growth except for one, however, they differed in their growth vigour. For several of them, growing under our conditions is questionable due to the extremely weak stem or strong branching.

Half of the lines had a strong, 23% of the lines had a medium growth vigour. The majority (74%) of the lines showed strong or medium lateral shoot growth and only 7% of them proved to be less prone to branching. In spite of the rapid growth, 20% of the lines had a weak main stem, the majority of the lines had a main stem medium strength.

Berry quality of tomato lines

The sixty tomato lines were very diverse regarding berry shape (Figure 3). In addition to the traditional flattened round and round shapes (categories were set up according to the UPOV description), the ratio of elongated angular types characteristic to the hollow tomatoes used for stuffing was also high.

The different shapes occurred in different colours, in addition to the traditional red colour (53%), there were orange, yellow, wine-red (blackish), lilac, green, almost white or multicoloured varieties. Unfortunately, most of the lines were prone to longitudinal or circular cracking of the

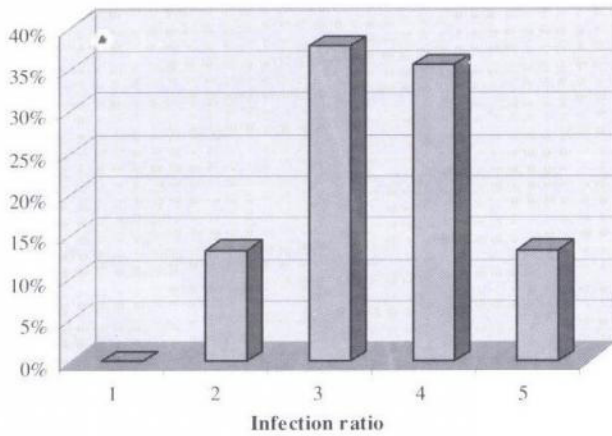


Figure 2 Health status of tomato lines

berries. However, this unfavourable trait is very dependent upon the environmental conditions, therefore, the rainy September was not suitable for assessing this characteristic. There were no lines of very early ripening among the studied ones. 19%, 38% and 43% of them were early, medium and medium-late and late, respectively.

Gastronomical value

In one of the kitchens of the Hungarian Association for Gastronomy, four types of dishes were prepared from San Marsano (crescent-shaped), elongated, hollow and ox-heart type tomatoes:

1. White tomato soup- made from the jelly-like, translucent placenta surrounding seeds.
2. Raw „Concassé” – from unseeded tomato flesh, not containing placenta.
3. Marinated tomato – peeled potatoes are cut in half (seeds are removed) and then are dried at 80–90 °C.
4. Bottled tomato- the unseeded tomatoes are half fried and then are sterilized at 75 °C in bottles in different pickling solutions (detailed recipe at the website of HAG: www.buvosszakacs.hu)

Based on the first experiences, all tested variety types had more favourable utilization characteristics than the traditional tomatoes. Varieties with a thick flesh and harmonic acid/sugar ratio such as some of the ox-heart varieties are especially valuable. For drying, the elongated types proved to be the best. The hollow tomato is the most special type which can be utilized most diversely. It is especially suitable for making white tomato soup and „Concassé” due to its easily removable placenta rich in jelly materials and its thick flesh. In addition, it can be used for preparing stuffed tomato.

Antioxidant capacity of the tomato lines

The laboratory works on the sixty lines are in progress and require a long time, therefore, detailed results will be published only later. When selecting the lines, biological

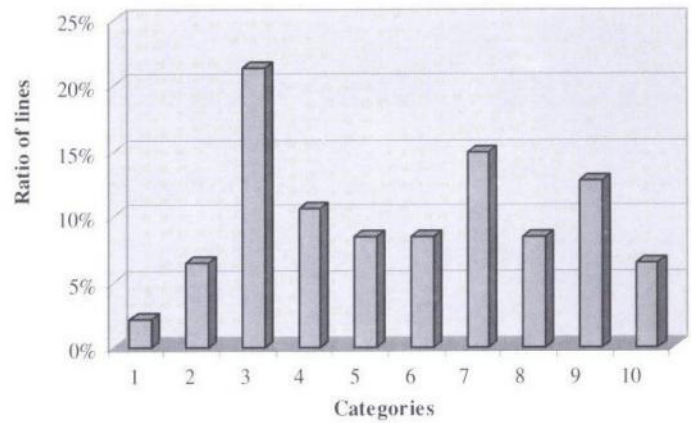


Figure 3 Berry shape of tomato lines

activity will be an important aspect for further studies. The first-year testing of the sixty „heirloom” tomato varieties was performed at the University of Debrecen Department of Horticultural Science and Plant Biotechnology under field conditions using a supporting system.

Our objective was to select such variety types which are suitable for safe production under organic management, are resistant to diseases and their gastronomical value is higher than that of varieties grown in intensive production, meet the requirements of modern and high-level gastronomy and are rich in health-preserving bioactive materials.

Based on our assessments, we selected 22 tomato lines for further examination. In addition to diverse berry shape and colour, those were selected the growing of which is favourable. They are characterized by a short or medium vegetation period, proper growth vigour (without strong branching). Disease resistance was also an important requirement. The ripening characteristics and gastronomical value were also taken into consideration. In 2008, the selected lines will be grown again under foil without heating.

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