Occurrence of Ascospores of Sclerotinia sclerotiorum in areas of central Alberta'

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Ascospores of Sclerotinia sclerotiorum were intercepted more frequently, on agar plates and flowering rapeseed plants, in areas north and west of Edmonton, than in areas to the south and east. There did not appear to be a correlation between total rainfall during the summer and ascospore incidence.

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Les ascospores de Sclerotinia sclerotiorum ont été interceptees plus frequemment sur gélose dagar et sur plantes de colza en fleur dans les regions situees au nord et a l'ouest d'Edmonton que dans les parties situees au sud et à l'est de la province. Il ne semble pas y avoir de correlation entre la pluviometrie totale d'été et la frequence des prelevements de spores.

Introduction

Rapeseed produced in south-central and east-central Alberta is rarely as heavily contaminated with sclerotia as rapeseed produced in north- and west-central regions. (Canadian Grain Commission weekly reports on Sclerotinia pieces in oilseed clean-out at Vancouver terminals, for years 1976-1979). The presence of airborne ascospores of *Sclerotinia sclerotiorum* (Lib.) de Bary in central Alberta in July - August 1978 was shown by Williams and Stelfox (1979), and potential for long range dispersal by these spores was suggested. Lower levels of infection by *Sclerotinia,* found in drier areas, may be due to lower ascospore production in these areas, or to reduced survival of incoming ascospores because of dry conditions. The occurrence of ascospores in seven locations, with differing precipitation levels, in central Alberta was monitored in summer 1979.

Materials and methods

Presence of airborne ascospores of S. *sclerotiorurn* was determined in two ways: 1) by exposing agar, in petri plates, and incubating after exposure so colonies of *Sclerotinia* could be identified: 2) by placing flowering rapeseed plants in fields for approximately one week, then incubating in humid conditions suitable for disease development.

1) Exposure of agar plates

A set of ten wooden stakes was placed in one field on each of four farms, north, south, east and west of Edmonton, Alberta. Two agar-containing petri plates could be attached vertically on each stake at approximately 60 cm and 125 cm above ground level. Stakes were placed on the east side of the field, at least 30 m apart, with plates facing west, the direction of prevailing winds. Field location and cropping history are given in Table 1. Petri plates (8.5 cm in diameter) contained acidified potato sucrose agar which is suitable for growth of S. *sclerotiorurn* and suppression of bacterial contaminants. Each set of plates (20 per field) was exposed for an average of 5.5 hours (4.5 - 7.5 hrs.), from 10 am - 3:30 pm, but on five occasions plates were exposed overnight, for 17 - 21 hrs at field N (twice) and field K (three times). After exposure plates were incubated at room temperature for a minimum of two weeks, with frequent examination for development of Sclerotinia colonies. Plates were exposed during the period June 21 - August 9, with seven exposure dates at D and T, six at N and 3 at K.

2) Exposure of flowering plants

Two varieties of rapeseed, Candle (*Brassica campestris* L.) and Midas (*B. napus* L.) were grown to flowering stage, in 4" pots in growth chambers where they were not exposed to spores of *Sclerotinia.* Each pot containing 4 - 5 plants was well-watered, enclosed in a polythene bag to prevent moisture loss in the field, and plants and pots were transported to the field in a polythene bag to prevent exposure to spores en route. Pots were placed in holes dug at the edge of the crop, so that pot soil was level with the soil surface. Five pots of each variety were placed in each field, on the east side, at least 30 metres apart. After exposure each pot of plants was again transported to the laboratory enclosed in a polythene bag; plants were then misted with tap water to run-off point and kept in high humidity at 20 - 22°C. Plants were periodically examined for infection by *Sclerotinia,* for up to five weeks after exposure; when sclerotia formed on any part of plants in one pot, infection was recorded and plants discarded. As a control, bagged plants were taken to and from the field, but not exposed, then misted and incubated as for exposed plants.

Total precipitation occurring during the summer was recorded at weather stations in Alberta. Data recorded at stations closest to fields where agar plates and plants were exposed are shown in Table 1. Unfortunately some stations

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Table 1. Location and cropping of fields

Field	Direction from Edmonton	Distance (km) approx. from Edmonton	Crop grown in 1978	Crop grown in 1979	Spore trapping method	Total rainfall from May 1 - Aug 29, 1979 (mm)
N	north	12.5	wheat	rapeseed	plates	246.5
T	southeast	60	rapeseed	wheat	plates	180.6
K	south	30	rapeseed	barley	plates	306.1
D	west	7.5	rapeseed	barley	plates	246.5
W	north	80	rapeseed & Alsike clover	clover	plants	259.6''
B	northeast	110	rapeseed	barley	plants	253.1*
V	east	87.5	summerfallow	rapeseed	plants	180.6
H	southeast	80	rapeseed	rapeseed	plants	180.6
G	southeast	140	rapeseed	rapeseed, wheat	plants	252.8
L	south	110	rapeseed	barley	plants	108.9
S	northwest	90	rapeseed	barley	plants	259.6''

''Rainfall from June 11 - August 20, 1979

were 40 - 50 km from field locations and values are not always applicable to the fields.

Results

1) Exposure of agar plates

Average percentages of plates developing colonies of S. *sclerotiorum* (Table 2) indicate the differences in presence of spores in the four fields, with high values obtained in north and west areas (N and D) and low values in south and east (K and T). Spores were intercepted every time plates were exposed at N and D (13 exposure times) and less frequently at T and K (6 out of 9 exposure times). Higher numbers of plates developed colonies at N and D on most exposure dates, and spores were intercepted earlier at N and D than at T. Equal numbers of plates at the two heights on the stakes developed S. *sclerotiorum* so data for the two heights were combined for each exposure.

Table 2. Interception of ascospores of S. *sclerotiorum* by agar plates at four locations

Date	% plates* on which colonies developed after exposure at location: N	D	K	T
June 18 - 24	40	10		
June 25 - July 1	70	50		0
July 2 - 8		50		0
July 9 - 15	95	65	5	
July 16 - 22	100	95	15	10
July 23 - 29		100		50
July 30 - Aug. 5	78	95	40	0
Aug. 6 - 12	100			25
Mean	80.5	66.4	20	14.2

*Values based on total of 20 plates at each location, each time, except at N in last two weeks, when 18 plates were exposed each time.

Table 3. Interception of ascospores of *S. sclerotiorum* by rapeseed plants at seven locations.

Date on which plants put in field	% plants* developing Sclerotinia infection after exposure at location: L	G	H	V	S	B	W
June 18 - 24					30	60	100
June 25 - July 1	20	20	40	20			
July 2 - 8	20	20	10	20	30		
July 9 - 15	0	0	10	30	60	50	20
July 16 - 22			0	0			
July 23 - 29			10	0	0**		
July 30 - Aug. 5	10	10	0	10		70	50
Mean	12.5	12.5	11.7	13.3	40	60	56.7

* Values based on 10 pots of plants exposed each time at each location.

**Severe flea beetle damage to plants, no foliage or flowers remained as infection sites; excluded from average.

Data in Table 2 also show that greater numbers of plates were colonized in mid-late July, when rapeseed crops were flowering, although an appreciable percentage of plates developed colonies of Sclerotinia by the end of June in fields N and D.

2) Exposure of flowering plants

Average percentage of plants infected with Sclerotinia was higher in the north and west (S, B, W) than in the south and east (L, G, H, V) (Table 3). The number of test plants developing disease was generally higher in late June - early July than later in the season: as the test plants were usually shorter than the field crop by this time, their exposure to airborne spores may have been reduced by the close proximity of the crop. No disease developed on control plants. There was no consistent difference between infection of the cultivars, therefore data are presented as a combined mean for each exposure date.

Total rainfall was low in the V, H and L fields, and high at W, B and S fields, particularly as values given for these areas are for 3 months rather than 4 months. (Table 1)

Discussion

Three possible explanations for the lower spore levels found in south- and east-central Alberta are: 1) number of sclerotia may be intrinsically lower, due to low levels of infection each year; 2) weather conditions may have been less suitable for apothecium production and hence spore production in 1979: 3) spores may not be produced in these areas but are carried south and east by prevailing westerly winds, and a reduction in spore numbers could be expected with increasing distance from inoculum source. Apothecia were only found in field D, but extensive surveys were not carried out in any of the fields.

Infection levels of plants exposed do not seem to be affected by total rainfall at the different locations. Numbers of plants developing infection are identical for G and L, yet weather stations close to field locations show that there was appreciably less rainfall at L than G. However, the highest frequency of disease development on plants in B, W and S fields is consistent with natural infection patterns, as rapeseed with a high level of contamination by sclerotia is produced more frequently in these areas than in the south and east.

Weather data for areas where plates were exposed suggest that field K would have received sufficient moisture for apothecium development, but low percentages of plates exposed developed colonies of Sclerotinia. Weather conditions in previous years will have affected production of sclerotia, and inoculum levels may be low due to previous conditions.

It has been reported that heavy rainfall reduces ascospore inoculum as spores are washed down into the soil rather than being released into the air (Kruger, 1974). Duration of conditions suitable for apothecium formation and spore release would be a more critical factor than total rainfall, in determining spore inoculum.

Ascospores of S. sclerotiorum were intercepted frequently in the north- and west-central regions, where rapeseed contaminated with high levels of sclerotia is produced in some years. However, sufficient spores were present in the drier regions to cause appreciable disease if climatic conditions suitable for infection had occurred.

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