

## Storage of strawberry pollen

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### S u m m a r y

This study was carried out to determine storage ability of strawberry pollen at different temperatures for three different strawberry cultivars 'Aliso', 'Brio', and 'Cruz'. Strawberry pollen was stored at room temperature ( $22 \pm 2$  °C), +4 °C, -4 °C and -18 °C in stabile humidity conditions. Strawberry pollen was germinated using the hanging drop method in a 20% sucrose solution.

Pollen germination rate increased because of low temperature storage. Pollen stored at room temperature and +4 °C, -4 °C, and -18 °C was kept for 8 months, about one year, and 20 months, respectively. Pollen germination rates decreased as the length of storage period increased. The reaction of all cultivars tested on the duration and temperature of storage was similar.

Key words: *Fragaria x ananassa*, pollen storage, germination.

### INTRODUCTION

The cultivated strawberry (*Fragaria x ananassa* Duch.) is grown in most arable regions of the world. The crop is enjoyed by millions of people in all kinds of climates including temperate, Mediterranean, subtropical and taiga zones. Most of this widespread popularity has arisen in the last 50 years as breeders utilised the diverse array of available germplasm to develop new cultivars tuned to widely different environmental conditions (Scott and Lawrence, 1975; Hancock, 1999).

Storage of the pollen of fruit is important for fruit breeding studies. It is known that there are close relationships between the quality of pollen used in artificial hybridisations and fruit bearing. Pollen storage is also important for artificial hybridisation of fruits grown under controlled conditions. In addition, pollen is used as an explant source to produce haploid plants in tissue culture (Hartman et al., 1990). For all of these reasons mentioned above, the maintenance of germination ability of pollen is important.

Pollen storage has a long history. As early as 2000 B.C. male date flowers (*Phoenix dactylifera*) with pollen were stored under dry conditions in the dark, in

order to pollinate flowers in the following season (Lee et al., 1981). In recent times, numerous investigations on pollen storage have been undertaken with various plant species with the objective to maintain germination ability.

Pollen from ten strawberry genotype belonging to four *Fragaria* species was stored for 7 years at  $+4 \pm 2^\circ\text{C}$  by MacFarlane Smith et al. (1989). They determined that the pollen was still viable after seven years of storage. Zebrowska (1995) stored pollen from 5 strawberry genotypes at  $-18^\circ\text{C}$  in 1990 and 1991; while fresh pollen germination ratio was 20 – 45%, this ratio after one year of storage under in vitro conditions was 8 – 21 %.

Pollen of four apricot cultivars was stored for one year at room temperature,  $-4^\circ\text{C}$  and  $-18^\circ\text{C}$  (Bolat and Güler yü z, 1994). These authors reported that the highest pollen germination ratio (10 – 16%), occurred when the pollen was stored at  $-18^\circ\text{C}$ . Similar results were reported for apple by Brown (1975), avocado by Sedgley (1981), pistachio by Polito and L u z a (1988), and for almond, apricot, sweet cherry, shore cherry and walnut by S a g l a m and Gü l c a n (1995).

The objective of this study was to determine storage period for the pollen of three strawberry cultivars kept in similar moisture conditions at the room temperature ( $22 \pm 2^\circ\text{C}$ ),  $+4^\circ\text{C}$ ,  $-4^\circ\text{C}$  and  $-18^\circ\text{C}$ .

## MATERIALS AND METHODS

This study was conducted in the Department of Horticulture at Atatürk University located in Erzurum, North East Anatolia, which has an altitude of 1850 m.

Pollen used in this study was taken from 'Aliso', 'Brio' and 'Cruz' strawberry cultivars grown as recommended by I ş t a r et al. (1983) and P i r l a k et al. (1997). Pollen from these cultivars was stored for 20 months at four different temperature levels. Pollen used in in vitro germination tests was collected and kept one night at the room temperature (S c o t t and L a w r e n c e, 1975; G a l l e t t a, 1983; E t i, 1991). Then, it was kept in tubes, whose tops were covered with one line  $\text{CaCl}_2$  to absorb moisture in the tube (E t i, 1991). Every tube was used just one time. Pollen was stored in tubes in the dark either at  $22 \pm 2^\circ\text{C}$ ,  $+4^\circ\text{C}$ ,  $-4^\circ\text{C}$  or  $-18^\circ\text{C}$  in the dark. The beginning of storage was on June 1st, 1996. Thereafter, the pollen germination tests were performed once a month. The hanging drop method was used for determining pollen germination ratios (E t i, 1991). In previous research, the highest pollen germination ratios were achieved in 20% sucrose solution. Therefore, a 20% sucrose solution was used for all pollen germination experiments. Two lams and four places in each lam were used for determining pollen germination ratios, which were evaluated after 24 hours the pollen was sown. Percent of pollen germination was determined by counts of germinated and ungerminated pollen grains (E t i, 1991).

## RESULTS AND DISCUSSION

The pollen germination ratios differed depending on storage temperature, storage duration and cultivar. These ratios decreased steadily from the beginning of storage with different reductions depending on temperatures and cultivars (Table 1).

Table 1. Monthly germination rates in % of fresh and stored pollen of some strawberry cultivars in a 20% sucrose solution.

Cultivars ⇒ Temperature⇒	Aliso				Brio				Cruz			
	Room Temp.	4 °C	-4 °C	-18 °C	Room Temp.	4 °C	-4 °C	-18 °C	Room Temp.	4 °C	-4 °C	-18 °C
June 01, 1996 (Fresh)	49.87	49.87	49.87	49.87	54.15	54.15	54.15	54.15	46.65	46.65	46.65	46.65
July 01, 1996	32.43	40.80	47.03	43.75	38.70	41.66	49.25	51.20	38.60	41.63	44.96	43.75
August 01, 1996	20.00	29.09	36.84	40.35	34.16	31.25	41.66	47.62	24.45	29.13	37.50	41.05
September 01, 1996	13.33	26.91	31.81	37.77	23.53	28.57	36.00	46.66	17.62	21.40	26.66	36.36
October 01, 1996	11.61	23.81	21.42	36.31	15.58	21.05	29.71	44.81	10.52	16.66	18.75	34.43
November 01, 1996	7.14	20.00	18.33	32.00	11.76	17.65	25.53	42.17	5.34	10.52	12.50	34.10
December 01, 1996	5.23	12.65	15.25	29.62	7.14	14.28	25.41	41.38	4.86	6.02	10.52	33.30
January 01, 1997	4.14	6.66	15.01	23.40	5.30	11.11	23.52	36.84	4.73	4.57	6.66	29.62
February 01, 1997	2.96	5.26	12.55	20.74	3.03	6.25	20.18	33.33	3.39	4.02	5.26	29.16
March 01, 1997	0	0	10.63	19.46	0	0	19.61	28.13	0	2.10	3.24	25.43
April 01, 1997	--	--	8.33	19.45	--	--	17.87	27.78	--	0	2.71	24.81
May 01, 1997	--	--	6.25	19.35	--	--	17.32	25.87	--	--	2.53	24.48
June 01, 1997	--	--	5.00	18.81	--	--	13.33	25.00	--	--	1.23	22.33
July 01, 1997	--	--	3.54	17.39	--	--	10.02	22.22	--	--	0	21.70
August, 01 1997	--	--	0	17.04	--	--	9.91	22.00	--	--	--	20.18
September, 01 1997	--	--		16.08	--	--	7.69	17.36	--	--	--	20.00
October 01, 1997	--	--		10.52	--	--	5.23	11.11	--	--	--	11.40
November 01, 1997	--	--		6.13	--	--	0	8.09	--	--	--	8.39
December 01, 1997	--	--		3.71	--	--		6.67	--	--	--	5.00
January 01, 1998	--	--		0	--	--		3.75	--	--	--	0

Pollen germination ratios of 'Aliso', 'Brio' and 'Cruz' cultivars before storage (June 1, 1996) were determined as 49.87 %, 54.15 % and 46.65 %, respectively (Table 1). MacFarlane Smith et al. (1989) reported that pollen germination ratios for ten strawberry genotypes, belonging to four strawberry cultivars, varied between 76% and 93%, before storage. Zebrowska (1995) showed that pollen germination ratios for 5 strawberry genotypes were 20-45 %. The differences in germination rates for various genotypes and cultivars may be due to genotype or different water and nutrient status of the pollen.

The differences in pollen germination ratios for pollen stored in four examined temperature levels were determined. The pollen which was stored at either room temperature or +4°C lost germination ability after 8 months. This was true for all the cultivars studied. Pollen kept at -4°C lost its germination ability after 12, 13 and 16 months of storage for 'Cruz', 'Aliso' and 'Brio' cvs., respectively. When the pollen of 'Aliso' and 'Cruz' cvs. was stored at the temperature -18°C, its germination ability was lost completely at the end of the 20th month, whereas for pollen of 'Brio' cv. stored in the same environment it was 3.75% (Table 1). Generally, pollen germination ratios decreased with an extension of storage duration. Similar results have been reported in the literature (MacFarlane Smith, 1989; Bolat and Gülerüz, 1994; Zebrowska, 1995).

The highest reduction in pollen germination rates for all cultivars was noted for the pollen stored at the room temperature, whereas that stored at low temperature was characterized by highest germination ratios. Many researchers have documented that pollen germination ability for strawberry and some other fruit species are maintained for longer durations in low temperature storage (Brown, 1975; Sedgley, 1981; Polito et al., 1988; Bolat and Gülerüz, 1994; Sağlam and Gülcen, 1995). During this investigation, a reduction in pollen germination rates (kept at either -4°C or -18°C) was not consistent for cultivars studied.

These results demonstrate that pollen of 'Aliso', 'Brio' and 'Cruz' strawberry cultivars can maintain germination ability if stored up to 20 months at -18°C. Then, in these circumstances the pollen from these cultivars can be available all year (without flower production) for various genetic and horticultural applications.

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## Przechowywanie pyłku truskawki

Określano zdolność do przechowywania pyłku truskawki odmian 'Aliso', 'Brio' i 'Cruz' w zależności od temperatury. Badania prowadzono w temperaturze pokojowej ( $22 \pm 2^\circ \text{C}$ ),  $+4^\circ \text{C}$ ,  $-4^\circ \text{C}$  i  $-18^\circ \text{C}$  w warunkach stabilnej wilgotności. Kielkowanie pyłku badano w wiszącej kropli 20% roztworu sacharozy. Niska temperatura zachowywała zdolność pyłku do kielkowania, ale jego tempo zmniejszało się przy przedłużeniu okresu przechowywania. Pyłek przechowywany w temperaturze pokojowej i  $+4^\circ \text{C}$  zachowywał zdolność kielkowania przez okres około 8 miesięcy, w temperaturze  $-4^\circ \text{C}$  – przez około roku, a w temperaturze  $-18^\circ \text{C}$  – przez 20 miesięcy, niezależnie od odmiany.