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START OF THE BLUEBERRY BREEDING PROGRAM AT THE UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST

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Abstract

Blueberry varieties are one of the central decision and part of the orchard success when it comes to the investor's choice. Therefore, even it is remarked a steadily increase of fruits demand from the global blueberry market, the consumer and producers claim new varieties of blueberries with new and better quality traits such as firmness, flavor, shelf life, storability, mechanical harvest, resistance to biotic and abiotic stress and even decorative values enhancement. In this trend, our endeavor at the Faculty of Horticulture Bucharest is focused to start breeding cultivars for the next blueberry generation. Beside the general breeding goals set for blueberries, at the University of Agronomic Sciences and Veterinary Medicine of Bucharest we are targeting additional objectives such as earliness in ripening, fruit color variability and decorative appearance. For the spring of 2021, we choose the following blueberry varieties as genitors: 'Simultan', Hannah's choice', 'Early blue', 'Duke', 'Chandler', 'Pink lemonade', 'Spartan', 'Blue ribbon', 'Hortbleu petite', 'Peach sorbet', V. angustfolium. First hybridization results are promising and new crossing and evaluations are about to be done in the next years.

Key words*: Vaccinium corymbosum, Vaccinium angustifolium, crossing, variety.*

INTRODUCTION

In the range of the berry crops, blueberries are ones of the most appreciated and desired fruits by consumers. Beside the well-known nutraceutical proprieties (Min S et al., 2017) and benefits for human consumption (Kalt W. et al., 2019), the blueberries are expecting to continue grow in interest for farmers and investors worldwide.

In this respect, the breeders must develop new blueberry varieties with superior traits (Pluta S. & Zurawicz E., 2014) that match both the actual and future consumer preferences and growers' expectations (Gilbert J. et al, 2014). The difficulties in choosing the right traits for the new blueberry cultivars come from the relevance of these traits in different parts of the world including adaptation, resilience (Lobos G. & Hancock J.F., 2015) and industry priorities among consumers demands (Gilbert J., 2016). So, some of the plant and fruit characteristics represent common goal for many breeders to achieve but some of them still define the local or regional particularities.

Nevertheless, fruit quality remains a strong target in the business. For instance, firmness, sweetness (Gilbert J. et al., 2015), flavour (Sater H., 2020; Farneti B. et al., 2017), shelf life and overall appearance are most relevant traits to be addressed (Gallardo K. et al., 2018).

On the other side, for the large-scale production, the emerging blueberry varieties need to be ready for mechanical harvesting and in this regard, additional traits of plants and fruits are needed such as plant architecture, compact ripening period, excellent fruit firmness, easy detachment from stalks etc.

Modern techniques (Cappai F. et al., 2020) as marker-assisted breeding method (Mengist, M.F. et al., 2021) are developed and extended to be predictable and to have a better selection efficiency in the breeding activity. For this, special logistics and knowledge is required.

Not for long time ago, few breeding companies aimed to create blueberry varieties with

ornamental value or mixt valorisation of plants, opening a new direction for blueberry breeding programmes (Kobelt M., 2020) and enlarging the genetic datasets.

Famous breeding companies as Fall Creek started specific breeding programme for northern highbush blueberries in Europe (Fresh Plaza, 2020) and many of the latest cultivars became already well-known and appreciated.

For the producers it is very important to start a new plantation with a high value genetic material, and to influence the market and trends for fresh blueberry consumption. This is one of the reasons to increase and speed the breeding work for the upcoming period.

For Romania, the Research Institute for Fruit Growing Pitesti is the single institution that own a breeding programme for blueberry and in more than 30 years of activity in this field, fifteen great Romanian blueberry varieties have been bred (Mladin P. et al., 2012) and are available for growers (Ancu I. et al., 2013).

At the Faculty of Horticulture in Bucharest, a great number of blueberry varieties have been collected and studied in the past 10 years. Also, since 2016, in the frame of the Laboratory for sensorial analyses of the Research Centre for Studies of Food Quality and Agricultural Products, we organized yearly tasting sessions with more than 60 blueberry varieties.

The great interest of the consumers and farmers for the national and international blueberry assortment indicate us the opportunity to start a new breeding programme and bring our contribution to the next blueberry generation.

The current paper is presenting the first steps of our effort in developing a long lasting and fruitful breeding programme in the University of Agronomic Sciences and Veterinary Medicine of Bucharest.

MATERIALS AND METHODS

For the first year of breeding activity at the Faculty of Horticulture Bucharest, beside the general breeding goals set for blueberries, at the University of Agronomic Sciences and Veterinary Medicine of Bucharest we are looking for additional objectives such as earliness in ripening, fruit size, colour variability and decorative plant traits.

In the spring of 2021, we choose the following blueberry varieties to work with as genitors: 'Simultan' (RO), 'Hannah's choice', 'Early blue', 'Duke', 'Chandler', 'Blue ribbon', 'Hortbleu petite', 'Peach sorbet' and *V. angustifolium*.

From the nine blueberry varieties, 16 cross combinations have been done between 17.04.2021 and 6.05.2021 (Table 1).

Table 1. Dates of hybridizations made in 2021 and genitors used in crossings

No	Pollination date	Cross combination
1	20.04.2021	Simultan x Duke
2	20.04.2021	Simultan x Hannah's choice
3	20.04.2021	Simultan x Hortbleu petite
4	6.05.2021	Simultan x Blue Ribbon
5	20.04.2021	Duke x Simultan
6	17.04.2021	Duke x Early blue
7	20.04.2021	Duke x Hannah's choice
8	20.04.2021	Duke x Chandler
9	17.04.2021	Hannah's choice x Duke
10	20.04.2021	Hannah's choice x Simultan
11	17.04.2021	Early blue x Duke
12	1.05.2021	Blue ribbon x Simultan
13	20.04.2021	Chandler x Duke
14	6.05.2021	V. ang x Hortbleu petite
15	6.05.2021	V. ang x Peach sorbet
16	6.05.2021	Peach sorbet x Hortbleu petite

We aim to harvest the seed from other varieties that cannot be used this year for controlled hybridization such as: 'Pink lemonade', 'Spartan', 'Toro', 'Pink breeze', 'Legacy'.

Each plant container was utilized for only one cross combination (Figure 1).

Figure 1. Blueberry hybridization plot in the experimental field of the Faculty of Horticulture Bucharest

The mother plants have been prepared in advance (Figure 2):

- selecting the right flower clusters,
- flowers were protected by special paper to avoid accidental or foreign pollination.
- emasculation of flowers
- reintroducing the flower clusters into the paper bags

The father plants were used to harvest the pollen from the suitable flowers and moment. Pollen drops were captured in the Petri vessels and regularly shacked about 24h-36h until the full release of the pollen. After 1-2 days, the paper bags were opened, and the pollen was gentle placed with the brush on the top of the stigma. Then the number of pollinated pistils were counted and bag resealed.

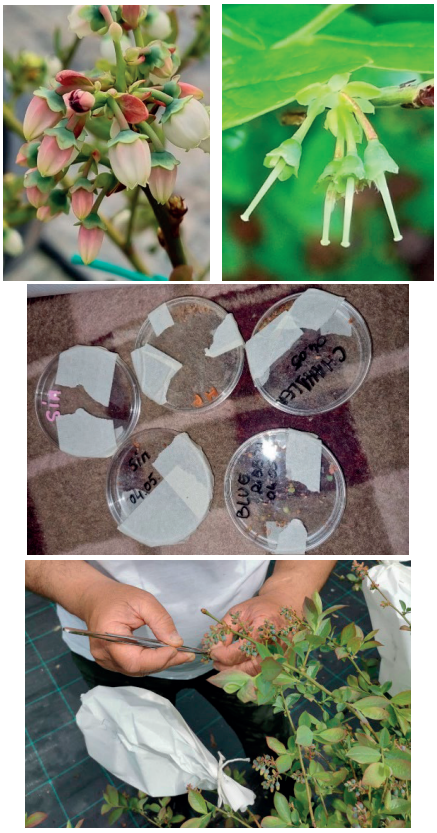

Figure 2. Blueberry breeding steps

After three weeks, the control was made for each bag and cross combination. The fruits set was observed (Figure 3), and the hybrid fruits counted.

Figure 3. Hybrid fruits set (Early blue x Duke)

RESULTS AND DISCUSSIONS

From the 16 cross combinations (Figure 4), 756 flowers were pollinated in 2021 and 653 hybrid fruits were set up. In this respect, the percentage of 86.38% of fruit set is considered a promising one.

Some examples of different hybrid fruits obtained are in Figures 5, 6, 7 and 8.

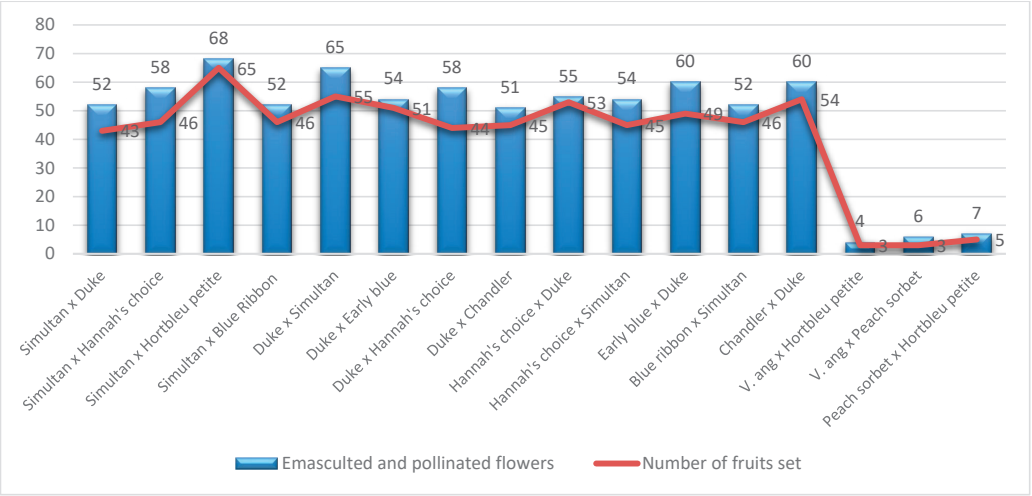

Figure 4. The results of blueberry varieties cross combinations made in 2021

Figure 5. 'Duke' x 'Simultan'

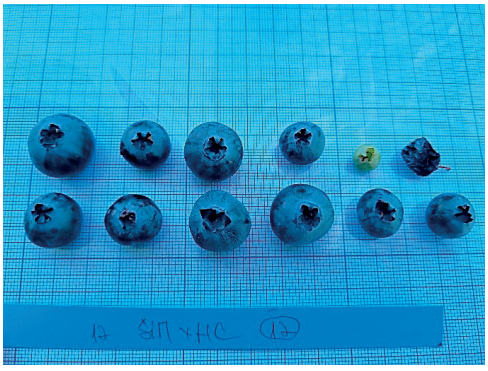

Figure 6. 'Simultan' x 'Hannah's choice'

Figure 7. 'Simultan' x 'Duke'

Figure 8. 'Chanticleer' x 'Duke'

Analysing in depth each cross combination (Figure 9), we can observe that most of the varieties exceed 80% of fruits set. The highest percentage of 90.00% was achieved by 'Chandler' followed by 'Hannah's choice' and 'Blue ribbon'. The lowest share of fruit sets (60%) was remarked at *Vaccinium angustifolium*.

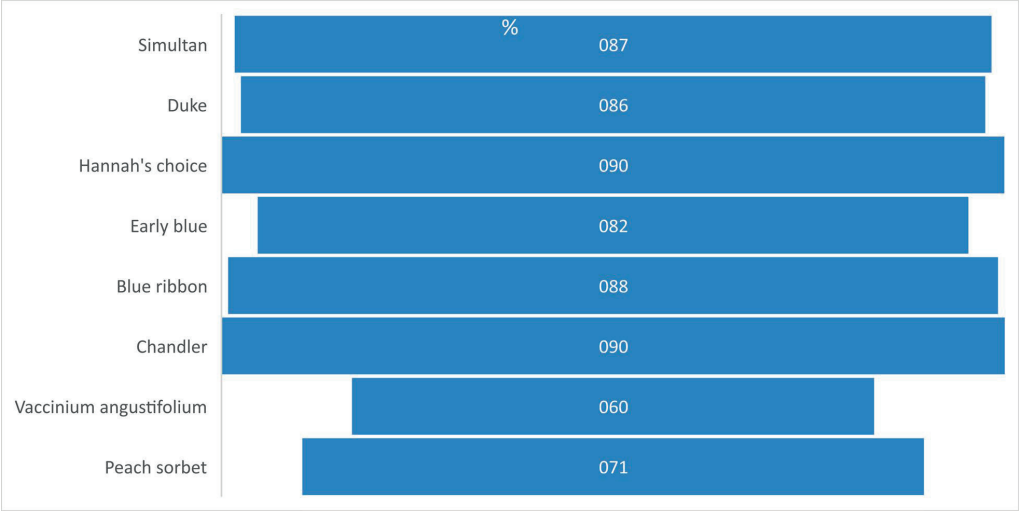

Figure 9. The fruit set percentage of the mother blueberry varieties regardless the male genitor

The *V. angustifolium* and 'Peach sorbet' variety choose for the decorative purpose has encountered lower percentages. Although, the fruits set up from the interspecific combinations (*V. angustifolium* x *V. corymbosum*) allow us to follow the hybrid seeds in further breeding process.

CONCLUSIONS

First hybridization results are promising, and new crossing and evaluations are about to be done in the next years.

Interspecific hybridization results in a lower number of fruits set than intraspecific crossings. The highest number of fruit sets percentage (90%) was calculated at 'Chandler' x 'Duke' combination.

Early varieties combinations range between 81.67% and 88.46% fruit set.

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