

Degree of Self-Fertility in Sweet Cherry Hybrids Obtained by Open Pollination of Stella Cultivar

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Abstract: Establishment of self-fertile sweet cherry cultivars marked a significant advance in the last two decades.

The breeding programme of the Fruit-Growing Institute – Plovdiv started in 1987, one of its major aims being the establishment of self-fertile sweet cherry cultivars.

During the period 1988-1990, 221 hybrids from open pollination of Stella cultivar were established. 24 of them proved to be self-fertile to a different degree. The present study covered the period 2002-2004. Most of the 19 investigated hybrids belonged to the category of the partially self-fertile. 5-12 % of the fruits obtained resulted from self-pollination. The number of hybrids which could be considered as self-fertile (like Stella cultivar) was half of the number of the partially self-fertile. The hybrids of low level of self-fertility were about 10 % of the studied ones and they did not have practical importance.

Key words: cherry (*Prunus avium* L.), hybrids, self-fertility.

Introduction

One of the major aims in modern breeding programmes for improving the sweet cherry cultivars refers to the problem of self-fertility. Work for overcoming difficulties started at John Innes Institute where the first three self-fertile cherry forms were established. Later they were used in Canada for compiling the hybrid fund, from which the first self-fertile cultivar Stella was bred in 1958 (Matthews, 1984).

Later the breeding programme in Canada was broadened and the next self-fertile cultivars Sunburst and Lapins were developed based on Stella cultivar as a father parent form (Sansavini and Lane, 1983; Trefois, 1986).

The establishment of self-fertile sweet cherry cultivars in the last two decades marked a significant advance. In the USA Glacier and Starkrimson cultivars were established, in Italy – the cultivars Isabella and Cronio. Canada is the leading

country in breeding self-fertile sweet cherry cultivars. During the same period the cultivars developed there were Samba, Santana, Sumesi, Sonata, Skeena, Sandra rose, Sweet Heart and Celeste (Edin et al., 1997; Albertini and Della Strada, 2001).

The breeding programme of the Fruit-Growing Institute – Plovdiv started in 1987. One of its major aims was the establishment of self-fertile sweet cherry cultivars (Zhivondov, 1994; Zhivondov et al., 2004).

It was found out that 11 % of the hybrid plants obtained by open pollination of Stella cultivar were self-fertile (Zhivondov, 2005). The aim of the present study was to establish the degree of self-fertility in those 11 % of the Stella hybrids.

Material and methods

During the period 1988-1990, 221 hybrids from open pollination of Stella cultivar were established. 24 of them proved to be self-fertile to a different degree. After additional investigations five of the studied hybrids were excluded from the experiment due to their unsatisfactory pomological characteristics. Objects of the study were 19 hybrids at the age between 10 and 13 years, grown in a breeding orchard, planted at a distance of 6,0 x 1,5 m.

The experiment was conducted during the period 2002-2004, the same characteristics of Stella cultivar being also reported annually.

The degree of self-fertility was studied by thrice isolating and artificial pollinating with own pollen of at least 100 flowers. Annually the percentage of the fruit set from approximately the same number of flowers under the conditions of open pollination was also reported.

The average data from the three years of the study were calculated and the criteria of Student and Duncan were applied for the statistical processing.

Results and discussion

In the first year of the study the values of the established degree of self-fertility varied within the range of 0,00 % in hybrid No. 4-167 to 36,10 % in hybrid No. 4-171 (Table 1). In the same hybrids the fruit set obtained from open pollination was 10,50 % and 49,50 %, respectively. In the same year the parent cultivar Stella had a degree of self-fertility 11,10 % versus 18,30 % fruit set from open pollination. High degree of self-fertility was also reported in the hybrids No. 4-89 – 32,20 %, No. 4-145 – 20,00 % and No. 4-176 – 19,40 %.

During the next year of the study the degree of self-fertility in Stella cv. was 41,40 %, while the fruits obtained by open pollination were 47,90 % of the number of flowers. The degree of self-fertility closest to that of Stella but not surpassing it was established again in the same hybrids. The values of the degree of self-fertility in the hybrids varied from 1,90 % in No. 4-167 to 40,50 % in No. 4-89. The fruits from open pollination were from 4,60 % in hybrids No. 4-69 and 4-167 to 48,20 % in No. 4-171.

In the third year the degree of self-fertility of the studied cherry hybrids was from 2,00 % again in No. 4-167 to 41,80 % in No. 4-171. The results established for the fruits obtained from open pollination varied from 6,60 % in

hybrid No. 4-69 to 51,00 % in No. 4-171. In Stella cv. the degree of self-fertility in 2002 was 24,50 %, the fruits obtained from open pollination being 32,00 %.

For the three-year period of study the average values about the degree of self-fertility varied from 1,30 % in hybrid No. 4-167 to 38,93 % in No. 4-171. The degree of self-fertility was also high in hybrid No. 4-89 – 36,17 %. Only the values of hybrids No. 4-171 and No. 4-89 had statistically significant differences to the degree of self-fertility in Stella cv., the latter being 25,67 % in average for the period of study. High degree of self-fertility was established in hybrids No. 4-176 – 20,93 %; No. 4-145 – 19,00 % and No. 4-130 – 18,20 %. The values of the three hybrids did not exceed those of Stella, however the differences were statistically insignificant ($GD\ 5\% = 8,00$). The lowest degree of self-fertility was established in hybrids No. 4-167 and No. 4-175, their values having statistically significant differences to the values of Stella and to the seven hybrids of the highest degree of self-fertility.

The values about the percentage of the retained fruit set obtained from open pollination for the period 2002-2004 varied from 6,70 % in hybrid No. 4-69 to 49,57 % in No. 4-171. The same index was 32,73 % in Stella. The values of three of the studied hybrids surpassed that of Stella but only the value of hybrid No. 4-171 had statistically significant difference ($GD\ 5\% = 13,74$).

The analysis of the data during the years of the study showed that there was not any definite tendency in the degree of self-fertility of the hybrids. Neither was it manifested when analyzing the results obtained from open pollination of the flowers. Comparing both indices it became obvious that the percentage of the fruit set obtained from open pollination had higher values than the percentage of the set from self pollination.

Cases when the fruits obtained from open pollination were less than those obtained from self pollination in one and the same year were only exceptions. That only confirmed regularity established long ago.

In quite a number of cases the fruits obtained from open pollination were several times more than the retained fruit set from self pollination (Table 1).

Usually the hybrids of lower degree of self fertility bore several times bigger percentage of fruits from open pollination – No. 4-175, No. 4-167, No. 4-162, No. 4-143, No. 4-141, No. 4-108, No. 4-91. For the three-year period an exception to that regularity was established only for hybrid No. 4-69, in which all the values of both studied characteristics were low. That underlined its poor fertility.

Averaged data for the period of study showed that in all the hybrids a bigger number of fruits were obtained from open pollination of flowers than from self pollination. The average results about the percentage of retained fruit set from open pollination showed that the values of six hybrids, marked “c”, were very low. Those values would not give optimal fruiting, due to which the hybrids did not have economic importance.

Analyzing the averaged data from self pollination and keeping in mind the results of the statistical processing, it could be stated that the two hybrids that had higher values than those of Stella, as well as the three hybrids marked “bc”, were self fertile. The two hybrids, which degree of self fertility was marked “c” also had economic importance.

Table 1. Degree of self fertility of sweet cherry elites obtained from open pollination of Stella cultivar (%)

Elite No.	Year of study						Average results for the period 2002 - 2004	
	2002		2003		2004			
	self pollina- tion (%)	open pollina- tion (%)	self pollina- tion (%)	open pollina- tion (%)	self pollina- tion (%)	open pollina- tion (%)	self pollination (%)	open pollination (%)
4-69	5,70	8,90	2,90	4,60	6,20	6,60	4,93 c d	6,70 c
4-89	32,20	63,80	40,50	38,00	35,80	24,00	36,17 a	41,93 a b
4-91	12,70	24,40	4,20	27,20	8,90	22,60	8,60 c d	24,73 b c
4-93	6,70	8,30	19,70	34,40	14,00	24,70	13,47 c	22,47 b c
4-108	7,70	13,50	4,00	13,10	7,00	14,50	6,23 c d	13,70 c
4-130	10,60	15,00	27,10	21,30	16,90	19,80	18,20 b c	18,70 b c
4-136	15,70	33,70	8,10	16,90	14,10	20,10	12,63 c	23,57 b c
4-137	6,70	2,90	4,30	16,00	9,10	12,10	6,70 c d	10,33 c
4-141	7,70	23,00	6,20	28,70	7,80	19,20	7,23 c d	23,63 b c
4-143	1,70	13,30	13,50	17,80	7,70	15,60	7,63 c d	15,57 c
4-145	20,00	29,70	18,40	37,50	18,60	22,40	19,00 b c	29,87 b c
4-154	12,00	21,20	10,50	36,50	13,50	40,00	12,00 c d	32,57 b
4-162	6,10	8,30	4,50	17,50	5,20	12,40	5,27 c d	12,73 c
4-166	4,70	17,40	9,80	17,30	7,30	19,50	7,27 c d	18,07 b c
4-167	0,00	10,50	1,90	4,60	2,00	10,90	1,30 d	8,67 c
4-168	10,60	44,40	6,60	18,80	9,40	26,60	8,87 c d	29,93 b c
4-171	36,10	49,50	38,90	48,20	41,80	51,00	38,93 a	49,57 a
4-175	4,10	30,00	2,20	18,60	2,90	18,70	3,07 d	22,43 b c
4-176	19,40	40,00	22,80	36,30	20,60	38,10	20,93 b c	38,13 a b
Stella	11,10	18,30	41,40	47,90	24,50	32,00	25,67 b	32,73 b
GD 5%							8,00	13,74

The biggest group was that of the hybrids, which values of fruit set from self pollination were marked "cd". They were categorized as partially self fertile. The values of the two hybrids marked "d" were very low and they did not have practical importance.

Conclusion

The major part of the studied hybrids belonged to the category of partially self fertile ones. 5 – 12 % of fruits in them were obtained from self pollination.

The hybrids that could be considered as self fertile (like Stella) were one half of the partially self fertile.

Seedlings of low degree of self fertility were 10 % of the studied ones.

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STEPEN SAMOOPLODNJE KOD HIBRIDA TREŠNJE DOBIJENIH SLOBODNOM OPLODNJOM SORTE STELA

- originalni naučni rad -

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Rezime

Dobijanje samooplodnih sorti trešnje beleži značajan napredak u zadnje dve dekade.

Jedan od glavnih ciljeva u programu oplemenjivanja Instituta za voćarstvo-Plovdiv, započetog 1987. je selekcija samooplodnih sorti trešnje.

U periodu 1988-1990. dobijen je 221 hibrid slobodnom oplodnjom sorte Stela, od kojih su se 24 pokazala kao samooplodna u različitom stepenu. Proučavanje je obuhvatilo period 2002. do 2004. godine. Većina od 19 ispitivanih hibrida pripadala je kategoriji delimično samooplodnih. 5-12% dobijenih plodova je bio rezultat samooplodnje. Polovina od broja delimično samooplodnih hibrida bi se mogla označiti kao samooplodna (u nivou sorte Stela). Hibridi sa niskim nivoom samofertilnosti su činili oko 10% ukupno proučavanih i nisu imali praktičan značaj