

# Susceptibility to Apple Scab, Nectria Canker and Powdery Mildew of Different Unsprayed Apple Varieties

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## Abstract

Twentyfive apple varieties were evaluated for Apple scab (*Venturia inaequalis*), Nectria canker (*Nectria galligena*) and Powdery mildew (*Podosphaera leucotricha*) for 4 to 7 years. The trees were grown unsprayed. The weather conditions at the experimental orchard normally results in high infections of apple scab and low infections of powdery mildew. Infections of Apple scab is often seen also in scab resistant varieties. *Williams Pride*, *Katinka* and *Katrina* (scabresistant varieties) were the only varieties not showing scab in the experimental period. The two scabresistant varieties *Angold* and *Produkta* (varieties having a poor fruit quality) was unsusceptible to Nectria canker. The reference variety *Elstar/Elshof* was in all plantings among the most resistant varieties. Powdery mildew is not a problem at the experimental orchard. Most varieties had low susceptibility to Powdery mildew. Varieties with low susceptibility to diseases in general were *Angold*, *Produkta*, *Rajka*, *Rubinola*, *Ahrista*, *Gerlinde*, *Gul Richard*, *Sukkertop*, *Katinka*, *Katrina*, *Marian* and *Primicia*.

**Keywords:** Apple varieties, Apple scab (*Venturia inaequalis*), Nectria canker (*Nectria galligena*), Powdery mildew (*Podosphaera leucotricha*)

## Introduction

When choosing apple varieties for an organic orchard it is extremely important to know about the varieties susceptibility to pest and diseases. The possibilities for control of pest and diseases in organic growing are limited. High resistance is therefore very important. In Denmark only sulphur is allowed for organic disease control.

## Materials and methods

25 different varieties were planted with three or four trees of each variety in either autumn 1996, spring 1999 or spring 2000 at the experimental orchard in Aarslev, Denmark. *Elstar/Elshof* was planted each year as reference variety. Planting distance was: 4,0 x 2,0 m. 3 or 4 trees of every variety were planted. Trees were supplied with drip irrigation the first two growing seasons. Conventional (not organic) fertilisers were supplied according to leaf analysis. The trees were kept unsprayed so no control of pest or diseases was conducted. Trees were removed when they were dead. The weather conditions at Aarslev normally bring about high infections of apple scab and low infections of powdery mildew.

In the tables scabresistant varieties are marked with an \*.

Susceptibility to diseases was assessed in mid August on a scale 0-9. Scores were given to express intensity of damage/symptoms of Apple scab (*Venturia inaequalis*), Nectria canker (*Nectria galligena*) and Powdery mildew (*Podosphaera leucotricha*). Scores were given on tree level.

0 = No damage/no symptoms

1= Very low susceptibility

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- 3 = Low susceptibility
- 5 = Medium susceptibility
- 7 = High susceptibility
- 9 = Very high susceptibility

Results are based on at least 4 years results.

In 2003 damages/infections of apple scab were registered on both trees (leaves) and fruits for 75 unsprayed apple varieties.

For varieties planted in autumn 1996:

Evaluations for *Produkta* and *Redcroft* stopped after 2000

Evaluations for *Delcoro* and *Gloster* stopped after 2001

Evaluations for *Angold* stopped after 2002

*Producta*, *Delcoro* and *Angold* had unsatisfied fruit quality.

*Gloster* was too susceptible to diseases.

*Redcroft* was an average variety that fruitgrowers did not find interesting

## Results and discussion

### ***Apple scab (table 1)***

Average scores of apple scab varied only a little from one year to another. For all 3 plantings lowest average scores were obtained in 2001. Scabresistance has been broken in most of the scabresistant varieties. There is a high infection level in the orchard; nearly half (48%) of the varieties was infected the first year after planting. *Williams Pride*, *Katinka* and *Katrina* (scabresistant varieties) were the only varieties not showing any scab in the experimental period. *Williams Pride* was very resistant to apple scab, no symptoms were observed in any of the 7 experimental years. The scab resistant varieties in general obtained scores below medium (except *Santana* in 2003) while the non resistant varieties *Elise*, *Elstar/Elshof*, *Gloster* and *Jonagold* were high susceptible to apple scab. The two old Danish nonresistant varieties *Gul Richard* and *Sukkertop* in general obtained scores below medium.

Scab will often damage both trees (leaves) and fruits. In 2003 it was demonstrated that if scab was observed on trees it was in 87% of the trees found on the fruits as well.

**Table 1.** Susceptibility to Apple scab evaluated in August at different unsprayed apple varieties

VARIETY	1997	1998	1999	2000	2001	2002	2003	AVERAGE
ANGOLD*	0	0	2	0	2	0	.	0.7
DELCORO	4	4	6	3	3	.	.	4.0
ELSTAR	7	5	6	6	2	7	6	5.6
GLOSTER	6	5	8	4	4	.	.	5.4
PRODUKTA*	0	3	0	0	.	.	.	0.8
RAJKA*	0	0	0	2	0	2	4	1.1
REDCROFT	0	0	0	3	.	.	.	0.8
RUBINOLA*	2	0	3	0	0	2	3	1.4
RUBINSTEP	4	5	6	4	3	6	5	4.7
TOPAZ*	3	4	3	4	2	3	4	3.3
WILLIAMS PRIDE*	0	0	0	0	0	0	0	0.0
AVERAGE	2.4	2.4	3.1	2.4	1.8	2.9	3.7	2.6
AHRISTA*	.	.	0	0	0	0	2	0.4
ELISE	.	.	4	5	0	6	6	4.2
ELSTAR	.	.	5	7	2	6	5	5
GERLINDE*	.	.	0	0	0	3	3	1.2
GUL RICHARD	.	.	3	4	2	3	3	3
SUKKERTOP	.	.	3	4	0	3	3	2.6
AVERAGE			2.5	3.3	0.7	3.5	3.7	2.7
ELSHOF	.	.	.	6	2	6	6	5
JONAGORED	.	.	.	5	3	4	6	4.5
KATINKA*	.	.	.	0	0	0	0	0
KATRINA*	.	.	.	0	0	0	0	0
MARIANN*	.	.	.	0	0	0	1	0.25
PRIMICIA*	.	.	.	0	0	0	2	0.5
SANSA	.	.	.	0	0	4	0	1
SANTANA*	.	.	.	0	0	3	7	2.5
AVERAGE				1.4	0.6	2.1	2.8	1.7

**Nectria canker (table 2)**

The two scabresistant varieties *Angold* and *Produkta* (varieties having a poor fruit quality) was unsusceptible to *Nectria* canker. The reference variety *Elstar/Elshof* was in all plantings among the most resistant varieties.

If *Nectria* canker is not controlled it can be very damaging for some varieties. *Williams Pride* a scabresistant variety was found to be highly susceptible to *Nectria* canker. In winter 1999/2000 half of the experimental trees had to be removed due to *Nectria* canker.

**Table 2.** Susceptibility to Nectria canker evaluated in August at different unsprayed apple varieties

VARIETY	1997	1998	1999	2000	2001	2002	2003	AVERAGE
ANGOLD*	0	0	0	0	0	0	.	0.0
DELCORO	3	0	0	0	0	.	.	0.6
ELSTAR	0	0	0	0	0	2	4	0.9
GLOSTER	0	0	2	2	5	.	.	1.8
PRODUKTA*	0	0	0	0	.	.	.	0.0
RAJKA*	0	0	0	0	2	5	7	2.0
REDCROFT	0	0	2	2	.	.	.	1.0
RUBINOLA*	0	0	2	3	2	2	3	1.7
RUBINSTEP	0	0	0	0	2	1	3	0.9
TOPAZ*	0	0	0	2	2	2	4	1.4
WILLIAMS PRIDE*	2	4	8	2	3	4	4	3.9
AVERAGE	0.5	0.4	1.3	1.0	1.8	2.3	4.2	1.3
AHRISTA*	.	.	0	2	2	5	4	2.6
ELISE	.	.	0	0	2	5	6	2.6
ELSTAR	.	.	0	0	0	2	3	1
GERLINDE*	.	.	2	2	3	5	3	3
GUL RICHARD	.	.	2	2	0	2	3	1.8
SUKKERTOP	.	.	0	0	2	4	4	2
AVERAGE			0.7	1.0	1.5	3.8	3.8	2.2
ELSHOF	.	.	.	0	0	0	2	0.5
JONAGORED	.	.	.	3	2	3	4	3.0
KATINKA*	.	.	.	0	0	2	5	1.8
KATRINA*	.	.	.	0	0	0	1	0.3
MARIANN*	.	.	.	1.5	1	1	3	1.6
PRIMICIA*	.	.	.	0	2	1	2	1.3
SANSA	.	.	.	0	0	6	4	2.5
SANTANA*	.	.	.	0	0	0	3	0.8
AVERAGE				0.6	0.6	1.6	3.0	1.5

**Powdery mildew (table 3)**

Most varieties had low susceptibility to Powdery mildew. *Elshof*, *Katinka*, *Mariann* and *Sansa* planted in 2000 did not in any year show any symptoms of Powdery mildew. Only the variety *Redcroft* were in some years evaluated with scores higher than medium.

**Table 3.** Susceptibility to Powdery mildew evaluated in August at different unsprayed apple varieties

VARIETY	1997	1998	1999	2000	2001	2002	2003	AVERAGE
ANGOLD*	0	3	4	4	2	4	.	2.8
DELCORO	0	0	2	2	0			0.8
ELSTAR	0	2	3	2	2	4	4	2.4
GLOSTER	0	0	2	0	0	.	.	0.4
PRODUKTA*	0	3	2	3	.	.	.	2.0
RAJKA*	0	0	0	2	2	0	0	0.6
REDCROFT	0	7	4	7	.	.	.	4.5
RUBINOLA*	0	0	2	2	0	0	0	0.6
RUBINSTEP	0	0	0	2	0	0	0	0.3
TOPAZ*	0	2	3	4	2	1	0	1.7
WILLIAMS PRIDE*	2	5	2	3	3	3	2	2.9
AVERAGE	0.2	2.0	2.2	2.8	1.2	1.7	1.0	1.7
AHRISTA*	.	.	4	4	4	3	2	3.4
ELISE	.	.	0	0	0	1	0	0.2
ELSTAR	.	.	0	3	3	4	4	2.8
GERLINDE*	.	.	3	3	3	3	2	2.8
GUL RICHARD	.	.	5	5	5	4	4	4.6
SUKKERTOP	.	.	0	0	0	0	1	0.2
AVERAGE			2.0	2.5	2.5	2.5	2.2	2.3
ELSHOF	.	.	.	0	0	0	0	0.0
JONAGORED	.	.	.	0	2	1	0	0.8
KATINKA*	.	.	.	0	0	0	0	0.0
KATRINA*	.	.	.	0	2	1	0	0.8
MARIANN*	.	.	.	0	0	0	0	0.0
PRIMICIA*	.	.	.	2	3	2	2	2.3
SANSA	.	.	.	0	0	0	0	0.0
SANTANA*	.	.	.	3	0	1	1	1.3
AVERAGE				0.6	0.9	0.6	0.4	0.6

**Table 4** review the results of the different varieties.

Varieties with low susceptibility to diseases were *Angold*, *Produkta*, *Rajka*, *Rubinola*, *Ahrista*, *Gerlinde*, *Gul Richard*, *Sukkertop*, *Katinka*, *Katrina*, *Marian* and *Primicia*. Many of these varieties can not be recommended for growing in Denmark because of low yield/ to small sized fruits/ to poor external or internal fruit quality. The varieties: *Rajka*, *Rubinola* and *Ahrista* can be recommended for Danish growing conditions.

**Table 4.** Susceptibility to Apple scab, Nectria canker and Powdery mildew at different unsprayed apple varieties

VARIETY	PLANTING YEAR	APPLE SCAB	NECTRIA CANKER	POWDERY MILDEW
ANGOLD	1996	x	0	x
DELCORO	1996	xx	x	x
ELSTAR	1996	xx	x	x
GLOSTER	1996	xx	x	x
PRODUKTA	1996	x	0	x
RAJKA	1996	x	x	x
REDCROFT	1996	x	x	xx
RUBINOLA	1996	x	x	x
RUBINSTEP	1996	xx	x	x
TOPAZ	1996	xx	x	x
WILLIAMS PRIDE	1996	0	xxx	x
AHRISTA	1999	x	x	x
ELISE	1999	xx	x	x
ELSTAR	1999	xx	x	x
GERLINDE	1999	x	x	x
GUL RICHARD	1999	x	x	x
SUKKERTOP	1999	x	x	x
ELSHOF	2000	xx	x	0
JONAGORED	2000	xx	xx	x
KATINKA	2000	0	x	0
KATRINA	2000	0	x	x
MARIANN	2000	x	x	0
PRIMICIA	2000	x	x	x
SANSA	2000	x	xx	0
SANTANA	2000	xx	x	x

0 = Not susceptible

x = Low susceptibility

xx = Medium susceptibility

xxx = High susceptibility