Selection of miniature varieties of Solanaceae crops in Armenia

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Abstract. The article considers the creation of miniature varieties of nightshade crops. For breeding purposes, wild species and relatives of solanaceous crops were used. We have created miniature varieties of tomato - Emmy, hot pepper - Bouquet, eggplant - Solsis, physalis - Lady, nightshade - Black Karaleva. New varieties can be effectively introduced in the republic and similar regions of the globe.

1. Introduction

The Solanaceae family includes several types of vegetable plants, widely distributed in different regions of the globe. The most valuable of them are: tomato, eggplant, sweet pepper, hot pepper and physalis. In the genus Solanum there are also a number of less common leafy vegetable plants, such as nightshade (Solanum nigrum) [1].

Many varieties of nightshade crops have been created for canning and fresh consumption, with the participation of wild species and relatives of these crops. The current market also requires ornamental plants, miniature varieties of nightshade crops. They are eaten and used to color various buffet dishes. Bringing this together using wild nightshade crops with us was the challenge for the hobby grower to create new miniature varieties. The miniature variety is characterized by the presence of small fruits (a few centimeters in length), narrow and rounded in shape, chili and cherry-type fruits, multi-colored in color. [1-8]

The history of the development of breeding shows that one of the effective ways to use the generic potential of economically valuable plant traits was interspecific hybridization. It has always been tempting for a person to create new forms of cultivated plants, in which signs of different species and genera, valuable from an economic point of view, were combined [9].

Distant hybridization is the most important method of enriching the gene pool of cultivated plants, which is widely used in the breeding of nightshade crops, including potatoes, tomatoes and peppers. Involvement in the selection process of wild-growing relatives of cultivated plants contributes to the activation of the natural shaping process, ensures the receipt of new economically valuable traits and the creation of species and crops that do not exist in nature [10-11].
2. Materials and methods
The main breeding work has been carried out in Armenia since 2004. The Department of Breeding and Technology of Solanaceous Crops Cultivation of the Scientific Center for Vegetable and Melon Crops was tasked with studying wild species from the gene pool of solanaceous crops and introduced from UNRA - France, AVRDC - Taiwan, used and local wild weeds of black nightshade distributed in the Tovush region of Armenia.

Experiments on the study of new technologies for the cultivation of nightshade vegetable crops were carried out in four repetitions according to the methodology of the World Vegetable Center (AVRDC).[12] Feeding area(90-70)x20cm for tomatoes, for eggplant, for peppers. The characteristics of the varieties are described according to the methods of VNIIR, AVRDC and IPGRI (Bioversity International) [13-17].

Analytical-synthetic selection methods were used.

Crossbreeding and generational selection of *Lycopersicon pennelli* and the local variety Zvartnots of tomato resulted in a constant cherry-type line, which was named Emmy. When selecting *Capsicum frutescens*. - a variety of hot peppers of the Bouquet type of chili, which is regionalized in Armenia. When selecting the wild species *Solanum sissymbrifolium* - a variety of eggplant of the scarlet type, which is named Solsis. When selecting Physalis alkekengi, the Lady variety was obtained. When selecting the local black nightshade *Solanum nigrum L.*., the Chernaya Karaleva variety was obtained.

Below are the drawings of the studied Armenian varieties *Lycopersicon pennelli* - Cherry type tomato. Emmy variety. (figure 1), *Capsicum frutescens* - Chilli type pepper. Sort Bouquet. (figure 2), *Solanum sissymbrifolium* - Scarlet type eggplant. Variety Solsis. (figure 3), *Physalis alkekengi*. - Physalis. Lady variety. (figure 4), *Solanum nigrum L.* - Black nightshade. Variety Black Karaleva. (figure 5).

![Figure 1. Cherry type tomato. Variety Emmy.](image1)

![Figure 2. Chili type pepper. Sort Bouquet.](image2)
3. Results and Discussion
The results of the study of the duration of interphase periods in varieties of miniature solanaceous crops (table 1) showed that "Sprouts - flowering" in the Emmy variety was 60 days, and in the varieties Bouquet, Solsis, Lady, Chernaya Karaleva, respectively - 72, 51, 92, 47 days. "Blossoming - technical ripeness" for the variety Emmy - 74 days, and for the varieties Bouquet, Solsis, Lady, Black Karaleva - 90; 68; 91; 59 days. "Sprouts - technical ripeness" for the Emmy variety is 85 days, and for
the varieties Bouquet, Solsis, Lady, Chernaya Karaleva, respectively - 101, 80, 210, 68 days. "Seedlings - biological ripeness" for the Emmy variety was 100 days, and for the varieties Bouquet, Solsis, Lady, Chernaya Karaleva, respectively - 128, 95, 130, 80 days. Varieties of tomato, eggplant, nightshade are early, and pepper and physalis are mid-ripening.

The results of the study (table. 2) according to the characteristics of quantitative traits in miniature varieties of post-new crops, showed that the early yield of the Emmy variety was 0.850 - kg / m$^2$, the total yield was 4, 760 kg / m$^2$, and for the varieties Bouquet, Solsis, Lady, Chernaya Karaleva: respectively - 0.600; 0.1020; 0.320, 0.180 - (early), respectively - 3.024; 5.400; 1.653; 0.975 kg/m$^2$ (total).

Fruit weight in variety Emmy was 7.0 g, fruit length - 1.0 cm, diameter 1.3 cm, and in varieties Bouquet, Solsis, Lady, Chernaya Karaleva - respectively - 7.2; 9.1; 8.2; 5.3; gr. 1.0; 1.1; 1.8; 0.9; see 1.3; 1.4; 2.2; 2.1; 1.2 cm

The number of fruits in the Emmy varieties was only 136 pieces, commercial - 134 pieces, the number of clusters - 17 pieces, the number of fruits in one brush - 8 pieces, and in the varieties Solsis, Lady, Chernaya Karaleva - respectively; 84; 120; 38; 184; 82; 118; 38; 182; fourteen; fifteen; eighteen; 23; 6; eight; 2; 8 pcs.

**Table 1.** The duration of the interphase periods in varieties of miniature nightshade crops in the conditions of Armenia, days (average 2020 - 2021).

| Culture, variety                  | Seedlings-flowering | Flowering - technical ripeness | Seedlings - technical ripeness | Seedlings - biological ripeness |
|-----------------------------------|---------------------|---------------------------------|---------------------------------|---------------------------------|
| Cherry type tomato. Variety Emmy  | 60                  | 74                              | 85                              | 100                             |
| Chili type pepper. Sort Bouquet   | 72                  | 90                              | 101                             | 128                             |
| Scarlet type eggplant. Variety Solsis | 51              | 68                              | 80                              | 95                              |
| Physalis. Grade Lady              | 82                  | 97                              | 110                             | 130                             |
| Black nightshade. Variety Black Karaleva | 47              | 59                              | 68                              | 80                              |

**Table 2.** Characteristics of varieties by quantitative traits in miniature nightshade crops in the conditions of Armenia (average 2020 - 2021).

| Culture, variety                  | Yield kg/m$^2$ | Fruit | Number of fruits, pcs. |
|-----------------------------------|---------------|-------|------------------------|
|                                  | early | general | average weight, g. | average length, cm. | diameter, see | total | including commodity | number of brushes | number of fruits in one cluster |
| Cherry type tomato. Variety Emmy  | 850   | 4760    | 7.0               | 1.0                 | 1.3           | 136   | 134                   | 17.0             | 8.0                           |
| Chili type pepper. Sort Bouquet   | 600   | 3021    | 1.2               | 1.1                 | 1.1           | 84    | 82                    | 14.0             | 6.0                           |
| Scarlet type eggplant. Variety Solsis | 1020  | 5400    | 9.1               | 1.8                 | 2.2           | 120   | 48                    | 15.0             | 8.0                           |
| Physalis. Grade Lady              | 320   | 1653    | 8.7               | 1.6                 | 2.2           | 38    | 38                    | 19.0             | 2.0                           |
| Black nightshade. Variety Black Karaleva | 180   | 975.2   | 5.3               | 0.9                 | 1.2           | 184   | 182                   | 23.0             | 8.0                           |

A description of the characteristics of fruits in miniature varieties of nightshade crops is given in table. 3. The color of the skin of unripe fruits is from light to intensely dark, the intensity of the green color is from weak to strong, the shape of the tip of the inflorescence is closed and open, the state of the tip
of the inflorescence is concave, pointed, flat, the color of the skin of the ripened fruit is green, color of the core - light, dark, moderate, color of the skin of a ripe fruit - red, orange, black, color of the inner part of the pulp - red, orange, black, yellow, color intensity of the inner part of the pulp - weak, medium, dark, cross-section - round, angular, hardness - medium, hard soft, mixed, the dominant shape of the fruit (after changing the color of the fruit) - round, oblong.

Table 3. Description of fruit characteristics in miniature nightshade crops in Armenian conditions (average 2020 - 2021).

| Fetal data                        | Cherry type tomato. Variety Emmy | Chili type pepper. Sort Bouquet | Scarlet type eggplant. Variety Solias | Physalis. Grade Lady | Black nightshade. Variety Black Karaleva |
|----------------------------------|----------------------------------|---------------------------------|---------------------------------------|----------------------|------------------------------------------|
| Coloration of the skin of unripe fruits | light                            | light                           | intense black                         | light                | intensely dark                           |
| Green color intensity            | weak                             | average                         | strong                               | average              | strong                                   |
| Inflorescence tip shape          | closed                           | open and closed                 | closed                               | closed               | closed                                   |
| Conditions of the tip of the inflorescence | concave             | pointed                         | flat                                 | flat                 | concave                                  |
| Ripe skin color                  | green                            | green                           | green                                | green                | green                                    |
| Core color                       | light                            | light                           | moderate                             | light                | dark                                     |
| Ripe skin color                  | red                              | orange                          | red                                  | orange               | black                                    |
| The color of the inside of the pulp | red                              | orange                          | red                                  | yellow               | black                                    |
| The color intensity of the inner part of the pulp | average             | weak                            | average                              | weak                 | dark                                     |
| Transverse section               | round                            | angular                         | round                                | round                | round                                    |
| Hardness                         | the average                      | solid                           | the average                          | mixed                |                                         |
| Dominant fruit shape (after fruit color change) | round                           | oblong                          | round                                | oblong               | round                                    |

4. Conclusion
Using analytical - synthetic breeding methods, with the help of wild species, for the first time in Armenia, we have created new miniature varieties of nightshade crops. The value of these varieties is both food and decorative. They are tested in different regions of Armenia for introduction into production. Hot pepper variety Bouquet is already zoned and allowed to be used. The remaining varieties will be included in the State Varieties of Nutrition.

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