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Field Resistance of Black Currant Cultivars (*Ribes nigrum* L.) to Diseases and Pests

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Abstract

The performance of 16 black currant cultivars was evaluated during three or six seasons, no pesticides were applied. Annual growth, yield and berry size were recorded, and the level of diseases and pests was estimated. The infections of the diseases American powdery mildew (*Sphaerotheca mors-uvae* (Schwein.) Berk. & Curt), leaf spot (*Gloeosporidiella ribis* (Libert) Petrak) and white-pine blister-rust (*Cronartium ribicola* (J. C. Fischer) were rather serious, while insects were not a problem. *Ribes nigrum* L. cv. 'Titania' had the greatest disease resistance and a high yield. The cultivars 'Ben Alder,' 'Ben Conan,' 'Ben Lomond,' 'Ben Sarek,' 'Ben Tirran,' 'Ben Tron' were susceptible to diseases and also had high yields. These cultivars therefore are recommended for organic or low-chemical-input systems. 'Stor Klas,' 'Hedda' and 'Risager' were susceptible to diseases and had low yields and can't be recommended.

Key words: Black currants, *Ribes nigrum,* cultivars, growth, yield, disease, pest, susceptibility, field resistance.

Introduction

Organic and integrated productions systems need to avoid the use of pesticides or reduce their use. Growing cultivars that are less susceptible to diseases is a supporting strategy. The disease resistance of many cultivars has not been reported. The present study was conducted to obtain more complete information about the disease and pest resistance of important cultivars under field conditions in Denmark.

Materials and Methods

Trial 1: Ten one-year-old plants of each of five black currant cultivars (Table 1) were planted in 1990. Healthy cultivars were selected. 'Ben Lomond,' the most frequently grown cultivar in Denmark, was included as a control cultivar. Chemical fertilizers were applied after determination of the average amount of nutrition in leaf samples. Weeds were controlled mechanically in the row.

Trial 2: Another group of 12 cultivars (Table 2) were planted in spring 1994 as one-year-old plants with 'Ben Lomond' as a control cultivar. The bushes were fertigated and herbicide strips were established in the row.

The trials were planted at the Aarslev Research Station, Denmark. Ten bushes of each cultivar were randomized in 10 blocks. Two-meter-wide grass alleys were established and the planting distance between bushes was 3.50 x 1.5 m.

The bushes were not sprayed with any organic pesticide. Buds infected with black currant gall mite (*Cecidophyopsis ribis* (Westwood)) were removed by hand regularly during the autumn and winter. In early spring of 1993, two applications of sulphur were made in trial 1 because of a severe infestation of gall mites in some bushes and to reduce the risk of it spreading to other research areas. The highly infested bushes were removed.

Annual growth was assessed in June of each year on a scale where 1 = no growth and 9 = maximum growth in 1994 and 1996. Yield and berry size from each bush were recorded. The level of diseases and pests was rated for each bush as 1 to 10 = severe in June, just before harvest in late July-August and in autumn.

The trials are treated as two separate trials because the augment in the yield is different between younger and older bushes. The berry size is bigger in very young bushes. The growth is also larger in young bushes and that increases the level

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of powdery mildew. Even the third year, 1996, the level of mildew was larger in trial 2. In the older bushes the level of the diseases rust and leaf spot was larger as it takes time for these diseases to develop and increase the infection level.

The analysis of variance (SAS's 'General Linear Model (GLM)' procedure) was used to study the differences in yield and berry size. The differences in annual growth and level of diseases and pests were analyzed by using the Kruskal-Wallis test (2, 12).

Results

Growth and yield.

Annual growth was good in all three years.

Trial 1: The cultivar 'Ben Alder' had a weaker growth than the other cultivars (Table 1). 'Titania' had the highest yield in the three years, while 'Hedda' and 'Risager' had the lowest. 'Ben Lomond' had the largest berries (Table 1).

Trial 2: Annual growth was generally small in 1994 (data not shown), especially for the cultivars 'Ben Sarek' and 'BRi 8315-25,' while growth was great for all cultivars in 1995 and 1996 (Table 2). 'Ben Conan,' 'Ben Sarek' and 'Ben Tron' had the highest yield, while 'Ometa,' 'Stor KIas' and 'Risager' had low yields. Berry size was extremely large for 'BRi 8315-25' and rather small for 'Ometa' (Table 2).

Diseases

Resistance to American powdery mildew was assessed just before harvest. Leaf spot and white-pine blister-rust were at the highest level at the end of the season, so the estimation of these diseases was performed during the autumn.

Trial 1: 'Hedda,' 'Ben Alder' and 'Titania' were resistant to mildew, while 'Risager' and 'Ben Lomond' were moderately susceptible (Table 1). 'Hedda' and 'Titania' were only slightly attacked by leaf spot, while 'Ben Alder,' 'Ben Lomond' and 'Risager' were moderately sensitive. White-pine blister-rust was the most serious disease; the only cultivar not susceptible to this disease was 'Titania' (Table 1).

Trial 2: 'Ben Lomond,' 'Ometa' and 'Roodknop 504' were moderately susceptible to mildew and leaf spot and 'Polar' was sensitive to leaf spot too. The other cultivars were not seriously attacked during these three years (Table 2). 'Stor KIas,' 'Farleigh,' 'Triton,' 'Ben Tirran,' 'Ben Tron' and 'Roodknop 504' were highly susceptible to white-pine-blister rust, while 'Polar' and 'BRi 8315-25' were resistant (Table 2).

Pests

The highest level of capsids (Heteroptera) and Tortrix (Tortricidae) infestation occurred in June, while damage by aphids (Aphididae), leaf midge (Dasineura tetensi (Rübsaamen)) and spider mites (Tetranychus urticae, (Koch)), was greatest just before harvest. The infestation ratings were taken during these periods.

Trial 1: Capsids and spider mites were present in only minute numbers and without any differences between cultivars (Table 5). 'Ben Alder' was slightly more susceptible to attack by tortrix, while 'Hedda' was a little more susceptible to aphids and slightly less sensitive to leaf midge (Table 1).

Trial 2: The occurrence of capsids, aphids and spider mites was negligible (Table 2). 'Triton' seemed a little more susceptible to tortrix, and leaf midge seemed to prefer 'BRi 8315-25' more than 'Stor KIas' (Table 2).

Discussion

Black currant cultivars were rather seriously infected by diseases, while pests were not a problem in the present study (Table I and 2). American powdery mildew was not the most serious disease in these unsprayed trials. White-pine blister- rust was prevalent in several cultivars (Table I and 2).

The growth in 1994 in trial 2 was rather low, probably because the cultivars were not planted until April 1994.

'Ben Alder' was hardly attacked by mildew. This was also found in Germany (1), Norway (7,9) and Sweden (10). However leaf spot and rust were medium to se-

Table 1: Annual growth (1-9), yield (kg/bush) and berry size (g/100 berries.) in average of 1994-1996. Susceptibility (rated on a scale 1-10, 1 = no damage) of American gooseberry mildew, leaf spot, white-pine blister rust, capsids, tortrix moth, aphids, leaf midge and two-spotted spider mites. Average of different years for 5 black currant cultivars.

Cultivar	Yield 1994-1996	Berry size 1995-1996	Growth 1994-1996	Mildew 1991-1996	Leaf spot 1991, 1993-1996	Rust 1991, 1993-1996	Capsids 1994-1996	Tortrix 1992, 1994-1996	Aphids 1994-1996	Leaf midge 1994-1996	Spider mites 1991-1996
'Ben Alder'	3.44	79.6	7.4	1.4	4.0	6.8	1.7	2.4	1.5	2.8	1.0
'Ben Lomond'	3.16	108.8	7.9	3.2	4.0	6.3	1.8	2.1	1.3	2.6	1.0
'Hedda'	2.06	95.7	7.8	1.0	1.5	7.6	1.9	2.1	2.2	1.7	1.0
'Risager'	2.22	67.8	7.9	3.9	3.4	6.3	1.8	2.1	1.2	3.0	1.0
'Titania'	5.05	102.1	8.0	1.7	2.1	2.1	1.8	2.1	1.6	2.4	1.1
LSD (5%) or P-value	0.59*	6.8*	0.0001	0.0001	0.0001	0.0001	0.6457	0.0143	0.0006	0.0001	0.5372

*LSD (5%)

vere diseases on 'Ben Alder.' This finding as regards leaf spot agrees with the finding of Petterson (10). Yield was medium to high (Table 1).

'Ben Conan' was very slightly damaged by mildew and had low to medium susceptibility to leaf spot and rust. Growth, yield and berry size were at the highest level (Table 2).

'Ben Lomond' was moderately susceptible to mildew, leaf spot and rust in both trials. Several other researchers also found 'Ben Lomond' susceptible to mildew, (1, 3, 10), while Heiberg & Måge (3) and Petterson (10) mentioned that 'Ben Lomond' was only slightly susceptible to leaf spot and rust. The reason for a rather low yield could be because of a poor fruit set especially in 'Ben Lomond' in 1995 caused by climatic conditions (6). In spite of the susceptibility to common diseases, 'Ben Lomond' managed to produce a satisfactory yield in trial 1 (Table 1 and 2).

'Ben Sarek' was almost completely field resistant to mildew and leaf spot, while moderately susceptible to rust. Anon (1), Nes & Meland (9) and Petterson (10) also found 'Ben Sarek' less susceptible to either leaf spot or rust then the other cultivars they tested. The yield was one of the best (Table 2). Nes & Meland (9) found that capsids (*Lyngus pabulinus*) preferred 'Ben Tron' and 'Triton' to 'Ben Sarek,' but this was not demonstrated in this study (Table 2).

'Ben Tirran' was slightly affected by mildew and leaf spot, which agrees with Norwegian findings (7, 9). 'Ben Tirran' was susceptible to rust and had a medium yield (Table 2).

'Ben Tron' was field resistant to mildew, which agrees with the finding of Nes & Meland (9), and leaf spot, while rust was a serious disease. Growth, yield and berry size were at a high level (Table 2).

'BRi 8315-25' was field resistant to all diseases, while growth was at the lowest level and yield was medium (Table 2).

'Farleigh' is resistant to currant gall mite (11) and therefore of great interest. Nevertheless rust seems to be a serious disease. Growth was satisfactory and yield was medium (Table 2).

'Hedda' was field resistant to mildew, which agrees with findings in Germany (1) and Norway (3, 7, 9). Leaf spot caused only a very slight damage, which was also found by Heiberg & Måge (3) and Måge (7). In contrast to Måge (7) 'Hedda' in this trial was susceptible to rust. Growth was satisfying, while yield was low (Table 1). Nes & Meland (9) found 'Hedda' less susceptible to capsids (*Lyngus pabulinus*)

Table 2: Annual growth (1-9), yield (kg/bush) and berry size (g/100 berries) average of different years. Susceptibility (rated on a scale 1-10, 1 = no damage) of American gooseberry mildew, leaf spot, white-pine blister rust, capsids, tortrix moth, aphids, leaf midge and two-spotted spider mites. Average of 1994-1996 for 12 black currant cultivars.

Cultivar	Yield 1995-1996	Berry size 1995-1996	Growth 1994-1996	Mildew 1994-1996	Leaf spot 1994-1996	Rust 1994-1996	Capsids 1994-1996	Tortrix 1994-1996	Aphids 1994-1996	Leaf midge 1994-1996	Spider mites 1994-1996
'Ben Conan'	2.97	144.9	7.8	1.4	2.4	4.4	1.5	1.8	1.2	2.0	1.0
'Ben Lomond'	1.08	107.2	7.7	4.4	3.7	5.2	1.1	1.7	1.1	2.7	1.0
'Ben Sarek'	2.25	147.8	7.4	1.3	1.7	5.2	1.5	1.5	1.2	2.2	1.0
'Ben Tirran'	1.06	86.8	7.9	1.8	1.8	6.8	1.3	1.8	1.1	2.8	1.2
'Ben Tron'	2.11	110.2	8.0	1.0	1.0	6.6	1.6	1.8	1.4	2.6	1.0
'BRi 8315-25'	1.33	204.8	7.1	1.5	1.0	1.4	1.6	1.5	1.3	2.9	1.0
'Farleigh'	1.46	89.1	8.2	1.7	2.2	7.6	1.4	1.6	1.4	2.6	1.0
'Ometa'	0.54	78.6	7.9	4.2	3.5	5.7	1.4	1.8	1.2	2.7	1.0
'Polar'	1.02	118.5	7.8	1.8	3.8	2.2	1.5	1.8	1.2	2.6	1.0
'Roodknop 504'	0.71	98.9	8.1	3.7	2.7	6.6	1.3	1.6	1.2	2.7	1.1
'Stor Klas'	0.70	99.4	8.1	1.0	1.4	8.6	1.4	1.9	1.4	1.7	1.2
'Triton'	0.85	83.0	8.2	1.5	1.7	7.4	1.5	2.2	1.2	2.4	1.0
LSD (5 %) or P-value	0.54*	9.8*	0.7769	0.0001	0.0001	0.0001	0.0617	0.0029	0.0167	0.0001	0.1255

*LSD (5%)

than 'Ben Tron' and 'Triton,' but this was not demonstrated in this study (Table 2).

'Ometa' was the second most injured cultivar by mildew in trial 2. This does not agree with the German findings, where 'Ometa' was listed as resistant to mildew (1). Leaf spot had one of the highest scores in trial 2, while 'Ometa' was moderately sensitive to rust. Yield was the lowest (Table 2).

'Polar' was slightly damaged by mildew and rust and moderately susceptible to leaf spot. Growth was satisfactory and yield was medium to low (Table 2).

'Risager' was included in the trial because it was recommended for growing in gardens, where the use of pesticides is limited. Meland (8) and Temmen et al. (13) also reported that 'Risager' was not sensitive to mildew. This is not in agreement with the findings of this trial, where 'Risager' was more susceptible to mildew than 'Ben Lomond' and moderately to high sensitive to leaf spot and rust. Yield was low (Table 1).

'Roodknop 504' was moderately susceptible to mildew, which agrees with Petterson (10), Heiberg (4) and Meland (8). Leaf spot and rust attacked 'Roodknop 504' at a medium to high level, which also was found by Kazimiers et al. (5). Yield was rather low the first three years (Table 2).

'Stor Klas' was field resistant to mildew and slightly damaged by leaf spot, and this was also found by Petterson (10). However rust got the highest score. Yield was low (Table 2).

'Titania' was field resistant to mildew and only slightly harmed by leaf spot and rust, which was also found by Petterson (10). Yield was highest (Table 1).

'Triton' was slightly harmed by mildew and leaf spot, corresponding to the findings of Pettersen (10). However heavy rust attacks occurred. The yield was low (Table 2).

Conclusion

This study showed that 'Titania' had the lowest susceptibility to diseases and a high yield. 'BRi 8315-25' was a healthy cultivar and had extremely big fruits, the yield was medium during the first 3 years after planting. 'Farleigh' is resistant to currant gall mites and even though this cultivar was highly susceptible to rust it gave a rather high yield.

Many Scottish cultivars were susceptible to diseases, but anyway they managed to produce a high yield. 'Ben Alder,' 'Ben Lomond,' 'Ben Conan,' 'Ben Tron' and 'Ben Sarek' may have some interest in low-input growing systems.

'Stor Klas,' 'Ometa,' 'Hedda,' 'Risager' and 'Roodknop 504' were susceptible to one or more diseases and gave a low yield, so they can't be recommended for organic or integrated growing systems.

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PRESS REPORT

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It is with great pleasure that the Research Station for Fruit Growing at Wilhelminadorp, The Netherlands presents to you a new book, titled "Index of Top Fruit Cultivars: 25 years' Research in Brief," written by Ing. P. D. Goddrie, who has been a research worker for many years at our station. His long experience with cultivar evaluation in apple, pear, plum and cherry has been summarized in this book.

The book of 147 pages, written in three languages (Dutch, English and German) and embellished with several beautiful colour photos, gives relevant information on cultivars, clones and mutants collected in the period 1970-1995. An alphabetical cultivar review supplies data on field numbers, origin, testing period, and references to articles and other publications.

The book is an important source of information for growers and nurserymen and can be ordered by remittance of 25 Dutch guilders to postal bank number 49 50 17 of the Research Station for Fruit Growing at Wilhelminadorp, The Netherlands, mentioning 'Bulletin nr. 23.'