ACTA SCIENTIARUM POLONORUM *Acta Sci. Pol., Hortorum Cultus 3(1) 2004, 89-96*

THE INFLUENCE OF ARTIFICIAL WIND BLOW ON THE POLLINATION AND FRUCTIFICATION OF BLACKCURRANT (*Ribes nigrum* L.) CULTIVARS

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Abstract. The experiment of the additional blow of bushes of 8 cultivars of blackcurrant (*Ribes nigrum* L.) was conducted in 1995–1997 in Pulawy, Poland. The artificial wind blow generated by the vacuum cleaner fan was used. The additional blow of free-pollinated and isolated bushes did not caused better pollination of flowers and did not have any positive effect on the weight of 100 fruits, the yield structure or the number of seeds per fruit.

Keywords: blackcurrant (*Ribes nigrum* L.), artificial wind blow, pollination, fructification

INTRODUCTION

The currently cultivated blackcurrant cultivars are highly self-fertile, hence the number of pollen grains reaching stigmas is more important than pollen origin [Lech 1976, Kołtowski et al. 1999, Denisow 2003]. The pollen of blackcurrant, once the anthers have burst, forms big sticky conglomerations, which prevents its transfer by wind [Baldini and Pisani 1961, Soczek 1971, Lech 1976].

Pollinating insects are extremely efficient at transferring blackcurrant pollen [Kołtowski et al. 1997, Denisow 2002a, b]. Żurawicz et al. [1993] suggest that the efficiency of pollination can be improved by using wind blow. The above-mentioned authors obtained 45% increase of the number of fruits set and 23–56% increase of crop, depending on cultivar, from additionally blown bushes. However, Gwozdecki [1994] and Kołtowski et al. [1997] applying strong artificial air flow did not obtain any positive effects on the crop.

Therefore, the aim of this study has been to find out the effect of the additional blow of free-pollinated and isolated bushes on the number of pollen grains reaching stigmas. It has also been estimated how the artificial air stream influenced the process of fructification.

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MATERIAL AND METHODS

The experimental plantation of blackcurrant was situated in Pulawy. The experiments were made in 1995–1997, using the randomised block method in four replications with five bushes of a given cultivar per plot. Eight cultivars were taken under consideration: 'Ben Alder', 'Ben Lomond', 'Ben Nevis', 'Ben Tirran', 'Ceres', 'Ojebyn', 'Titania', 'Triton'. The bushes were grown on pseudopodsolic soil, pH 5.2.

The additional wind blow of free-pollinated bushes was made in 1996 and 1997. The separate row of free-pollinated bushes was additionally treated by wind blow (S_0) and compared to free-pollinated and not blow bushes (treatment S). The additional wind blow of isolated bushes was made only in 1995. The first row of bushes was completely isolated by the plastic net tunnel to protect bushes from pollinators (treatment I). The second row isolated by the net was additionally treated by wind blow (treatment I_o). The blow was performed 5 times when the bushes were in full bloom in midday hours and during the sunny weather. The bushes were treated by artificial wind from every direction. The wind blow was generated by a vacuum cleaner fan (Zelmer type). The blow was strong enough to cause shoots and all inflorescences to sway.

The number of pollen grains per stigma was counted in lactophenol slides under light microscope MB 30S with 10×10 multiplication. The slides were made in four replications for each cultivar and pollination treatment.

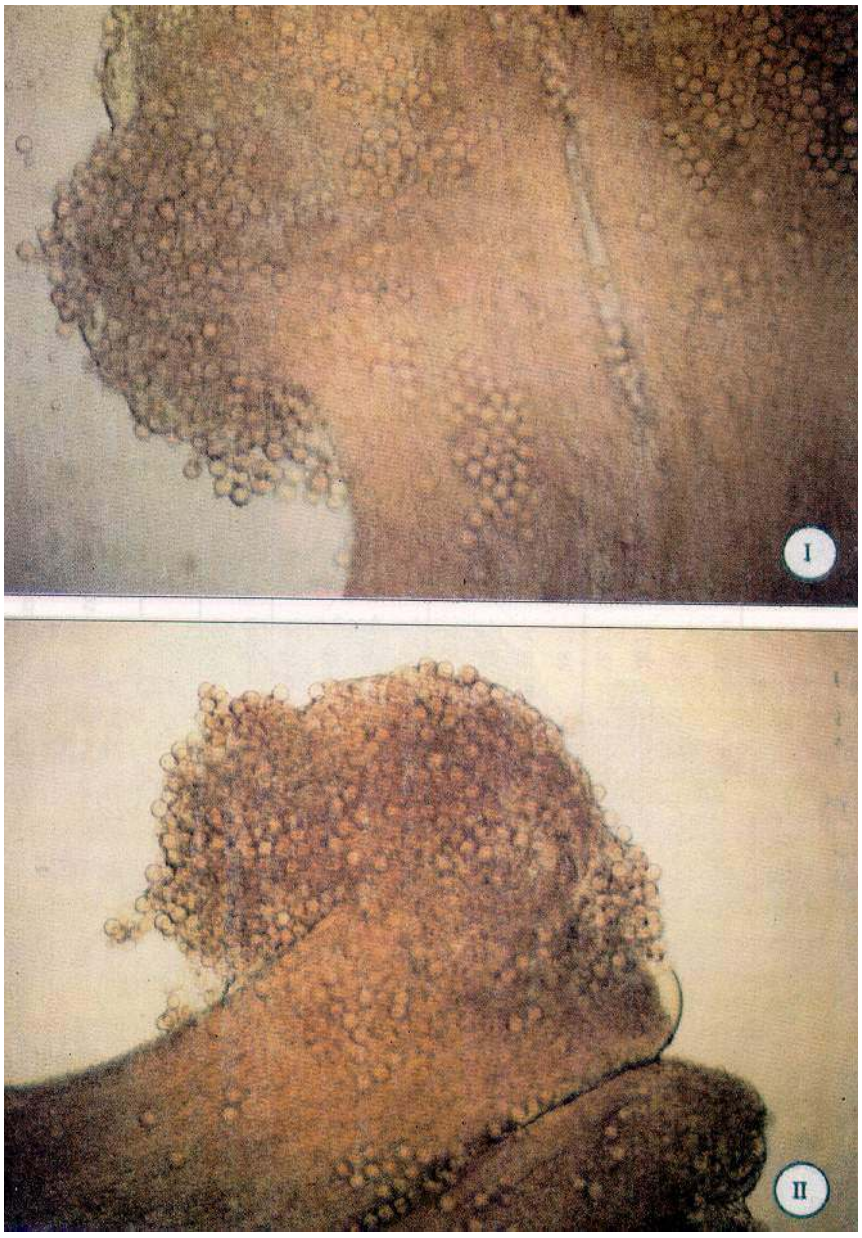
Ripe fruits were picked up from a few branches of each bush separately. The berries were classified according to their diameter into four groups: < 8 mm, 8–10 mm, 10–12 mm, > 12 mm. In this way the structure of the yield was established. The weight of 100 berries and the number of seeds per one berry was also estimated, as well as the number of berries in 40 fruits for each replication and cultivar.

The data were analysed statistically using double factor ANOVA. The significance of differences was estimated by Duncan's test at $p = 0.05$.

RESULTS

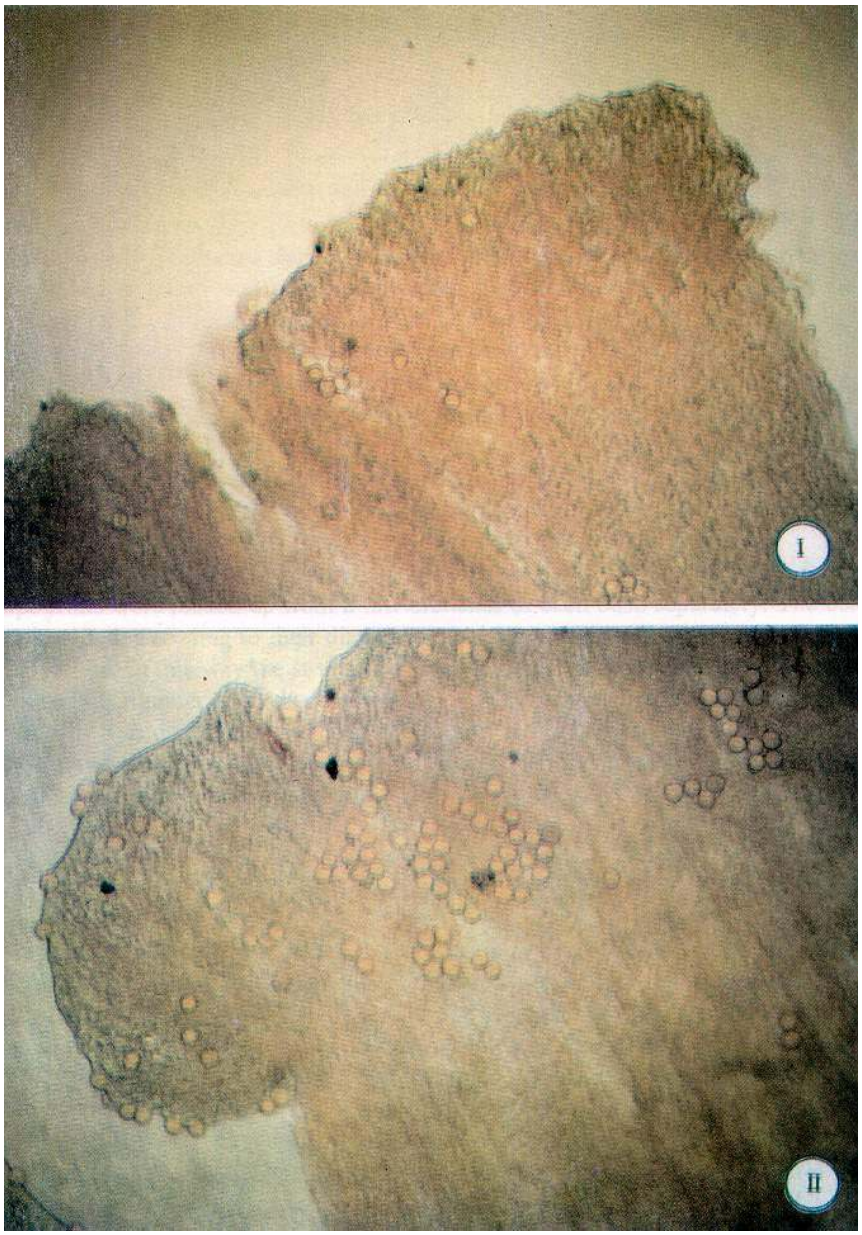
The average number of pollen grains on stigmas from flowers treated by additional wind blow was compared with the data obtained from free-pollinated and isolated bushes (tab. 1). The average number of pollen grains per stigma in free-pollinated flowers accessible to different insects ranged from 98 ('Ojebyn') to 323 ('Titania') – photo 1. A similar number of pollen grains was found on the stigmas of free-pollinated flowers with additional wind blow. The bushes whose flowers were isolated and additionally blown (treatment I_0) show little difference in the number of pollen grains per stigma (up to 12) in comparison with only self-pollinated flowers (photo 2). The difference is statistically insignificant.

The weight of 100 fruits set from free-pollinated flowers fluctuated from 69.2 g to 97.5 g against (69.8–90.4 g) obtained from free-pollinated and additionally wind blown flowers. Once again, the difference is not statistically significant. The additional wind blow of isolated flowers also did not influence the weight of fruits between these combinations. The weight of 100 fruits was 69.3 g and 73.1 g, respectively.



Phot. 1. Pollen grains on stigma in free-pollinated flowers of blackcurrant cultivars: I – 'Ben Lomond', II – 'Ceres' (×125)

Fot. 1. Ziarna pyłku na znamieniu słupka swobodnie zapylanych kwiatów porzeczki czarnej odmian: I – Ben Lomond, II – Ceres (×125)



Phot. 2. Pollen grains on stigma in self-pollinated flowers of blackcurrant cultivars I – 'Ben Tirran', II – 'Titania' (×125)

Fot. 2. Ziarna pyłku na znamieniu słupka samoczynnie zapylanych kwiatów porzeczki czarnej odmian I – 'Ben Tirran', II – 'Titania' (×125)

Table 1. Comparison of some studied features after free-pollination (S) and after self-pollination (I) with measurements after additional wind-blow (S_o) and (I_o)

Tabela 1. Porównanie badanych cech w warunkach zapylania swobodnego (S) i izolacji (I) z wartościami cech uzyskanymi w kombinacjach zapylania z dodatkowym owiewaniem (S_o) i (I_o)

Feature Cecha	Pollination treatnent Sposób zapylania	Cultivar – Odmiana								
		Ben Alder	Ben Lomond	Ben Nevis	Ben Tirran	Ceres	Ojebyn	Titania	Triton	average średnio
Number of pollen grains per stigma in one flower Liczba ziaren pyłku na znamieniu słupka 1 kwiatu	(S)	222.4_{bc}	309.8_{d}	187.6_{ab}	307.4_{d}	188.3_{ab}	136.9_{a}	284.1_{d}	188.5_{ab}	228.12_{A}
	(S_o)	211.8_{bc}	303.3_{d}	178.9_{ab}	291.3_{d}	156.7_{a}	157.8_{a}	251.4_{bc}	183.5_{ab}	216.83_{A}
	(I)	57.2_{bc}	73.7_{c}	39.6_{ab}	30.8_{a}	55.4_{bc}	40.4_{ab}	24.8_{a}	46.4_{b}	46.04_{A}
	(I_o)	58.2_{bc}	61.2_{c}	37.3_{ab}	32.9_{a}	66.9_{c}	48.1_{b}	28.6_{a}	47.8_{b}	47.63_{A}
Weight of 100 fruits Masa 100 owoców	(S)	81.2_{bc}	86.3_{cd}	91.0	81.7_{bc}	83.1_{bc}	78.0_{b}	90.0_{d}	70.0_{a}	82.66_{A}
	(S_o)	78.0_{b}	80.0_{bc}	90.4	74.7_{ab}	84.4_{c}	79.1_{b}	88.0_{d}	69.0_{a}	80.45_{A}
	(I)	52.9_{b}	57.8_{c}	58.3_{c}	50.9_{ab}	85.8_{de}	58.3_{c}	82.5_{de}	57.8_{c}	63.03_{A}
	(I_o)	53.9_{b}	58.8_{c}	58.2_{c}	56.9_{bc}	76.6_{d}	47.7_{a}	78.0_{d}	63.6_{cd}	61.71_{A}
Number of seeds per one fruit Liczba nasion w jednym owocu	(S)	14.5_{a}	24.5_{d}	29.2_{e}	22.2_{cd}	23.4_{cd}	24.3_{d}	19.4_{c}	24.0_{d}	22.68_{A}
	(S_o)	16.6_{ab}	24.1_{d}	29.3_{e}	20.3_{c}	23.1_{cd}	27.6_{de}	17.5_{b}	24.4_{d}	22.86_{A}
	(I)	19.4_{b}	24.0_{c}	28.4_{d}	25.5_{c}	15.4_{a}	26.5_{cd}	18.8_{b}	25.5_{c}	22.93_{A}
	(I_o)	14.9_{a}	27.0_{cd}	27.0_{cd}	28.0_{d}	17.9_{ab}	23.1_{c}	20.8_{bc}	24.4_{c}	22.88_{A}

S i S_o – aveage from 1996–1997 – średnio z lat 1996–1997
I i I_o – average in 1995 – średnio w 1995

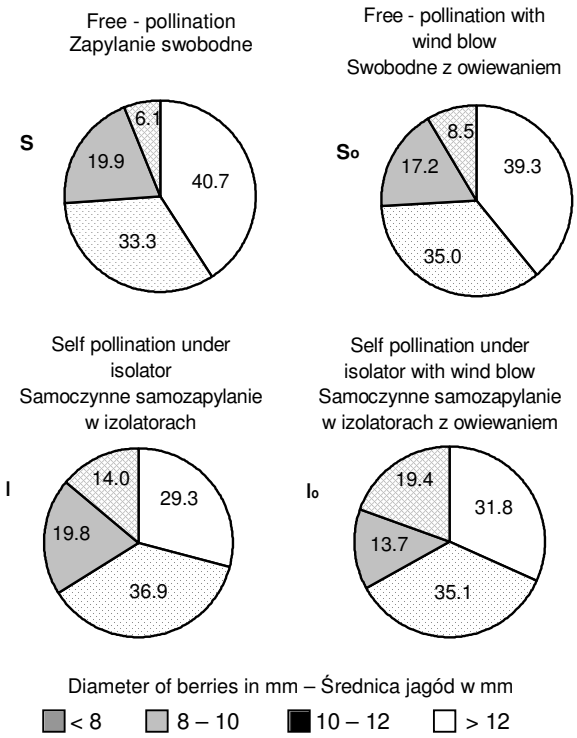


Fig. 1. Percentage share of blackcurrant berries in size classes in the yield from free-pollinated (S) and self-pollinated (I) bushes and in the yield from bushes additionally treated with wind blow S_o and I_o (average from 1995–1997)

Rys. 1. Porównanie procentowego udziału jagód porzeczki czarnej w klasach wielkości, w plonie krzewów swobodnie zapylanych (S) i izolowanych od owadów (I) oraz w plonie tak samo zapylanych i dodatkowo owiewanych strumieniem powietrza S_o i I_o (wartości średnie z lat 1995–1997)

Some differences between the number of seeds in the berries of the two combinations with the additional wind blow and in those without it have also proved to be statistically insignificant. The yield structure achieved from bushes treated with additional wind blow, taking into account only free-pollinated and only isolated bushed, did not differ from the yield structure of those which were not treated by additional wind blow (fig. 1).

DISCUSSION

The obtained statistical data prove that the additional wind blow of bushes which were freely available for pollinating insects as well as those which were completely

isolated did not result in the increase of the number of pollen grains on stigmas of any of the examined cultivars. These results support the opinion that wind is not a significant factor in the transfer of blackcurrant pollen, although it may well be that the artificial wind blow was not strong enough. The relevant literature presents contradictory claims concerning the role of wind in the pollination of blackcurrant. My conclusions regarding the little role of anemophily in the pollination of blackcurrant tally entirely with the views expressed by Kołtowski et al. [1997], although their opinion regarding the validity of this factor for the efficiency of pollination was only based on indirect reasoning. Baldini and Pisani [1961] also express their doubt about the positive role of wind because they did not find blackcurrant pollen in traps located on a blackcurrant plantation. On the other hand, Żurawicz et al. [1993] claim that better fruit setting in bushes treated by wind blow may indicate the positive role of anemophily. Similarly, Gwozdecki [1994], in spite of the lack of positive effects after additional wind blow of flowering bushes, does not rule out the possibility of wind having positive influence on pollen transfer of *Ribes nigrum.* It may well be the case that the effect of wind blow depends on some other factors like air humidity or temperature, but these were not taken into account in the experiment.

CONCLUSSIONS

1. Quite a strong wind produced artificially by a vacuum cleaner fan did not influence the number of pollen grains attached to stigmas from free-pollinated and isolated flowers.

2. The applied wind blow did not have any positive effect on the weight of fruits, the yield structure or the number of seeds developed in fruits, which follows from the lack of any significant differences in the number of pollen grains on stigmas.

REFERENCES

Baldini E., Pisani P., 1961. Ricerche sulla biologia florale e di frutificazione del ribes nero. Rivista della Ortof. Italiana, 86, 619–620.

Denisow B., 2002. The efficiency of pollen transfers in some cultivars of black currant (*Ribes nigrum* L.). The 2nd European Scientific Apicultural Conference. 10–15 September, Gödöllo, Hungary, 17.

Denisow B., 2002. The influence of the degree of pollination of black currant flowers (*Ribes nigrum* L.) on the number of seeds in fruits and its size. Annales UMCS sec. EEE, 11, 11–18.

Denisow B., 2003. Self-pollination and self-fertility in eight cultivars of black currant (*Ribes nigrum* L.). Acta Biologica Cracoviensia Ser. Botanica 45(1), 111–114.

Gwozdecki J., 1994. Wpływ otrząsania krzewów porzeczki czarnej w czasie kwitnienia na wytwarzanie owoców. Pr. Inst. Sad. i Kw. Skierniewice. XXXIII Ogólnop. Konf. Sad., 333–334.

Kołtowski Z., Jabłoński B., Szklanowska K., Pluta S., 1997. Wpływ owadów zapylających na plonowanie ważniejszych odmian porzeczki czarnej (*Ribes nigrum* L.). Pszczeln. Zesz. Nauk. 42 (1), 253–274.

Kołtowski Z., Pluta S., Jabłoński B., Szklanowska K., 1999. Pollination requirements of eight cultivars of black currant (*Ribes nigrum* L.). J. Hort. Sci. and Biotech. 74 (4), 472–474.

Lech W., 1976. Przebieg zapylenia i zapłodnienia u odmian porzeczki czarnej. Acta Agraria et Silvestria 16, 82–95.
Soczek Z., 1971. Wpływ zapylania przez owady kwiatów siedmiu odmian porzeczki czarnej na wysokość plonów. Pr. Inst. Sad. 15, 161–167.
Żurawicz E., Pluta S., Chlebowska D., 1993. Wyniki badań nad zapylaniem nowych odmian porzeczki czarnej w roku 1992. III Zjazd Hod. Rośl., SGGW, Warszawa, 272–277.

WPŁYW OWIEWANIANA KRZEWÓW KILKU ODMIAN PORZECZKI CZARNEJ (*Ribes nigrum* L.) NA ICH ZAPYLANIE I OWOCOWANIE

Streszczenie. Badania dodatkowego owiewania krzewów 8 odmian porzeczki czarnej prowadzono w latach 1995–1997 na terenie RZD w Puławach. Wykorzystano ruch powietrza pochodzący od wentylatora odkurzacza. Dodatkowe owiewanie krzewów zarówno swobodnie dostępnych dla owadów, jak i całkowicie izolowanych nie wpłynęło na lepsze zapylenie kwiatów, nie powodował również zmian w strukturze plonu, masie owoców oraz liczbie zawartych w nich nasion.

Słowa kluczowe: porzeczka czarna (*Ribes nigrum* L.), owiewanie, zapylanie, owocowanie

Zaakceptowano do druku – Accepted for print: 24.02.2004