

# Field Evaluation of Resistance to White Pine Blister Rust of Selected Blackcurrant Genotypes in Poland

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ADDITIONAL INDEX WORDS. **black currant, *Cronartium ribicola*, *Ribes nigrum*, resistance, breeding**

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**SUMMARY.** Field resistance to white pine blister rust (WPBR) (*Cronartium ribicola* J. C. Fischer) was investigated on 53 black currant (*Ribes nigrum* L.) genotypes (cultivars and breeding selections) in 1998 and 1999. Uredia did not form on the black currant 'Titania' and 17 advanced selections during field evaluations made at the Experimental Orchard at Dabrowice, near Skierniewice, Poland.

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**F**or many years, Poland has been the top world producer of *Ribes* fruit. Black currants are one of the main horticultural crops produced in Poland. Annual fruit production of this crop ranges between 100 and 130 thousand tonnes (110.2 – 143.3 thousand tons) harvested from about 30,000 ha (74,000 acres). Polish *Ribes* acreage has increased over the last 2 years because of the high demand for fruit and high prices returned to Polish growers.

The major black currant cultivars in commercial production are 'Ojebyn', 'Titania' and 'Ben Lomond'. Although excellent in many ways, these cultivars have some defects, including excessive vegetative growth ('Titania'), poor processing quality of fruits ('Ojebyn', 'Titania') or susceptibility to fungal diseases ('Ojebyn', 'Ben Lomond') (Broniarek et al., 1997, 1999). White pine blister rust (WPBR) is a severe disease affecting *Ribes*. This disease together with leaf spot (*Drepanopeziza ribis* Kelb.) causes complete defoliation of bushes. In Poland heavy infection can result in decreased ability survive low winter temperatures and in reduced yield for the subsequent year. Besides harming the *Ribes* crop, WPBR can damage forest trees (alternative host).

To resolve these difficulties, a new and expanded blackcurrant breeding program was implemented in 1986 at the Research Institute of Pomology and Floriculture at Skierniewice, Poland (Pluta and Zurawicz, 1993). The development of WPBR resistance or immunity in *Ribes* is one of the main goals of this breeding program. Donors of a resistance gene *Cr* are used as parents.

These are the Canadian cultivars Consort, Crusader and Coronet, as well as the cultivar Titania (Ogolcova, 1991; Pluta and Hummer, 1996). Other resistant parents, such as 'Belaruskaya Sladkaya' a selections of *R. nigrum* var. *sibiricum*, are also being used.

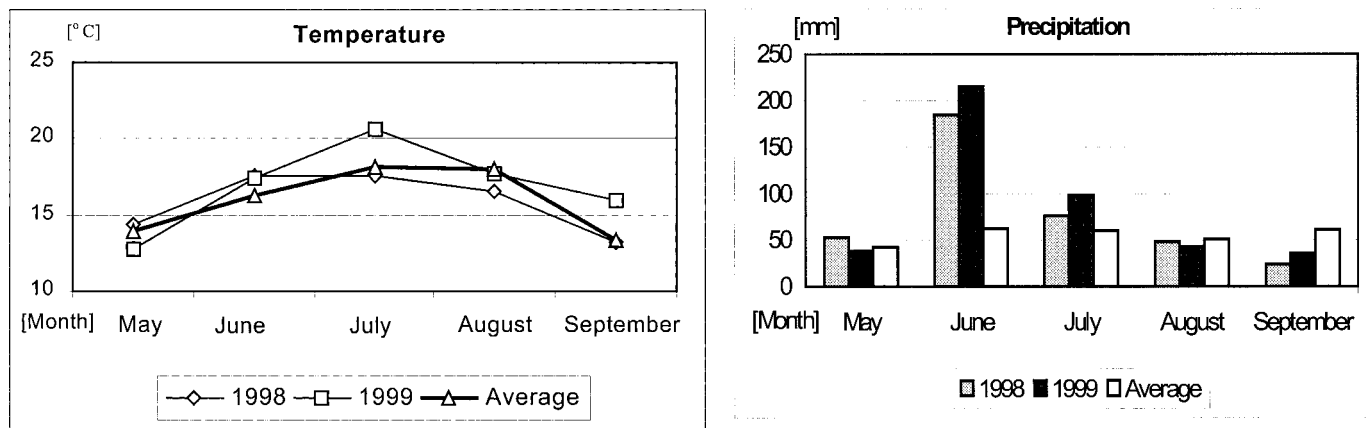
The main objective of this study was to determine the WPBR field resistance of selected cultivars and breeding selections that were planted in 1994, 1995 and 1997.

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**Fig.1. The monthly average temperature (A) and precipitation (B) recorded in central Poland in 1998 and 1999 ( $^{\circ}\text{F} = 1.8^{\circ}\text{C} + 32$ ;  $25.4\text{ mm} = 1.0\text{ inch}$ ).**

## Materials and methods

Black currant cultivars and advanced breeding selections were grown in two cultivar trials planted in 1994 and in 1995. In addition, over 20 selections (marked PC) originated from our breeding program, and planted at the clone collection in 1997, were also investigated. Field experiments were carried

out at the Experimental Orchard at Dabrowice, near Skierniewice (central Poland).

Cultivar trails were established in a random block design, in triplicate, with three plants per plot. Advanced selections were planted without replications, with three plants per individual plot. The genotypes were subjected to natural infection with WPBR under field

conditions. No chemical disease protection was applied.

Genotypes were observed for the presence of WPBR uredia in the middle of August and September in 1998 and 1999, using the ranking scale 1 to 5 (1 = no symptoms, 5 = very severe symptoms on leaves). Plants were scored individually, with results collected from nine plants grown in the cultivar trials

**Table 1. White pine blister rust (WPBR) field resistance of black currant genotypes planted in two cultivar trials in 1994 and 1995, at the Experimental Orchard, Dabrowice, Poland. Means followed by the same letter within column do not differ significantly according to Duncan's multiple range test ( $P = 0.05$ ).**

Cultivar or selection	Parentage	WPBR rating <sup>a</sup>		
		1998	1999	Avg
Cultivars planted in Fall 1994				
Ojebyn	Unknown	2.6 c-e	2.3 e-h	2.5 e-g
Titania	Altajskaja D. x (Consort x Kajaanin M.)	1.0 a	1.0 a	1.0 a
Ben Lomond	(Consort x Magnus) x (Brodtorp x Janslunda)	1.3 a-c	1.7 c-f	1.5 a-c
Ben Alder	Ben More x Ben Lomond	2.1 a-e	1.9 d-f	2.0 c-e
Ben Nevis	(Consort x Magnus) x (Brodtorp x Janslunda)	2.3 b-e	1.9 d-f	2.1 c-f
Ben Sarek	Goliath x Ojebyn	1.2 ab	1.8 c-f	1.5 a-c
Ben Tirran	Ben Lomond x N29/17	2.0 a-e	1.8 c-f	1.9 c-e
Ben Connan	Ben Sarek x Ben Lomond	1.2 ab	1.1 ab	1.2 ab
Storklas	SunderbynII x (Consort x Kajaanin M.)	2.0 a-e	1.6 b-e	1.8 b-e
4D/10	Ben Nevis x Ojebyn	1.6 a-d	1.4 a-d	1.5 a-c
11D/2	Beloruskaja Sladkaya x Titania	1.0 a	1.0 a	1.0 a
26C/5	Titania x Ben Nevis	1.2 ab	1.2 a-c	1.2 ab
Ben Alder x / 5	Ben Alder x op	3.1 e	3.0 g-j	3.1 g
138 x 76/69A/1	7/72 x Ceres	1.0 a	1.0 a	1.0 a
74020-6 x /1	Polar x op	1.0 a	1.0 a	1.0 a
210 x B. Alder/8	Titania x Ben Alder	2.6 c-e	2.3 e-h	2.5 e-g
Cultivars planted in Fall 1995				
Ojebyn	Unknown	2.9 de	3.1 hij	3.0 g
Titania	Altajskaja D. x (Consort x Kajaanin M.)	1.0 a	1.0 a	1.0 a
Ben Lomond	(Consort x Magnus) x (Brodtorp x Janslunda)	1.7 a-e	1.7 c-f	1.7 b-d
80 x 138/2	Ben Lomond x 7/72	1.5 a-d	3.2 ij	2.4 d-g
B.T. x Tit./2	Ben Tirran x Titania	3.1 e	3.1 h-j	3.1 g
Tit. x B.A./2	Titania x Ben Alder	1.4 a-c	2.1 d-f	1.8 b-e
B.L x /7	Ben Lomond x op	2.3 b-e	3.3 j	2.8 f-g
B.L x /2	Ben Lomond x op	1.3 a-c	2.2 e-g	1.7 b-d
83 x 80/1	Beloruskaja Sladkaya x Ben Lomond	1.0 a	1.0 a	1.0 a
PC-15	Ben Lomond x 7/72	1.5 a-c	2.2 ef	1.9 c-e
PC-17	Ben Lomond x 7/72	1.7 a-e	2.4 f-i	2.1 c-f

<sup>a</sup>Ranking scale 1 to 5; 1 = no symptoms, 5 = very severe symptoms on leaves.

**Table 2. White pine blister rust (WPBR) field resistance of black currant genotypes planted at the clone collection in 1997, Experimental Orchard, Dabrowice, Poland. Means followed by the same letter within column do not differ significantly according to Duncan's multiple range test ( $P = 0.05$ ).**

Cultivar or selection	Parentage	WPBR rating <sup>z</sup>		
		1998	1999	Avg
Ojebyn	Unknown	2.3 b-d	3.3 e	2.8 ef
Titania	Altajskaja D. x (Consort x Kajaanin M)	1.0 a	1.0 a	1.0 a
Ben Lomond	(Consort x Magnus) x (Brodtop x Janslunda)	2.3 b-d	1.7 bc	2.0 cd
Bona	Ojebyn x ( <i>R. dikuscha</i> x Climax)	2.3 b-d	2.6 de	2.5 d-f
Ceres	( <i>R. dikuscha</i> x Barchatnaja) x op	2.5 cd	2.0 cd	2.3 c-e
Tiben	Titania x Ben Nevis	3.0 d	3.0 e	3.0 f
Tisel	Titania x selfed	1.6 b	1.3 ab	1.5 b
PC-73	Consort x Ben Nevis	2.0 bc	2.0 cd	2.0 cd
PC-95	Consort x Ojebyn	1.6 b	2.0 cd	1.8 bc
PC-106	Titania x Ben Nevis	3.0 d	3.0 e	3.0 f
PC-110	Ojebyn x Bieloruskaja Sl.	2.6 cd	2.8 e	2.7 ef
PC-223	(C/2/1/62 x Ben Alder) x S12/1/117	1.0 a	1.0 a	1.0 a
PC-241	Bona x Titania	1.0 a	1.0 a	1.0 a
PC-275	(Ben Lomond x 7/72) x Ben Nevis	2.5 cd	1.3 ab	1.9 bc
PC-276	Titania x Polar	1.0 a	1.0 a	1.0 a
PC-280	Titania x Ceres	1.0 a	1.0 a	1.0 a
PC-287	Golubka x Titania	1.0 a	1.0 a	1.0 a
PC-290	Magnus x Ceres	1.0 a	1.0 a	1.0 a
PC-332	Ben Lomond x Polar	1.0 a	1.0 a	1.0 a
PC-335	Ben Lomond x Polar	1.0 a	1.0 a	1.0 a
PC-339	S 47 x Ojebyn	1.0 a	1.0 a	1.0 a
PC-401	C1/9/10 x Ceres	1.0 a	1.0 a	1.0 a
PC-413	Golubka x Ri 74020-16	1.0 a	1.0 a	1.0 a
PC-421	Titania x C2/15/40	1.0 a	1.0 a	1.0 a
PC-425	Titania x P/9/11/14	1.0 a	1.0 a	1.0 a
PC-427	Titania x selfed	1.0 a	1.0 a	1.0 a

<sup>z</sup>Ranking scale 1 to 5; 1 = no symptoms, 5 = very severe symptoms on leaves.

and from three plants in the clone collection. On each plant five leaves were randomly chosen and examined.

Analysis of variance (ANOVA) was applied to the ranks. Duncan's multiple range test at 5% level of probability was used for the separation of means.

### Weather conditions

The temperature and precipitation for the months May to September 1998 and 1999 are presented (Fig. 1). In central Poland, temperatures were above normal during summer in 1999. In 1998 they were very similar to multiyear average recorded for last 20 years. Precipitation was generally higher than normal during June and July in both years of investigation. These weather conditions were fairly good for fungal disease infection (including WPBR) in the field.

### Results and discussion

The F values for the ranks of the cultivar evaluation trial were significant in 1998 and 1999 ( $F = 4.47$ ,  $P = 0.05$ ;  $F = 12.26$ ,  $P = 0.05$ ). WPBR infection levels were rather low during the test years and a rank of 3.3 was the highest level of infection observed (Table 1). No uredia were observed on 'Titania' at

any time during the study. 'Titania' probably inherited the *Cr* gene from 'Consort' (Ogolcova, 1991) and agrees with earlier research (Pluta et al., 1993). The following selections: 11D/2, 138x76/69A/1, 74020-6x/1, and 83x80/1 showed high field resistance to WPBR (Table 1). In these selections, WPBR resistance genes may have come from cultivars 'Bieloruskaja Sladkaya' or 'Titania' which were the parents or grandparents.

The F values for the ranks of the selection evaluation trial were also significant in 1998 and 1999 ( $F = 22.14$ ,  $P = 0.05$ ;  $F = 7.02$ ,  $P = 0.05$ ). Field evaluation of resistance to WPBR of the breeding selections planted in the collection is presented (Table 2). No uredia were found in the tested selections marked PC-223, PC-276, PC-280, PC-290, PC-332, PC-335, PC-339, PC-401, PC-413, PC-421, PC-425, and PC-427, or on 'Titania', which has the *Cr* resistance gene. 'Titania' was a common parent in the pedigree in most of these selections.

Genotypes with high field resistance to WPBR and other fungal diseases will be included in future black currant crosses. The best resistant selections, possessing high productivity, good

fruit quality and suitable plant habit, will be included in the Polish National Fruit Trials. The best selections will be named and officially registered on the Polish List of Cultivars.

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