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NEW SOURCES OF *SOLANUM* GERMPLASM OF THE *LEPTOSTEMONUM* CLADE PRESERVED AND USED IN THE BREEDING PROGRAM OF THE PLANT GENETIC RESOURCES BANK BUZĂU, ROMANIA

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ABSTRACT. The cultivation of aubergine is widespread in Romania. It is one of the most consumed vegetables in Romania, especially in autumn. It can be found in various traditional Romanian dishes - zacusca, aubergine salad - but also in other popular dishes. There is a high demand from consumers but also from producers for new varieties of aubergine, which has contributed to the intensification of acclimatization and breeding work on the Solanum genus at PGRB Buzău. In order to diversify the complex of eggplants cultivated and consumed in Romania, PGRB has introduced new lines of *Solanum macrocarpon* and *Solanum aethiopicum* into the core collection. They have shown a good capacity for acclimatization to the pedoclimatic conditions of Romania, obtaining very good results in terms of growth and development, and fruit and seed production capacity. *Solanum macrocarpon* and *Solanum aethiopicum* have been cultivated in the experimental fields of PGRB Buzău since 2019, opening new horizons in terms of enriching the assortment of *Solanum* cultivated in Romania.

Keywords: *S. macrocarpon*, *S. aethiopicum*, core collection, morphotypes, acclimatization

1. Introduction

Solanum L. (*Solanaceae*), with approximately 1400 species, is one of the 10 largest genera of flowering plants and contains economically important species such as the tomato (*S. lycopersicum* L.), eggplants (*S. melongena* L.), and potato (*S. tuberosum* L.) (Frodin, 2004; Bohs, 2005; Stern et. al., 2011). The three cultivated eggplants are all Old World in origin; the gboma eggplant *Solanum macrocarpon* L. and the scarlet eggplant *S. aethiopicum* L. are mainly grown locally in Africa but are also cultivated elsewhere as minor crops (Daunay M. et.al., 2012; Knapp S. et al.,2013). The scarlet (*Solanum aethiopicum* L.) and gboma (*S. macrocarpon* L.) eggplants are two cultivated African vegetable crops locally important in their region of origin in tropical sub-Saharan Africa (Lester et al., 1990; Schippers, 2000; Lester and Daunay, 2003; Maundu et al., 2009, Plazas et. all., 2014). *S. aethiopicum*, according to Lester (1986) has four groups, respectively Aculeatum, Schum, Gilo, Kumba. The four cultivar groups of *S. aethiopicum* are completely

interfertile (Lester and Niakan, 1986). The Aculeatum group is cultivated for its ornamental characteristics, the Gilo group is cultivated for fruits, the Kumba group is cultivated both for fruits and leaves and the Schum group is cultivated for leaves consumption.

Depending on the cultivar, *S. macrocarpon* is cultivated for its fruits, leaves or both (Schippers, 2000; Lester and Daunay, 2003; Maundu et al., 2009, Plazas et. all., 2014).

In the present paper the results of research concerning the acclimatization to soil and climatic conditions of two new *Solanum* species, *Solanum aethiopicum* and *Solanum macrocarpon*, are presented. These two new species have been introduced in breeding programs since 2019 in order to allow the development of new cultivars showing resistance to the attack of the main pathogens, but also demonstrating the ability to adapt in the context of climate change and able to withstand and provide satisfactory yields in the presence of abiotic stress.

2. Materials and Methods

Solanum macrocarpon and *Solanum aethiopicum* were taken under study since 2019 and are still under study. The annual crops were established in protected spaces, because of the colder climate of Romania the fruits of certain lines cannot reach the physiological ripening age and cannot produce seed, due to the hoar-frost specific to Romania.

The crop was established by producing seedlings in alveolar pallets, using peat mixed with sand as substrate. At planting, the seedlings were 60 days old. The planting distances used were 70 cm between rows and 40 cm between plants per row.

The breeding method used was repeated individual selection. In order to obtain the author's seed, typical plants were chosen and the descendants were studied for a period of two years in order to eliminate those that deviate by one or more characters from the basic type of the variety. In the selection field, 100 plants for each genotype were planted. Each year of study, meaning 2019-2022, phenological observations and biometric determinations were carried out according to UPOV and IBPGRI standards.

3. Results and Discussion

The conventional breeding approaches to improve crop plants are the introduction, mass selection, pure-line selection, pedigree selection, single seed descent, bulk method, and backcross method. According to the situation and objectives, combinations of approaches have been found a valuable strategy (Kumar A. et all, 2020). Mass selection is most commonly used breeding method for both self and cross pollinated crops (Joshi, B. K. 2017).

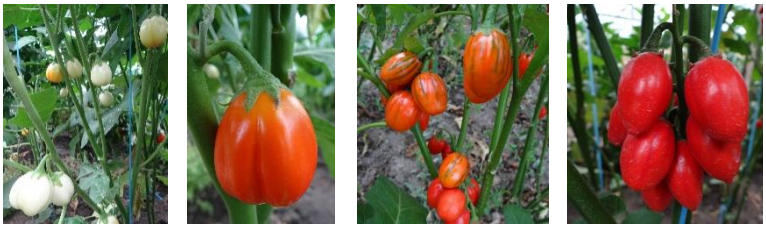
Using pure line selection in the *Solanum* selection field, annually were selected the representative plant genotypes for every identified group. It is a method used on a large scale by eggplant breeders all over the world. Breeding of these landraces was conducted via pure line selection method in 3 years. In the first year, 500 plants of each landrace were planted in the field and some plants of every landrace were selected with respect to quantitative and qualtitative traits. In year two, selected plants of the first year (as treatment) and their landraces (as control) were planted in an augment design and we selected 35 better lines base on the yield and quality of fruits. In third year, selected lines of 2nd year along a control were planted in a randomized complete block design with 3 replications. Finally, 23 better lines with best quality and highest yield were selected from aforesaid landraces (Bagheri, M. 2010). This method helped at identifying and therefore divide the *Solanum* genotypes studied in the recognised groups. The *Solanum aethiopicum* crop has a total of 6 genotypes, divided into 3 groups: Aculeatum 2 genotypes; Gilo 3 genotypes; Kumba 1 genotype. As can be seen in figure 1, the Aculeatum group is characterized by the white colour of the flowers, similar to those of peppers

(*Capsicum annuum*), and the fruits are green in the immature stage, while in the mature stage their colour varies from orange to deep red. Their shape is similar to that of a miniature pumpkin.

GSAA1 **GSAA2**

Fig. 1. Plant and fruit aspect of *Solanum aethiopicum* Aculeatum genotypes

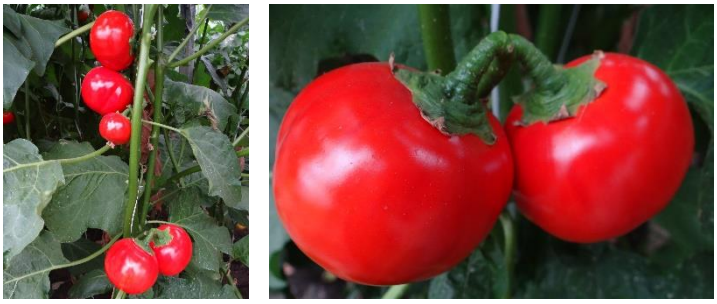
The Gilo group is defined by a much greater variety of fruit shapes. As can be seen in figure 2, the fruit shape is oval, smooth, or slightly ribbed. Their color varies from white-orange to light green with striations, turning orange or bright red at physiological maturity. The Gilo group is the most common due to the diversity of fruit shapes and because the fruit is edible, with a taste similar to aubergines.



GSAG1 **GSAG2** **GSAG3**

Fig. 2. Plant and fruit aspect of *Solanum aethiopicum* Gilo group varieties

In the *Solanum* core collection of PGRB Buzău, there is one genotype belonging to the Kumba group, a group cultivated for fruit and leaf consumption. The fruits are spherical, the color of the immature fruit is green and the apical part shows able striations. When ripe, the fruit turns bright red.



GSAK1

Fig. 3. Plant and fruit aspect of *Solanum aethiopicum* Kumba group genotypes

The *Solanum macrocarpon* crop comprised 4 genotypes.

GSM1 **GSM2** **GSM3** **GSM4**

Fig. 4. Plant and fruit aspect of *Solanum macrocarpon* genotypes

The morphotypes studied in the germplasm collection of PGRB Buzau are differentiated by fruit shape, color, ripening time. The main characteristics of the studied genotypes are listed in Table 1.

Morphotypes belonging to *Solanum macrocarpon* species are characterized by fruits with a higher weight, which makes them more appreciated by growers, since they associate them with the traditional *Solanum melongena* eggplants.

Compared to *Solanum melongena*, *Solanum aethiopicum* is a newly introduced species in Romania, and it did not require phytosanitary treatments to prevent and control specific pathogens.

Table 1

Main characteristics for the studied genotypes of *Solanum aethiopicum* and *Solanum macrocarpon*

Gentotype/ Characteristics	Plant height (cm)	Plant canopy (cm)	Fruit length (cm)	Fruit diam. (cm)	Fruit weight (g)	Unripe fruit color	Ripe fruit color
GSAA1	245	62	3.25	5.1	31	light green	orange-red
GSAA2	265	46	3.13	3.63	22.8	green	orange
GSAG1	300	57	5.1	3.8	30.6	white	orange
GSAG2	225	30	3.9	1.9	28.2	light green with greener stripes	orange
GSAG3	231	32	4.2	2.3	31.4	green	red
GSAK1	242	55	3.1	2.9	26.3	light green	red
GSM1	141	62	7	9	96.5	light-plum	brownish
GSM2	110	45	5.39	4.01	47.2	white	yellow
GSM3	98	42	5.89	8.21	112	green with white stripes	light orange
GSM4	125	46	8.2	12.2	132	white	yellow

As can be seen in table 1, *Solanum aethiopicum* genotypes show higher plant vigor characterized by greater plant height, with the GSAG1 genotype showing 202 cm greater height compared to the GSM3- *Solanum macrocarpon* genotype. The high plant vigor, correlated with the increased resistance to pathogen attack recommends the study of *Solanum aethiopicum* genotypes as rootstocks in order to improve the range of rootstocks available in Romania. The weight of *Solanum macrocarpon* fruits is between 47.2 g and 132 g, compared to the weight of *Solanum aethiopicum* genotypes whose values were between 22.8 g and 31.4 g.

The selected genotypes showed a good capacity of adaptation to the Romanian pedoclimatic conditions. This was reflected in the fruit and seed production capacity. The fruit weights recorded for the measured genotypes are presented in table 1 with mean values.

4. Conclusions

The genotypes of *Solanum aethiopicum* and *Solanum macrocarpon* from the germplasm collection of the Buzau Plant Genetic Resource Bank were evaluated, performing morphological observations and biometric determinations.

The studied genotypes showed a good acclimatization capacity to the pedoclimatic conditions of Romania, obtaining very good results in terms of growth and development, as well as fruit and seed production capacity.

Both *Solanum macrocarpon* and *Solanum aethiopicum* have been successfully cultivated in the experimental fields of PGRB Buzau since 2019, opening new horizons in terms of enriching the assortment of *Solanum* cultivated in Romania.

The study will be continued with breeding other valuable lines of aubergines for obtaining and registering new genotypes of *Solanum* suited for cultivation in Romania.

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