

THE CONTROLLED POLLINATION BEHAVIOR OF SOME INDIGENOUS VARIETIES OF CHERRY IN THE CONDITIONS S.C.D.P. BANEASA BUCHAREST

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Abstract

With a total remaining area of approximately five thousand hectares, after the existence of approximately 6900 ha with cherries was shown in 2013, Romania continues to be a country with relatively good productivity in terms of obtaining cherries. The cherry tree germplasm fund is part of the plant biodiversity that has developed over time in nature in a spontaneous and controlled way and that is the basis for the permanent improvement of cultivated varieties. The activity of collecting and preserving biological material in organized collections has a long tradition. The importance of this biological material is substantial, especially when we talk about the interaction of these genotypes with quarantine viruses, especially Plum pox virus, considered the most devastating. The pollination scheme used under SCDP Baneasa Bucharest conditions included one pollinating variety, Boambe de Cotnari, and four controlled pollinated varieties, Daria, Izverna, Superb and Severin.

Key words: pollen, hybridization, fruits, quality.

INTRODUCTION

In the improvement of horticultural plants, the history of the development of knowledge and achievements in the field were specific to the level of knowledge and the concrete possibilities of each time.

In the Middle Ages, the Renaissance period marked the moment when the first systematic plant breeding works began, so this moment can be considered as a second stage in the development of plant breeding works.

Beforehand, new technologies and culture methods were developed, species were introduced, greenhouses were built, etc. (Sestraš, 2004).

On a global level, there is an intense and continuous concern for the genetic improvement of cherry varieties as the main way to improve agricultural performance, harvest quality, increase the commercial value of the fruit and the only possibility of increasing disease resistance, with implications in reducing the costs of production and the level of pollution of the agro-ecosystem (Research Institute and Development for Fruit Growing Pitesti-Maracineni).

The cherry is part of the family Rosaceae, subfamily Prunoideae, genus *Prunus* (many botanists use the genus name *Cerasus* for the two species). The genus *Prunus* includes approximately 150 species, some of which are very important in fruit growing (those cultivated) and in breeding works (Cimpoieș, 2002).

Prunus avium (wild or bird cherry) is the species from which most cherry varieties were formed; in the spontaneous flora it is found in South-Eastern Europe, the Caucasus, North Africa, Asia Minor, China and shows a pronounced polymorphism. The trees grow up to 20-25 m in height, form a pyramidal crown and are pretentious to heat. According to Buia (1956), cited by Ardelean (1986), in our country, within the species there are three varieties: Sylvestris, Juliana and Duracina.

Cousin. Sylvestris Kirschl. (wild cherry) is the one from which the varieties with small, black, bitter fruits, with soft pulp and early ripening, such as Early May and Early (Fruhesteder Mark) come.

Cousin. Juliana L. (Ispas cherries), gave birth to varieties with medium and large black fruits, with soft and juicy pulp, sweeter than wild

cherries, with early and medium ripening. Ramon Oliva and French Timpurie are part of this variety.

Cousin. Duracina L. (stone cherries) is the variety from which the varieties with late ripening, large fruits, of different colors, yellow, red or black, with hard pulp (Bigarreau, "stone" varieties) come. This variety includes the most valuable cherry varieties grown in the world, including some well-known in our country: Germersdorf (synonymous with Schneiders's Späte), Hedelfinger, Napoleon (synonymous with Royal Ann), Dönnissen and others (Cimpoies, 2002).

From the multitude of these species, the most valuable germplasm fund and sources of genes suitable for cherry breeding work are made up of local and improved varieties, belonging to the cultivated species. The variability of *P. avium* varieties presents important characteristics for culture and improvement, such as productivity, fruit quality, resistance to diseases, frost, drought, etc.

MATERIALS AND METHODS

The efficient use of genetic resources is the most important step in the activity of germplasm identification, collection, evaluation and preservation. The more genetically diverse the germplasm pool, the greater the possibilities of obtaining new hybrid varieties with increased productivity, superior quality, with resistance to adverse environmental factors and the action of phytopathogenic agents. The basic principle of the efficient use of plant genetic resources is for the breeder to constantly know the gene pool as well as the objectives he pursues in the process of creating new forms of biological material.

If an effective selection within the germplasm forms is desired then a pronounced variability of the material is required. This can be natural, but it can also be created by breeders if the natural variability does not meet the requirements of an enhanced diversity. Regardless of the method of creating new forms of biological material (varieties, hybrids), it is mandatory to know the direction of work and the objectives pursued. But even if these problems are very clear, it will never be possible to obtain valuable material if the

germplasm pool is not sufficiently known and if its variability is not sufficient.

For these reasons, before starting any breeding process, a very clear evaluation of the initial breeding material, separately for each species, and the creation of databases that can be used by the breeder in order to facilitate his activities, are required.

The studies were carried out on a number of 5 varieties of cherry regarding the germinative capacity of the pollen and on a number of 4 varieties regarding the induced or controlled pollination. The germinative capacity of the pollen was determined according to the standard methodology.

The 5 cherry varieties were: Boambe de Cotnari, Daria, Izverna, Superb and Severin.

RESULTS AND DISCUSSIONS

Germinative capacity of pollen, fertility (self-fertility or self-sterility) and the quality of good or poor pollinator for other genotypes are particularly important characteristics in fruit tree species, with direct implications on the quantity and quality of the fruit harvest.

Even if the characteristics are determined genetically, they are also influenced by other factors, among which the climatic conditions, especially the temperature has a determining role.

Climatic conditions

The average temperature of January 2022 ranged from -11.5°C to 3.4°C. The highest values, over 2°C, were recorded in the center and south of Muntenia, including in the Bucharest area, at the Baneasa meteorological station. The deviation of the average January 2022 air temperature from the median of the standard reference interval (1991-2020) was positive over most of the country. Values above 3°C were recorded in the center and south of Muntenia. Analyzing the severity classes of thermal anomalies from January 2022, it can be seen that the thermal regime was extremely hot in the center of Muntenia.

The average temperature of February 2022 ranged from -9.7°C to 5.6°C. The highest values, above 4°C, were recorded in large areas of Muntenia. The deviation of the February 2022 mean air temperature from the median of

the standard reference interval (1991-2020) was positive. Large deviations, over 3°C, were recorded in Muntenia, including the Bucharest area.

The average temperature of March 2022 ranged from -11.8°C to 5.5°C. The highest values, above 4°C, were recorded in most of Oltenia, Banat and Crişana and locally, in the center and north-east of Muntenia. The deviation of the average air temperature in March 2022 from the median of the standard reference interval (1991-2020) was negative in all regions of the country. Deviation values higher than 1.5°C were recorded in extensive areas of the country. Analyzing the severity classes of the thermal anomalies from March 2022, it can be seen that the thermal regime was cold in most of Romania's territory. In southern Muntenia, it was very cold and extremely cold.

The average temperature of April 2022 ranged from -5.0°C to 12.7°C. The highest values, over 12°C, were recorded in areas in the east and south of Muntenia. The deviation of the April 2022 mean air temperature from the median of the standard reference interval (1991-2020) was negative over most of the country. Positive deviations had values below 1°C. In Muntenia, the thermal regime was warm.

The national average temperature of May 2022 was between 1.2°C and 19.5°C. The highest values, over 18 °C, were recorded in the south and northeast of Muntenia, but also locally in Banat. The deviation of the average air temperature in May 2022 from the median of the standard reference interval (1991-2020) was positive in almost the whole country. Analyzing the severity classes of the thermal anomalies from May 2022, it can be seen that the thermal regime was warm in most of Banat, Crişana, Oltenia and Muntenia.

The cherry requires a certain number of cold hours to complete the morphogenesis and microsporogenesis processes, so it can be assumed that in the climatic conditions of the January-May 2022 period, many cherry varieties did not accumulate the necessary cold, which affected the processes of pollen formation and pollination compatibility.

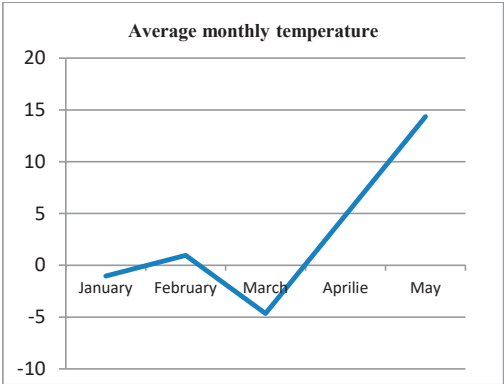


Figure 1. Evolution of the average air temperature between January and May 2022 in the Baneasa area of Bucharest

The germination capacity of the pollen

The data from Table 1 regarding the pollen germination capacity of the 5 varieties of cherry show values between 42.94% (Severin) and 68.75% (Boambe de Cotnari).

Table 1. Germination capacity of pollen in cherry varieties

Nr. crt.	Varieties	Microscopic field	Pollen grains		Germination percentage
			All	Germinate	
1	Daria	I	16	7	51.87
		II	14	7	
		III	17	9	
		IV	23	14	
2	Izverna	I	17	11	53.84
		II	15	8	
		III	19	9	
		IV	8	4	
3	Superb	I	11	6	50.45
		II	12	6	
		III	13	5	
		IV	17	10	
4	Severin	I	15	9	42.94
		II	12	5	
		III	14	6	
		IV	11	3	
5	Boambe de Cotnari	I	14	10	68.75
		II	15	9	
		III	13	10	
		IV	9	6	

It can be considered that the varieties with higher than average pollen germination percentage (Boambe de Cotnari, Izverna) were not influenced by the variable temperatures. The other genotypes, Daria, Superb and especially Severin, recorded anomalies in the process of pollen formation.

Controlled pollination

From the 5 genotypes, the Boambe de Cotnari variety was chosen as the pollinator variety.

The pollination scheme implemented was the following:

Combination I

(minimum 300 castrated and pollinated flowers)

Daria ♀ X Boambe de Cotnari ♂

Combination II

(minimum 300 castrated and pollinated flowers)

Izverna ♀ X Boambe de Cotnari ♂

Combination III

(minimum 300 castrated and pollinated flowers)

Superb ♀ X Boambe de Cotnari ♂

Combination IV

(minimum 300 castrated and pollinated flowers)

Severin ♀ X Boambe de Cotnari ♂

Table 2. The situation of fruit formation following controlled pollination

Nr. crt.	Varieties	Number of pollinated flowers	Number of fruits formed	Fruit binding percentage
1.	Daria	315	217	68.88
2.	Izverna	320	237	74.10
3.	Superb	310	194	62.58
4.	Severin	310	187	60.32
TOTAL		1255	835	66.53

From the data in Table 2, it appears that the total number of fruits formed was 835, which represents 66.53% of the total number of controlled pollinated flowers.

The highest number of tied fruits was recorded for the Izverna variety (237), and the Severin variety (187) had the lowest value.

The number of tied fruits compared to the 4 varieties was 208.75, according to the data in Table 3. The largest percentage difference compared to the average was registered by the Izverna variety (28.25%), and the smallest percentage difference, it was recorded in the Daria variety (3.95%).

Table 3. The difference recorded by varieties, in absolute and relative values, compared to the average number of fruits

Nr. crt.	Type	Number of fruits formed	Difference from the average (number)	Difference from the average (%)
1	Average varieties	208.75	-	-
2	Daria	217.00	+8.25	3.95
3	Izverna	237.00	+28.25	13.53
4	Superb	194.00	-14.75	7.07
5	Severin	187.00	-21.75	10.42



Figure 2. Detail of the cherry fruit branch

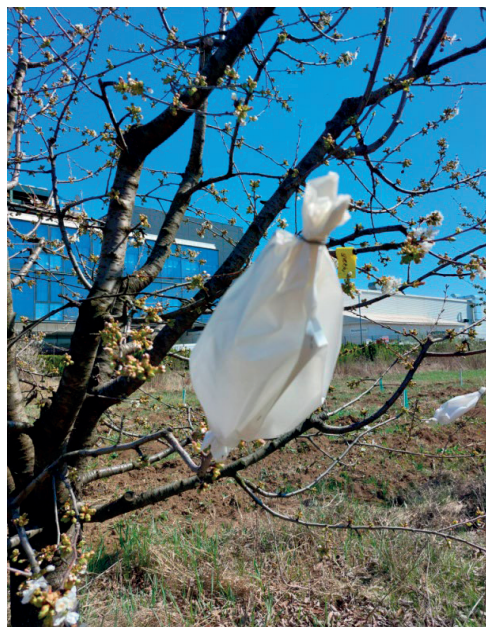


Figure 3. Controlled pollination



Figure 4. Daria variety detail



Figure 6. Checking the binding of the fruits

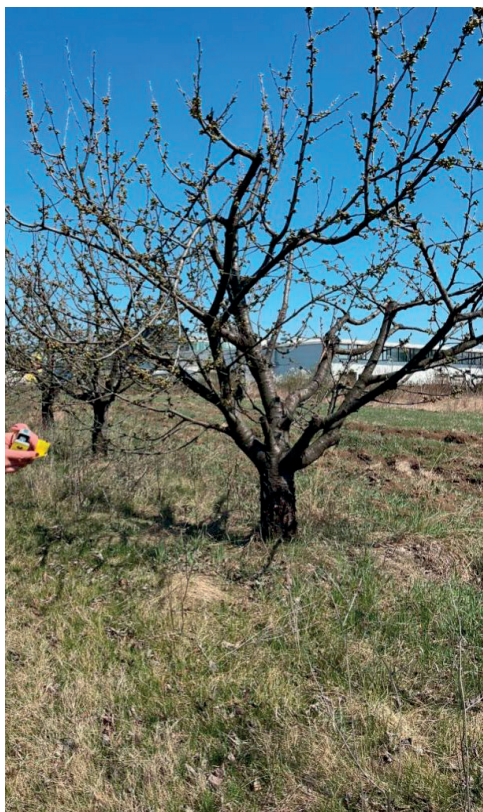


Figure 5. Aspect from the orchard S.C.D.P. Baneasa

CONCLUSIONS

The data regarding the germinative capacity of the pollen and the controlled pollination of a number of native cherry varieties, from the Orchard Baneasa Research and Development Station in Bucharest, in the climatic conditions from January to May 2022, show the normal variability of the absolute and average values, the characteristic genotypes of the cherry species.

There are, however, varieties that, by the values of the monitored parameters, are below the average of the analyzed genotypes. They are varieties more vulnerable to the high temperatures of the winter-spring period, which deregulate the organogenesis processes of the flower buds.

The pollen germination capacity of the 5 cherry varieties shows values between 42.94% (Severin) and 68.75% (Boambe de Cotnari).

The varieties Boambe de Cotnari and Izverna were not influenced by the variable temperatures during the study period.

The Severin variety registered anomalies in the process of pollen formation.

The number of fruits formed, after controlled pollination, represents 66.53% of the total

number of flowers. The highest number of tied fruits was recorded for the Izverna variety (237), and the lowest value was recorded for the Severin variety (187).

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