Petal Fall, Petal Retention and Petal Duration in Oilseed Rape Crops

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ABSTRACT

Stem rot in oilseed crops, caused by *Sclerotinia sclerotiorum,* can cause significant economic damage in many parts of the World. One of the principal routes of *S. sclerotiorum* infection of oilseed rape crops is via ascospore infected petals. Thus patterns of petal fall and the duration of petals on leaves play an important role in the initiation of stem-rot epidemics. Measurements were made, using the same methodology, over 3 consecutive seasons in the UK and 2 seasons in China. Patterns of petal fall and petal retention were broadly similar for European and Chinese crops. Roughly one third of petals deposited on leaves did not survive more than 2 days and a further third lasted less than 6 days. As it takes more than two days to infect leaves it is likely than about half petals bearing ascospore would not have time to cause infections. Petals lasted slightly longer on the lower and middle parts of the canopy than in the upper part, but the numbers of petals deposited on leaves in the lower part of the canopy was about half of that in the upper and mid-parts. The pattern of petal fall and petal deposit on leaves suggests that the crop is most vulnerable to infection towards the end of flowering.

Key words: *Sclerotinia sclerotiorum*, stem rot, oilseed rape, petals

INTRODUCTION

Sclerotinia sclerotiorum is the causal pathogen of stem rot in oilseed crops and can result in significant economic damage in many parts of the World. One of the principal routes of *S. sclerotiorum* infection of oilseed rape crops is via ascospore infected petals. Inoculum, in the form of airborne ascospores, is deposited on petals, which in turn are deposited on the crop. The petals act as a substrate for ascospore germination and growth allowing the fungus to penetrate and infect leaves, which can lead to damaging stem lesions. Thus patterns of petal fall and the duration of petals on leaves play an important role in the initiation of stem-rot epidemics. We report the results of studies of the patterns of petal fall and duration made in the UK and China.

MATERIALS AND METHODS

Four sets of measurements were made. (a) The rate of flowering was measured every 2-3 days by counting the number of fully open flowers on a random sample of flower heads. The number of flower heads per unit area was also measured. (b) The rate of petal fall was measured by placing plastic trays at three different heights in the crop to collect fallen petals. The collected petals were counted every 2-3 days and the trays emptied after each assessment. (c) Petal deposition on leaves was estimated by randomly sampling leaves from three layers in the crop (0-25cm, 25-50cm, 50-75cm) and counting the number of petals sticking to each leaf. This was done every 2-3 days. (d) The duration of petals on leaves was estimated by randomly marking plants and tagging individual leaves at different heights. The number and position of petals sticking to each tagged leaf was recorded every 2-3 days on a sketch of the leaf. These observations were used to determine the duration of each petal on the leaf. Measurements were done, using the same methodology, over 3 consecutive seasons in oilseed rape crops on the experimental farm at Rothamsted Research in the UK and 2 seasons in oilseed rape plots at Anhui Academy of Agricultural Science (AAAS) in China.

RESULTS

There were broad similarities in patterns of petal fall and petal retention at both sites. The rates of petal fall broadly reflected the pattern of flowering, except that the pattern was delayed by about 6-12 days, and the duration of petal fall was less than the flowering period (Figure 1). The number of petals deposited on leaves at the two sites on most years tended to reach a maximum of between 10 and 15 per leaf, except in 2000 at AAAS when the maximum did not exceed about 7 (Figure 2). At RR fewer petals tended to be deposited on leaves lower in the canopy. While at AAAS, in 2000, fewer petals were deposited on the upper layer of the crop than on the middle and lower layers, but in 1999 petal deposit on all layers was similar. At both sites, generally, about one third of the petals did not persist on the leaves for more than 2 days, while more than half did not persist on leaves for more than 5 days, and few lasted more than 10 days (Table 1). The average duration of petals in China was slightly less than in the UK, but maximum persistence time was about the same. Petal duration on leaves tended to be shorter in 2000 at both sites than in previous years. At AAAS this difference (and the lower number of petals on leaves) could have been cause by the hot dry weather during flowering preventing petals from sticking to leaves on the upper parts of the canopy. While at RR the shorter duration may have been due to a relatively wet season washing petals from leaves. These results suggest that weather may play a role in the duration of fallen petals on leaves, and consequently on the risk of the development of epidemics.

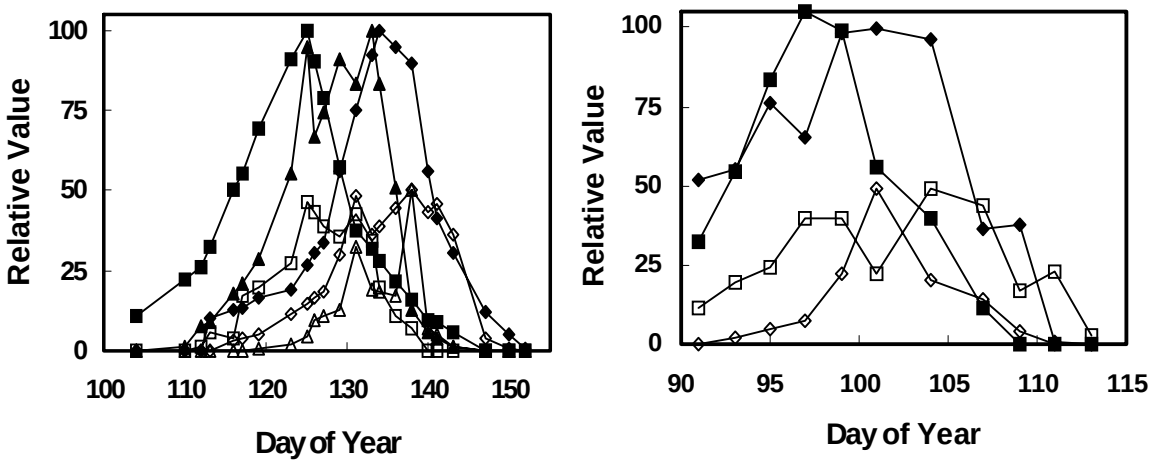

Figure 1: Flowering and petal fall. Closed symbols represent flowering rate, open symbols represent petal fall rate. Left: UK (◆ - 1998, ■ - 1999, ▲ - 2000); Right: China (◆ - 1999, ■ - 2000).

Table 1. Duration of petals on leaves in different layer of the crop. Values averaged over all the years of the study.

Height	**% of fallen petals on leaf for**							
	≤2 days		3-5 days		6-10 days		>10 days	
	UK	China	UK	China	UK	China	UK	China
<40cm	35.0	38.5	26.7	30.0	32.3	16.5	6.0	15
40-60cm	37.8	33	24.1	34	20.8	17.5	17.3	15.5
>65cm	28.8	32.5	31.7	38.5	15.0	14.8	24.5	14.2

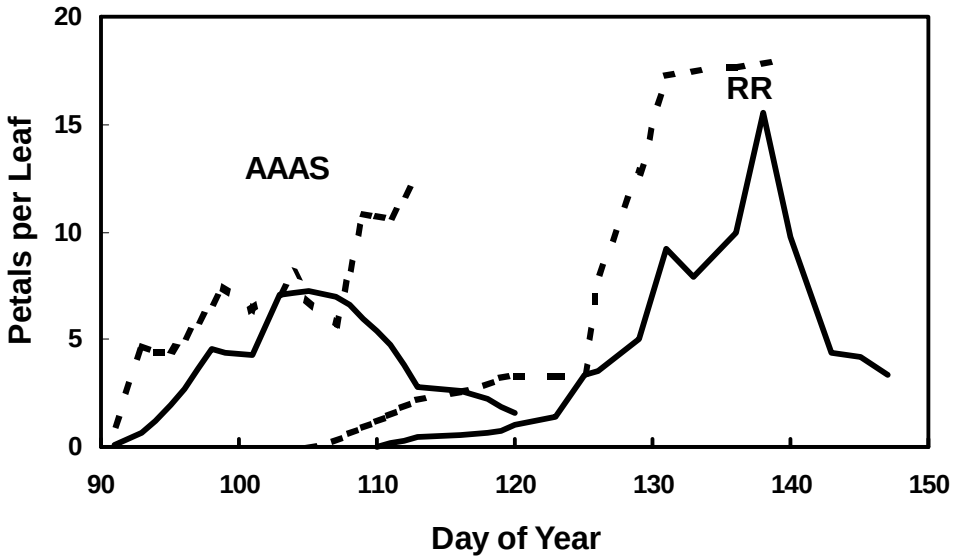

Figure 2: Pattern of petal deposition on leaves in the middle of the canopy at AAAS, China (left hand lines) and RR, UK (right hand lines) for 1999 (dashed line) and 2000 (solid line).

DISCUSSION

Patterns of petal fall and petal retention on leaves appear to be broadly similar for European and Chinese crops. Roughly one third of petals deposited on leaves do not survive more than 2 days and a further third last less than 6 days. As it probably takes more than two days to infect leaves (under ideal conditions) it is likely than about half the ascospore-bearing petals will not persist long enough to cause infections. Petals lasted slightly longer on the lower and middle parts of the canopy than in the upper part, but the numbers of petals deposited on leaves in the lower part of the canopy was about half of that in the upper and mid-parts. Although conditions in the lower part of the crop may be more favourable for infection, the difference in the number of petals deposited probably means that the leaves in the mid-canopy are most at risk of infection. The pattern of petal fall and petal deposit on leaves suggests that the crop is most vulnerable to infection towards the end of flowering, about 25 days after the beginning of flowering in the UK.

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