Scientific Papers. Series B, Horticulture. Vol. LXVII, No. 1, 2023
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

PRELIMINARY RESULTS ON THE ACCLIMATIZATION OF A NEW SPECIES OF THE *SOLANACEAE* FAMILY IN ROMANIA

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Abstract

The Solanaceae family has been of interest since ancient times, due to the numerous directions of use. Most are decorative species, others are cultivated for their medicinal, insecticidal, and culinary properties. The Solanum melongena species is much appreciated for its high production capacity, but also for the varied shapes, tastes, and textures of the fruits. After the 2000s, in Romania, research on the acclimatization of new species has reached new horizons, with many species being studied. PGRB Buzau has also focused its research on acclimatization and breeding of new species, including Solanum viride, known as poroporo. Although it is native to the Pacific, in particular to the Fiji Islands, the species has shown high adaptability to the climatic conditions of Romania. Plants with a high production capacity, abundant fructification, and increased resistance to the main pathogens specific to the species have been recorded. Research will continue, following phenotypic and biometric determinations, production indices, as well as the chemical composition of the fruits.

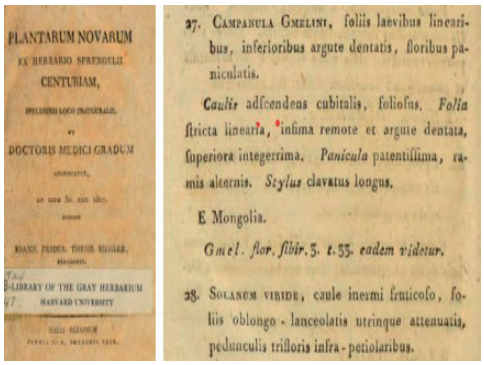
Key words*: Solanum viride, poroporo, germplasm collection, genebank, morphotype.*

INTRODUCTION

Around 30,000 of the total of approximately 250,000 flowering plant species in existence are edible (FAO, 1997; Samuels J., 2015). The *Solanaceae* family is composed of more than 100 genera and includes more than 3000 species, spread all over the world. Of these, only a few are widely cultivated and have a significant share in cultivation. The most important species in terms of production are *Solanum lycopersicum* (tomatoes), *Solanum tuberosum* (potatoes), *Solanum capsicum* (peppers), and *Solanum melongena* (aubergines). As a result of climate change and population growth, the range of species grown for fresh or processed consumption has been expanded. Thus, there has been an increase in the biodiversity of cultivated species but also an opening towards new directions of use of the species grown. Following this trend, Romania, through PGRB Buzau, is among the countries that put a special emphasis on improving the vegetable gene pool. Following in the footsteps of the forefathers of Romanian horticultural research, PGRB has dedicated part of its activity to the acclimatization and improvement of new species to the soil and climatic conditions of Romania. Every year, the germplasm collection of the *Solanaceae* family is enriched with dozens of accessions, which are then subjected to acclimatization and breeding works. The natural range of *S. viride* is in the Pacific area, from Fiji to the Pitcairn Islands and the Hawaiian Islands. The exact breeding area of *Solanum viride* is not known, but according to studies, the most accepted area is considered to be Samoa (S. Knapp, 2014).

It is a species with a particular notoriety because of the macabre context of its use. The cannibal communities of Fiji (Seemann, 1862; 1865-73), consumed the fruits and leaves of this species, as the human flesh called *baloka* was difficult to digest, often leading to severe constipation followed by death (A.B. Brewster, 1922).

According to Kew Royal Botanical gardens, the first scientific publication of this species was made in 1807, in the work *Plantarum Novarum ex. Herbario Sprengelii Centuriam* (Figure 1). This book can be found in the Harvard University library.


PLANTARUM NOVARUM
EX HERBARIO SPRENGELII
CENTURIAM,
DOCTORIS MEDICI GRADUM
HARVARD UNIVERSITY

27. CAMPANULA GMELINI, foliis laevibus linearibus, inferioribus argute dentatis, floribus paniculatis.

Caulis adscendens cubitalis, foliosus. *Folia* stricta linearia, infima remote et argute dentata, superiora integerrima. *Panicula* patentissima, ramis alternis. *Stylus* clavatus longus.

E Mongolia.

Gmel. flor. sibir. 3. t. 33. eadem videtur.

28. SOLANUM VIRIDE, caule inermi fruticoso, foliis oblongo-lanceolatis utrinque attenuatis, pedunculis trifloris infra-petiolaribus.

Figure 1. *Solanum viride* first mention in 1807 (p. 14, pt. 28)

The species was of interest for breeding work, as it has two edible organs: the fruit and the leaves. The fruit in fresh state is bitter, but by thermal preparation this bitterness becomes acceptable, and the leaves are consumed similar to spinach. In terms of biochemical composition, according to Han 1998, it contains solasodine and steroidal alkaloids. Extracts of glycoalkaloids can be used to obtain a potential skin cancer preparation for clinical research (Nada, et al. 2005).

MATERIALS AND METHODS

Beginning with the year 2022, PGRB has taken a new species of *Solanum* under study, namely *Solanum viride*, the *uporo* group.

The crop was established by producing seedlings in alveolar pallets. Peat mixed with sand was used as a substrate. The planting age of the seedlings was about 60 days. Figure 2 shows the planting scheme used by PGRB for the establishment of the culture. Planting distances were 35 cm between plants per row and 70 cm between rows.

The crop was established in open field.

Phenological observations and biometric determinations were carried out during the growing season. These were performed following the UPOV and IBPGRI descriptors adapted from *Solanum melongena*, with particular emphasis on phenotypic stability traits. The colour chart RHS Colour Chart Sixth Edition (2015-2019) was used to determine fruit colour.

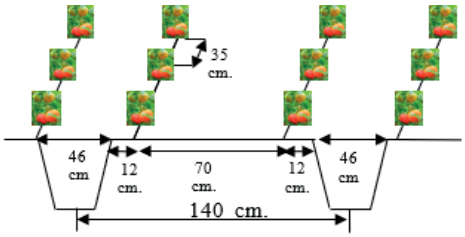


Figure 2. BRGV planting scheme for *S. viride*

RESULTS AND DISCUSSIONS

The general objective of PGRB Buzau is to expand the germplasm collection of the species under study. The *Solanaceae* family is one of the best-represented families in the BRGV Buzău germplasm collection, with more than 10.000 genotypes of tomatoes, peppers, physalis, and aubergines. Besides these well-known species, PGRB has genotypes of *Solanum mammossum*, *Atropa belladonna, Datura stramonium, Petunia spp., Nicotiana tabacum, and Solanum viride.*

Up to now, research on *S. viride* has been mainly aimed at morphological and phenotypic evaluation of the species under Romanian soil and climatic conditions. The process of introduction and acclimatization is the method used for crop improvement. PGRB applies this method by introducing new species in the cultivation area of PGRB Buzau succeeding in time to acclimatize the species of interest for breeding activities. *Solanum viride* was introduced in the process of acclimatization to the soil and climatic conditions of Romania-Buzău. Thus a number of 100 plants were evaluated morphological and phenotypical. The main qualitative characteristics of the plant are presented in Table 1.

Table 1. Main qualitative traits for *Solanum viride* in BRGV Buzau crop

Plant vigour	**medium**
Pubescence	weak
Anthocyanin pigments	absent
Plant growth	subscandent
Leaf color	light green
Flower colour	white
Time of beginning of flowering	medium
Thorns on calyx	absent

The species shows reduced pubescence on the leaves and on the rest of the organs, its presence is very weak. There are no spikes on any vegetative organ. The flowers are small, and white, similar to pepper flowers (Figure 3).

Figure 3. Under microscope aspects of the flower, sepals, stem, and the leaf of *Solanum viride*

Following the qualitative characters, it was observed that so far the species has shown a high degree of adaptability, expressing the specific characteristics of the species in the area of origin, as shown in the images below (Figure 4).

Figure 4. *S. viride* general aspect at BRGV Buzau

The main quantitative characteristics of the species are shown in Table 2. The species showed a well-balanced development, without a large variation of the main measured characters. It ranged in height from 81 cm to 67 cm. The number of shoots was directly proportional to the degree of development of the plants, with plants ranging from 45 cm to 62 cm in diameter in the field. Thus the number of shoots varied from 4 to 8 shoots.

Table 2. Main quantitative traits for *Solanum viride* in BRGV Buzau crop-mean values

Plant height (cm)	72.8
Plant canopy (cm)	53.4
No. of branches	6
Leaf blade length (cm)	12.67
Leaf blade width (cm)	8.92
Inflorescence no.	5
Flowers/inflorescence no.	7
Corolla diam. (cm)	3.06
Sepals no.	5-6
Sepals length (cm)	3.14

The plants showed increased resistance to attack by the main pathogens. The resistance of the species under field conditions is remarkable, the plant being in culture also in the second decade of November (Figure 5).

Figure 5. *S. viride* November crop at BRGV Buzau

It has mildly sinuate leaves with reduced pubescence and small dimensions. Light green in colour, without traces of anthocyanins. Leaf size is larger in the basal part of the plant with a length of up to 20.48 cm and decreases towards the apical part to 5.37 cm. Leaf width varies from 11.92 cm to 5.88 cm, in direct correlation with leaf length.

The main qualitative and quantitative characters of the studied fruits are presented in Table 3.

The fruits of the species are distinguished by their features. At the stage of technological ripening, according to the RHS colour charts, they fall into the yellow-green colour group, with code 151 D (Figure 6).

Table 3. Qualitative and quantitative characteristics for *S. viride fruits* - mean values

Length (cm)	**4.75**
Weight (g)	18
Diameter (cm)	5.88
Shape	small pumkin
Fruit/plant no.	50
Pistil scar (mm)	2.68
Fruit apex	indented
Fruit colour	green
Fruit colour intensity	light
Fruit stripes	present
Glossiness at ripness	strong
it ribs	present but weak
Peduncle length (cm)	4.06
Colour of flesh	green
Col. of skin at phys. ripeness	red-orange
Time of physiological ripeness	late
Seed dispersion in fruit	entire fruit
Genetic stability	advanced

Figure 6. Yellowish-green *fruits* of *S. viride*

At the stage of physiological ripening their colour is classified in the orange-red group, with code 33 B (Figure 7). They also have a high gloss at both stages of ripening, and this aspect is preserved for a long time after harvesting

Figure 7. Orange-red fruits of *S. viride*

The number of fruits per plant fluctuates according to the number of inflorescences, the number of fruits in inflorescences and the number of shoots. The number of fruits per plant varied from 35 fruits/plant to 87 fruits/plant, with an average of 50 fruits/plant. On each shoot, 3-5 inflorescences are formed, with the inflorescences in the middle part of the shoot showing the majority of fruits, 6-9 (Figure 8), and the inflorescences in the apical and basal part showing the lowest number of fruits, 2-5.

Figure 8. Inflorescence and fruit aspect of *S. viride*

When the fruit has reached consumption maturity, they can be eaten after thermal preparation. This also contributes to the change in taste, as it has a bitter taste. In their areas of origin they are used in sauces, like tomatoes. When fully ripe, the fruits become soft, fleshy, juicy (Figure 9).

Figure 9 Tomato-like appearance of *S.viride*

They have a high number of seeds in the fruit, that are dispersed throughout the whole fruit. They have a light consistency.

The seeds are surrounded by the gelatinous endocarp of the fruit. They are yellowish in colour, with a reniform shape (Figure 10), a good storage capacity after conditioning and also very good germination potential.

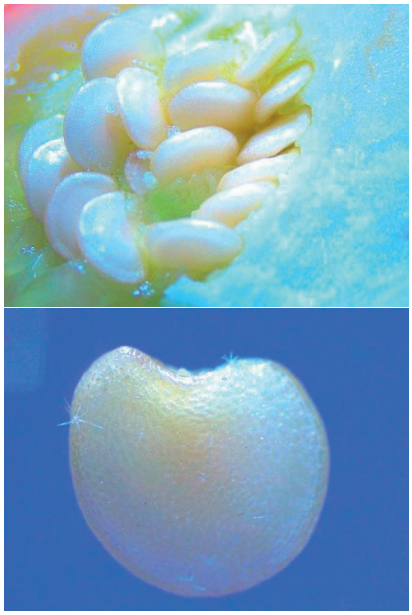


Figure 10. Seed *aspect* of *S. viride* under microscope

CONCLUSSIONS

The introduction of a new species belonging to the *Solanaceae* family in Romania produced promising results in the first years of testing. The plants developed harmoniously and kept the specific characteristics of the species. Following the planting in the open field of 100 seedlings obtained in alveolar pallets, adapting the cultivation technology of *Solanum melongena*, i.e. 35 cm between plants per row and 70 cm between rows, healthy, vigorous and productive plants were obtained. They did not show significant pathogen attacks. It was observed that they prefer well-drained soils, on which waterlogging does not occur. The growth and development of the plants are harmonious, demonstrating a good capacity for acclimatization to the pedoclimatic conditions of our country, especially Buzau, the location of the experiments. They have grown to a height of 67-81 cm, with a direct proportional diameter of the bush of 45-69 cm. The plants have a well-developed stem on which there are a number of 3-5 shoots, each presenting a number of 3-5 inflorescences with 2-9 fruits. They have a long fruiting period, can be harvested in staggered seasons and have a late ripening period. Fruits can be harvested from the second decade of August to the second decade of November. The advantage of this species is that the fruit can be eaten both when green and when fully ripened, their consistency becoming softer, slightly gelatinous on the inside, being suitable for use after thermal preparation such as tomatoes, in various sauces, stews, etc. It has a special commercial appearance conferred by the strong gloss expressed, which persists for many days after harvesting, both at the stage of technological and physiological ripening. This characteristic also ensures a high level of preservation of the fruit after harvesting, with reduced water loss.

The appearance of the plant, conferred by its growth, the green colour of the foliage and the red-orange colour of the fruit also recommend it as a plant with ornamental and decorative value.

Within PGRB Buzău the acclimatization research will continue, and after the completion of this stage, the species will be submitted to breeding works, in order to achieve new genotypes that will contribute to the enrichment of the Romanian vegetable genetic heritage.

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