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Short communication

Threshold values for chemical control of powdery mildew (*Erysiphe cruciferarum*) on Brussels sprouts

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Abstract

To establish control thresholds for chemical control of powdery mildew (*Erysiphe cruciferarum*) on Brussels sprouts, mildew intensity on leaves and buds was observed on the cultivars Lunet, Tardis and Asgard during three years in unsprayed plots. Mildew infection on the leaves was observed from late August onwards, increasing to moderate or high levels. In one year light infestation of the buds was observed, but no reduction in quality occurred. These preliminary results indicate, that from late August onwards the following levels of leaf injury by powdery mildew can be tolerated: T = 5 + 0.42*(Julian date − 235), in which T is the tolerable leaf injury in percentage leaf area covered. When sampling the crop to assess powdery mildew infection, care must be taken that leaves are sampled from all stem positions, as top leaves tend to be much less infected.

Introduction

Powdery mildew (*Erysiphe cruciferarum*) is a common disease of Brussels sprouts. Dixon [1974] found a strongly reduced quality due to infection of the buds. Little is known about threshold values for chemical control. In the Netherlands, chemical control is advised as soon as the symptoms are observed [Anonymous, 1993].

For the development of a threshold value for chemical control, distinction has to be made between infection of the leaves and infection of the buds. Infection of the leaves is conspicuous, though it may not be a good indicator of the injury on the buds. Theunissen and den Ouden [1985] found, that high levels of leaf injury by caterpillars can be tolerated in Brussels sprouts during early plant stages. A threshold level for chemical control must consider both quantitative and qualitative damage to the buds. Wit [1982] has studied the effect of defoliation on the yield of Brussels sprouts and his results will be used as an approximation of the quantitative damage due to leaf coverage by powdery mildew. The experimental work in this study concentrates on the qualitative damage caused by powdery mildew.

Materials and methods

In 1992, 1993 and 1994, the same field experiment was repeated on clay soils nearby Wageningen. Plots measuring 9 m × 10 m were planted end of May with cultivars Lunet, Tardis and Asgard in a 0.50 m × 0.75 m grid. The plots lay in a randomized complete block design with six blocks, each block containing a plot of each of the cultivars. The plots were not sprayed with fungicide.

Starting with 15 September 1992, 1 September 1993 and 23 August 1994, leaves were sampled weekly or fortnightly. Every sampling date, thirty fully developed leaves per plot were collected from thirty randomly selected plants. Of these thirty leaves, ten were top leaves, ten were middle leaves and another ten were bottom leaves. For every collected leaf, the percentage leaf area covered by different diseases was estimated for each disease by eye on both sides of the

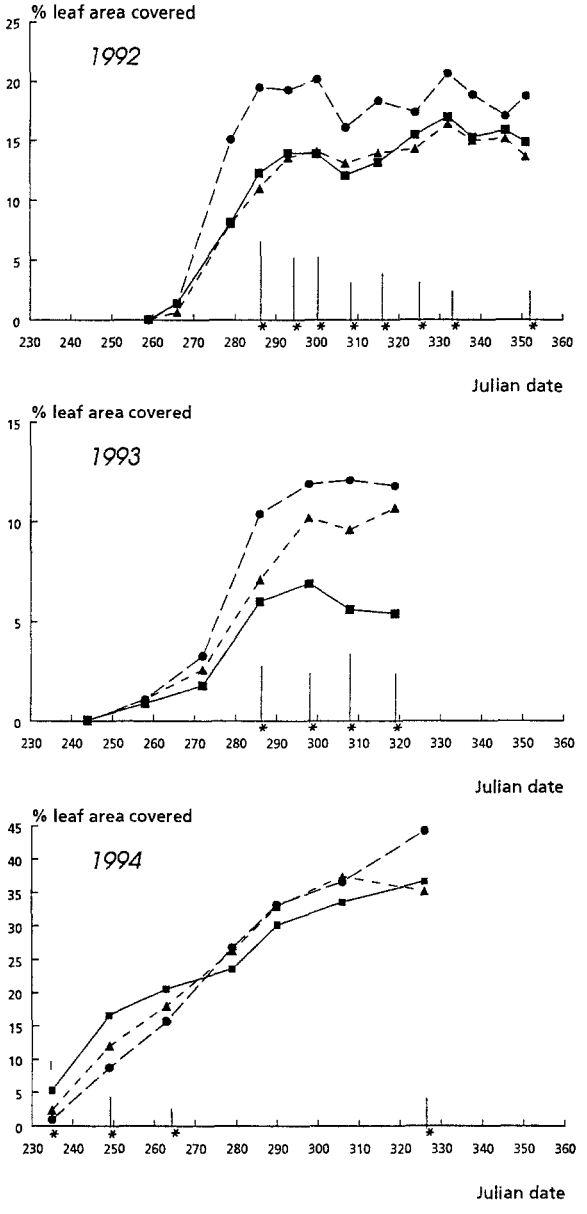

Fig. 1. Leaf injury by *E. cruciferarum* as averaged per cultivar: ■ Lunet, ▲ Tardis, ● Asgard; observations dates with a significant difference between the cultivars are indicated with an asterisk, the vertical lines indicating the least significant differences (ANOVA, α = 0.05). Different Y-scales are used.

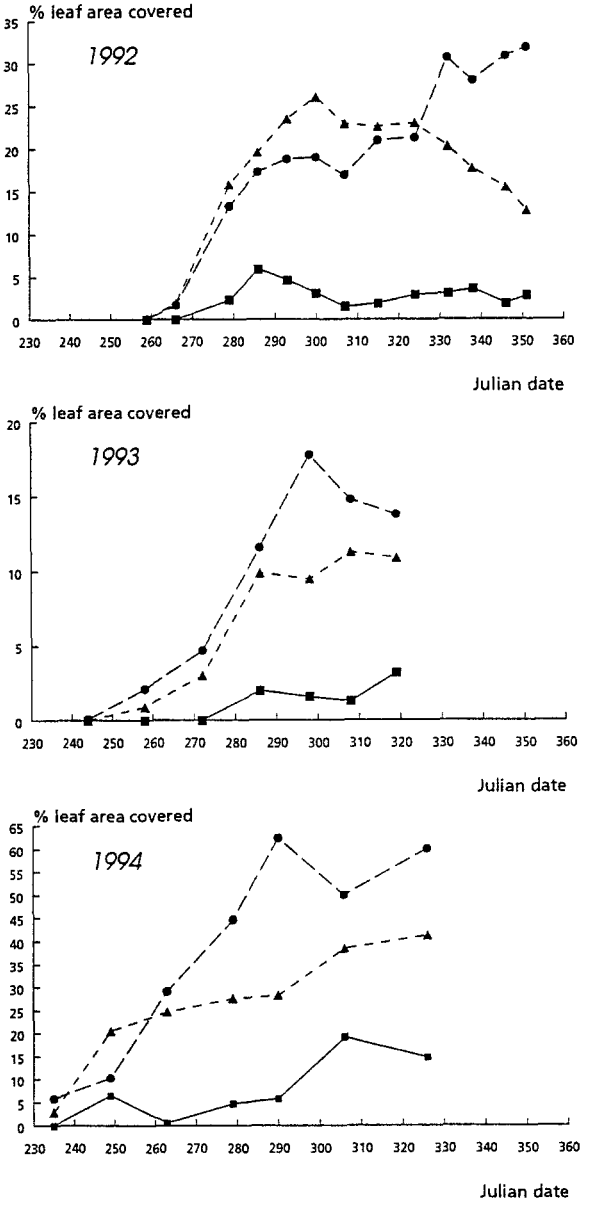

Fig. 2. Leaf injury by *E. cruciferarum* as averaged per stem position: ■ top, ▲ middle, ● bottom; the top leaves were always significantly less infected than the middle and bottom leaves (ANOVA, α = 0.05). Different Y-scales are used.

leaf. The total leaf area of both sides of one leaf was taken as 100%. On 21 December 1992, 20 December 1993 and 5 December 1994, 150 sprout buds per plot were collected from thirty randomly selected plants. Fifty buds were collected from a high position on the stem, fifty from a middle position and another fifty from a low position. After removal of the outer loose leaves, sprout bud infection by the different diseases was assessed.

Results

The following diseases were observed on the leaves and the sprout buds: *Alternaria* spp., *Mycosphaerella*

brassicicola, Albugo candida and *Erysiphe cruciferarum*. The average leaf injury caused by *Alternaria* spp., *M. brassicicola* and *A. candida* was always very low, less than one percent leaf area covered per disease. The leaf area covered with *E. cruciferarum* was considerable in all three years (Figs. 1 and 2). On several observation dates, a significant difference was found between the mean leaf injury per cultivar (ANOVA, $\alpha = 0.05$). On the whole, cultivar Asgard was more susceptible for leaf infection, followed by Tardis and Lunet, but this ranking was not consistent for all observation dates (Fig. 1). On all observation dates, there was a significant difference between leaves of different position, the top leaves being significantly less infected than the middle and bottom leaves (ANOVA, $\alpha = 0.05$, Fig. 2).

Despite the low leaf injury by *Alternaria* spp., buds were heavily infected with *Alternaria* spp. in all three years. The percentage of buds with a quality degrading infection with *Alternaria* spp. was 93% in 1992, 61% in 1993 and 47% in 1994. Sprout bud infection by *M. brassicicola* caused a quality degradation in 1% of the sprouts in 1992, whereas bud infection by *A. candida* caused a quality degradation in 2% of the sprouts in 1993. Bud infection by *E. cruciferarum* was only observed in 1994. Sixty percent of the sprout buds had traces of mycelium, that could only be observed with a magnifying glass and did not cause quality degradation. There was no difference in the percentage infected sprouts from different cultivars or stem positions.

Discussion

Although high levels of leaf infection by *E. cruciferarum* were observed in all three years, no qualitative damage occurred to the sprout buds. Only in 1994, trace infection of the sprouts was observed. The high levels of leaf infection of 1994 are therefore used as threshold levels for qualitative damage as function of time (Fig. 1).

Wit [1982] found, that from begin of September onwards, the yield of Brussels sprouts plants was insensitive to defoliation of up to 60% of the leaf area. Thus, it is unlikely, that the leaf injury levels of 1994 have caused quantitative damage. Also Dixon [1974] argued 'since infection by *E. cruciferarum* does not start until late August–early September, the major effect is likely to be on the quality of buds produced rather than on the growth potential of the plant'.

The results of this study indicate, that the following levels of leaf injury by powdery mildew can be tolerated from late August onwards, according to the line roughly describing the development of leaf injury in 1994:

$$T = 5 + 0.42*(\text{Julian date} - 235)$$

in which T is the tolerable leaf injury in percentage leaf area covered. When sampling the crop to assess powdery mildew infection, care must be taken that leaves are sampled from all stem positions, as top leaves tend to be much less infected. This threshold level must be considered as preliminary and has to be validated under even higher disease pressure, resulting in different levels of qualitative damage.

References

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