Apple varieties and insect damage

M. Bertelsen[1]

Summary

Eleven apple varieties were investigated for damage by apple sawfly, capsids, tortrix moths, codling moth, rosy apple aphid during five years. Significant differences between varieties were found in cases of capsid, rosy apple aphid and apple sawfly damage, while no consistent variety differences could be found in case of tortrix moths and codling moth.

Introduction

In 1987 a semi-organic trial including 11 commercially grown apple varieties was established. The aim of the trial was to compare the susceptibility of these varieties to various diseases and pests under low pesticide usage.
Results of the disease part of the trial has previously been published (Lindhard & V. Christensen 1994) and this paper will concentrate on results obtained on insect occurrence and differences in damage and infestation levels.

Materials and methods

The trial included 40 trees of each of the following varieties: 'Aroma', 'Belle de Boskoop', 'Cox Orange', 'Discovery', 'Elstar', 'Gloster', 'Jonagold', 'Mutsu', 'Red Ingrid Marie', 'Spartan' and 'Summerred', all on M26, planted at 4 x 2 m distance. Two different treatments were applied; one organic and one involving the usage of standard fungicides. Each treatment consisted of 3 trees and was replicated 3 times. Treatments were separated by three guard trees. Soil management and fertilization did not differ between treatments.
In the organic treatment pesticide usage was restricted to sulphur, copper, and Bacillus thuringiensis. The latter was applied once in 1992, four times in 1993 and two times in 1995. In the standard fungicide treatment no insecticides were used, and results from this treatment will be included in the evaluation of variety susceptibility to insect pests.
Investigations of relevance to this paper include:

- Sampling and identification of capsid nymphs, samples were taken in all varities once in 1994 and 1995, and across varieties 3 times in 1994.
- Examination of 100 fruitlet clusters for the presence of first instar larvae of the apple sawfly and for unhatched egg deposits. This was done in 1993-95 app. 10 days after petal fall.

[1] Marianne Bertelsen, Danish Institute of Plant and Soil Science, Department of Fruit and Vegetables, Kirstinebjergvej 6, DK-5792 Årslev

- Recording of number of shoots infested by rosy apple aphids (*Dysaphis plantaginea*) in the second week of July in 1993-95.
- Damage assessment at harvest by examination of 900 fruits of each variety (50 fruits/tree).

Results and Discussion

Apple sawfly (*Holocampa testudinea*)
Damage caused by apple sawflies gained importance during the trial period, from an overall average of a mere 0,9% in 1990 to a hitherto max. of 11 pct. in 1993. Certain variety differences in susceptibility to attack of apple sawflies appear distinct and consistent. 'Discovery' and 'Summerred' had a significantly higher percentage of flower clusters with egg deposits and a subsequent higher damage to the fruits than the other varieties (table 1). Yield reduction in consequence of apple sawfly infestation has only been registered in years of scarce flowering in 'Summerred'.

Table 1. Per cent flower clusters infested with apple sawfly eggs, hatching percentages and per cent fruits damaged by corky scars at harvest.

Variety	Pct. flower clusters with one or more egg deposits			Pct. egg hatched			Pct. fruits damaged	
	1993	1994	1995	1993	1994	1995	1993	1994
Summerred	66	-	69	51	-	41	24	-
Discovery	57	68	71	26	34	31	21	8
Jonagold	28	42	52	17	42	30	7	2
Mutsu	51	23	55	2	10	11	7	1
Boskoop	31	-	20	36	-	6	6	-
Spartan	4	13	14	-	45	19	5	1
Elstar	31	33	38	41	30	20	4	1
Aroma	33	3	16	10	17	10	4	>1
Gloster	14	10	28	-	22	8	3	1
Red Ingrid Marie	18	14	34	-	45	15	3	1
Cox Orange	17	54	33	-	34	14	2	1
LSD	-	13	16	-	-	-	3	5

Capsids

Damage caused by capsids was substantial in a number of varieties in all years except in 1991 (table 2). Though variety differences are not totally consistent over the years it appears reasonable to suggest that the varieties 'Aroma', 'Cox Orange', 'Mutsu', 'Spartan', 'Gloster' and 'Jonagold' are more prone to capsid attack than are 'Boskoop', 'Red Ingrid', 'Elstar', 'Summerred' and 'Discovery'. It must, however, be stressed that none of the capsids that are known to cause damage, predominantly common green capsid (*Lygosoris pabulinus*) and apple capsid (*Plesiocoris rugicollis*) were found in the samples taken in 1994 and 1995. Instead it was concluded that the damage must have been caused by either *Psallus ambiguus* (present in large numbers) or *Ortotyllus marginalis* (present in small numbers) (Hesjedal and Bertelsen 1995).

Table 2. Per cent fruit damaged by capsids.

Variety	1990	1991	1992	1993	1994
Aroma	15	0	21 *	3	31 *
Cox Orange	1	0	9	9	5
Mutsu	0	0	2	4	20 *
Spartan	2	0	1	4	11
Gloster	2	0	2	6	5
Jonagold	1	0	2	<1	5
Boskoop	1	0	0	0	-
Red Ingrid	0	0	0	<1	0
Summerred	0	1	-	0	<1
Elstar	0	0	0	0	1
Discovery	0	1	0	0	<1
LSD	-	-	5	6,4	10
* High damage percentages coinsided with low cropping.					

Tortrix moths

A complex of tortrix moths caused the greatest amount of damage to the fruits, varying from an overall average of 4% in 1993 to 14% in 1992 and 1994. Pheromone trapping revealed that *Spilonota ocellana, Hedya dimidioalba, Arcips podana* and *Arcips rosana* were the most predominant spices whereas only one moth of *Adoxyphyes orana* was caught during two years of trapping (Ravn et al. 1993).

Within a single year significant differences in damage between varieties could be found, typically a 3 or 4 fold difference. The highest level of damage was recorded in 1992 where 35% of 'Discovery' apples were damaged - opposed to less than 6 % of the variety 'Gloster'.
However seen over a range of years variety differences blurred. What was the most damaged variety in one year became one of the lesser damaged the next and visa versa. It has therefore not been possible to prove significant differences in susceptibility over a range of years.

Codling moth (*Cydia pomonella*)

Damage caused by codling moth was of less importance than expected. In average of 5 years and 11 varieties only 1,6% of the fruits were damaged. High catches of codling moths in pheromone-traps provoked treatment with Bacillus thuringiensis only in 1992. However the treatment did little to reduce the infestation as more fruit were damaged in treated than in non-treated parcels, and the damage reached a record high of 8 pct in 'Aroma' with an overall average of 3.5 pct damage.
Differences in susceptibility between varieties over a range of years could not be deduced.

Rosy apple aphids (*Dysaphis plantaginea*)

Due to very few aphids, infestation level was not registred until 1993. Since then the number of infested shoots have increased form an average of 0.8/tree to 2.6/tree. 'Gloster' had the highest infestation level in all years.

Table 3. Number of shoots/tree infested by rosy apple aphids 1993-95.

Variety	Infested shoots	Variety	Infested shoots	Variety	Infested shoots
Gloster	5,3 a	Mutsu	1,7 bc	Red Ingrid	0,6 c
Boskoop	4,0 ab	Elstar	1,6 bc	Spartan	0,4 c
Jonagold	2,6 bc	Summerred	0,8 c	Discovery	0,3 c
		Aroma	0,7 c	Cox Orange	0,3 c

References

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