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The study of the behavior in the pollination process of some local cherry populations

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Abstract

The analysis of local cherry varieties both phenotypically and genotypically provides extremely important information for breeders. On the other hand, the valorization of some local, Romanian cherry varieties or local populations and their reconsideration in the breeding programs, constitute an important premise on the scale of adaptability to the local climatic conditions. In the pollination schemes were used local cherry populations from Ialomiţa, "Mari de Malu", „Roşu de Mai" and the „Mărgărit" genotype that were hybridized with pollen from the Romanian varieties „Maria" and „Alex". Although a considerable number of flowers have been pollinated, the binding rate still low between 7.33% and 10%. It is therefore observed how the exogenous pollen coming from the varieties partner in the pollination process positively influences the characters of the hybrid fruit, as it is not identical with the varieties used as parents. The statistical analysis of the results demonstrated that the native varieties of cherry constitute an extremely valuable potential in inducing some characters of resistance to diseases, productivity, quality, but also the fact that most of them are self-fertile.

Keywords: Cherry; Pollination; Varieties; Breeding program

1. Introduction

Plum pox virus has a rich experimental distribution area although the natural area is much smaller. The main natural hosts of this virus are trees of the genus Prunus, for example: the plum (*Prunus Domestica* and *Prunus Salicina*), apricot (Prunus armeniaca) and peach (*Prunus persica*), as well as other related species, sour cherry (*Prunus persica*) and almond (*Prunus amygdalus*) which can be infected with Plum pox virus, but the manifestation of symptoms is difficult to observe [1]. Virus strains react differently to the hosts they infect, and not all strains affect the same species. In some cases, artificial infections remain local, without spreading. Natural Plum pox virus infection in cherry (*Prunus persica*) is very rare in nature. [2]. In addition to the species of the genus Prunus mentioned above, ornamental and wild species of the same genus can play a secondary host role for the Plum pox virus and can intervene in its control and its epidemiology [3]. Some of the ornamental and wild species with a possible role are: *Prunus spinosa, Prunus mahaleb, Prunus cerasifera, Prunus Insititia, Prunus bessey, Prunus tomentosa, Prunus americana*. Thus, it can be considered that all species of the genus *Prunus* are more or less threatened by Plum pox virus [4].

In addition to cultivated and wild species of Prunus species, a large number of herbaceous plants can be hosts of Plum pox virus [5]. Numerous researches have been carried out that revealed new herbaceous host plants both through artificial infection and through their discovery in the natural environment [6]. Many researchers have been carried out that revealed new herbaceous host plants both through artificial infection and through their discovery in the natural environment. Several of these herbaceous hosts such as *Chenopodium foetidum, Nicotiana clevelandii, Nicotiana benthamiana* and *Pisum sativum* are useful in virus concentration and purification. Other annual herbaceous plants that can serve as hosts are: Chenopodium quinoa, Chenopodium species, *Lamium purpureum, Lupinus albus, Lamium album,*

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Lamium amplexicaule, Lycium barbarum, Lycium halimifolium, Trifolium dulcamara, Trifolium pratense, Zinnia elegans, Campanula rapunculoides, Medicago lupulina [7].

It can thus be concluded that the list of plants found to be infected in their natural environment is smaller than that of artificially infected plants. The virus was also artificially transmitted to cherries and sour cherries, but the infections remained local, with no evidence that it would have spread [8 and 9]. Natural infections in the species *Prunus persica* were reported by Kalashyan et al. [10 and 11], but Plum pox virus infection of cherries is considered extremely unusual, being virtually unheard of in most of Europe.

2. Material and methods

The plant material consists of different F1 hybrid combinations from the species *Cerasus avium*. The hybrids taken in the study were obtained from Malu, Ialomita county. A first step in the implementation of molecular marker-assisted selection (MAS) in these genotypes is to evaluate some cherry hybrid combinations improved within the University of Agronomic Sciences and Veterinary Medicine Bucharest, under natural conditions of Plum pox virus infection, evaluation in terms of resistance to Plum pox virus.

Figure 1 and 2 Aspects of the pollination process

The plant material consisted of:

- Pollen obtained from the varieties “Maria” and “Alex” as sources of resistance to Plum pox virus used as the male parent.
- The varieties used for hybridization, “Mari de Malu”, “Margarit” and “Rosu de Mai”, varieties used as female parents.
- Pollen obtained from the varieties “Maria” and “Alex” as sources of resistance to Plum pox virus used as the male parent was collected in the spring of 2020-2021 in the didactic-experimental field at the Department of Pomiculture, Faculty of Horticulture from USAMV Bucharest.

3. Results and discussion

Plum pox virus, is the cause of one of the most destructive and feared diseases of the genus Prunus (Sharka), the main viral disease of fruit trees from the stone group (such as peach, plum, apricot or cherry) with important economic impact on fruit production. The current research proposed the involvement in the pollination process of some Romanian cherry varieties (“Alex”, “Maria”, “Alex” in 2020 and “George”, “Ludovic” and “Iosif” in 2021, genotypes used as paternal parents) and some local cherry populations from the Ialomita area (“Mari de Malu”, “Rosu de Mai” and “Margarit”).

The results in table 1 regarding pollinations in the spring of 2020 showed that the best results were recorded for Combination 3 "Mari de Malu" x "Alex" with 450 pollinated flowers, of which 47 flowers tied and with a binding percentage of 10.44%. The next variety that recorded a high percentage of fruit binding was "Rosu de Mai" x "Maria" with 10.00%. And as for Combination 2, where cross-pollination was carried out between the "Margarit" x "Alex" varieties, the recorded result was 7.33%, which proves that the resistance donor varieties "Alex” and “Maria" are represented as male parents in the process of hybridization. The next hybrid combination that recorded a high fruit set percentage was "Rosu de Mai" x "Maria" with 10.00%. And regarding Combination 2, where cross-pollination was carried out between the "Margarit" x "Alex" varieties, the recorded result was 7.33%.

Table 1 Results regarding the fruit set percentage in the case of spring 2020 pollinations

Nr. Crt.	Hybrid combinations	Parameters	Medium value	MedGen Ratio %	The MedGen difference	Estimated
1	Roşu de Mai ♀ x Maria ♂	Number of pollinated flowers	400	357.19	288.02	***
		Number of fruits tied	40	35.72	-71.98	ooo
		Fruit binding percentage (%)	10	8.93	-101.98	ooo
		Number of fruits reached maturity	11	9.82	-100.98	ooo
		Percentage of fruits reached maturity (%)	2.75	2.46	-109.23	ooo
2	Mărgărit ♀ x Alex ♂	Number of pollinated flowers	450	401.84	338.02	***
		Number of fruits tied	33	29.47	-78.98	ooo
		Fruit binding percentage (%)	7.33	6.55	-104.65	ooo
		Number of fruits reached maturity	15	13.39	-96.98	ooo
		Percentage of fruits reached maturity (%)	4.55	4.06	-107.43	ooo
3	Mari de Malu ♀ x Alex ♂	Number of pollinated flowers	450	401.84	338.02	***
		Number of fruits tied	47	41.97	-64.98	ooo
		Fruit binding percentage (%)	10.44	9.32	-101.54	ooo
		Number of fruits reached maturity	33	29.47	-78.98	ooo
		Percentage of fruits reached maturity (%)	7.33	6.55	-104.65	ooo

From a statistical point of view, the ANOVA software showed us that the results of the combination "Mari de Malu" ♀ x "Alex" ♂ are significantly positive, in terms of the percentage of binding and reaching maturity of the hybrid fruits in 2020, according to table 1.

Figure 3 and 4 Hybride combination “Rosu de Mai” x “Maria”

In 2021, it is a hybridization scheme that involves the use of “Iosif”, “Ludovic” and “George” cherry varieties as male parents.

The results in table 2 regarding pollinations in the spring of 2021 demonstrated that the best results were recorded for Combination 1 "Rosu de Mai" x "George" with 400 pollinated flowers, of which 237 flowers were tied and with a binding percentage of fruits of 59.25%. The next variety that recorded a high fruit set percentage was "Rosu de Mai" x "Ludovic" with 44.50%. And as for Combination 3, where cross-pollination was carried out between the "Margarit" x "Iosif" varieties, the recorded result was 20.48%, which proves that the resistance donor varieties "George”, “Ludovic” and “Iosif" are represented as male parents in the hybridization process.

Table 2 Results regarding the fruit set percentage in the case of spring 2021 pollinations

Nr. Crt.	Hybrid combinations	Parameters	Medium value	MedGen Ratio %	The MedGen difference	Estimated
1	Roşu de Mai ♀ x George ♂	Number of pollinated flowers	400	357.19	288.02	***
		Number of fruits tied	237	211.64	125.02	***
		Fruit binding percentage (%)	59.25	52.91	-52.73	ooo
		Number of fruits reached maturity	111	99.12	-0.98	ooo
		Percentage of fruits reached maturity (%)	27.75	24.78	-84.23	ooo
2	Roşu de Mai ♀ x Ludovic ♂	Number of pollinated flowers	400	357.19	288.02	***
		Number of fruits tied	178	158.95	66.02	***
		Fruit binding percentage (%)	44.50	39.74	-67.48	ooo
		Number of fruits reached maturity	98	87.51	-13.98	ooo
		Percentage of fruits reached maturity (%)	24.50	21.88	-87.48	ooo
3	Mărgărit ♀ x Iosif ♂	Number of pollinated flowers	420	375.05	308.02	***
		Number of fruits tied	86	76.8	-25.98	ooo
		Fruit binding percentage (%)	20.48	18.29	-91.5	ooo
		Number of fruits reached maturity	26	23.22	-85.98	ooo
		Percentage of fruits reached maturity (%)	6.19	5.53	-105.79	ooo

From a statistical point of view, the ANOVA software showed us that the results of the combination "Roşu de Mai" ♀ x "George" ♂ are significantly positive, in terms of the percentage of binding and reaching maturity of the hybrid fruits in the year 2021, according to table 2.

4. Conclusion

In the spring of 2020 showed that the best results were recorded for Combination 3 "Mari de Malu" x "Alex" with 450 pollinated flowers, of which 47 flowers tied and with a binding percentage of 10.44%. Pollination results from the spring of 2021 showed that the best results were recorded for Combination 1 "Rosu de Mai" x "George" with 400 pollinated flowers, of which 237 flowers were tied and with a percentage of fruit set of 59 .25%. The next variety that recorded a high fruit set percentage was "Rosu de Mai" x "Ludovic" with 44.50%. And as for Combination 3, where cross-pollination was carried out between the "Margarit" x "Iosif" varieties, the recorded result was 20.48%, which proves that among the resistance donor varieties "George, Ludovic and Iosif" that were represented as male parents in the hybridization process, it was demonstrated that the George variety had a good behavior in the pollination process of 59.25% given that the female parent "Rosu de Mai" was also used in the previous year in combination with the "Maria" variety but with a fruit binding percentage of 10.00%. The observations made after the determinations refer to the fact that the

local cherry populations, although they have a valuable genetic potential, their expression in the hybrid offspring is still difficult, starting with the poor behavior in the pollination process and going up to the manifestation of genetic resistance to *Plum pox virus*.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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