Incidence and etiology of pea rots in southwestern Ontario

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A survey was conducted in Essex and Kent countries in southwestern Ontario in the summers of 1983 and 1984 to determine the incidence and severity of root rots of pea. Approximately 50 and 75% of the commercial fields were surveyed in 1983 and 1984. Cultivars included in the survey were Green Giant (GG) 313,451,521, EJ 235 and Mini 381. The incidence of root rot for 1983 and 1984 was not significantly different between the 2 years and averaged 26.5 and 25.9%, respectively. However, the disease severity differed significantly among some of the cultivars. Generally, there was a positive correlation between yield and the incidence X severity. A total of 782 isolations were made. The frequencies of isolating *Fusarium solani, F. oxysporum, Aphanomyces euteiches* and *Pythium* spp. were 7:4:1:1.

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Durant l'été de 1983 et de 1984, on a effectub une enquête dans les comtbs d'Essex-Kent afin de déterminer l'incidence et la gravité du pourridib du pois. L'enquête a couvert environ 50 à 75 % des champs commerciaux en 1983 et 1984 et porte sur les cultivars Green Giant (GG) 313,451, 521, EJ 235 et Mini 381. L'incidence moyenne du pourridib en 1983 et 1984 a été respectivement de 26.5 et 25.9 % et n'a pas montrb de difference significative. Toutefois, la sévérité de la maladie diffbre significativement entre certains cultivars. Gbnbralement, on retrouve une corrblation positive entre le rendement et l'incidence X sévérité. Au total, 782 isolements ont été effectubs avec une frbquence respective d'isolement de 7:4:1:1 pour *Fusarium solani, F. oxysporum. Aphanomyces euteiches* et *Pythium* spp.

Introduction

Southwestern Ontario is a prime agricultural region in Canada. A variety of vegetable crops are grown here, including processing green peas. In 1981, Ontario growers farmed 8600 ha of peas with a total value of 9.3 million dollars (2) of which 60% was grown in southwestern Ontario and 30% in Essex and Kent counties.

Pea root rot is a world-wide disease problem that prevails in pea growing areas, and has become the major problem confronting pea growers and processing companies in southwestern Ontario. Root rot threatens the continuation of the pea industry in this area. Unfortunately, very little research has been done on pea root rots in Ontario (4). There are more than 20 different fungi that can cause pea root rots (6). The disease no doubt is caused by different fungi in different regions of the world. Thus, a detailed survey is necessary before a research program can be developed.

The incidence and severity of pea root rots were surveyed and a large number of isolations were made on diseased plants to assess the relative importance of various fungi in causing root rots in southwestern Ontario.

Materials and methods

A survey was conducted in Essex and Kent counties in southwestern Ontario. Totals of 48 and 58 fields (or 600 and 800 ha) were surveyed in 1983 and 1984, respectively. The acreages surveyed represented 50 and 75% of the total acreage of the biggest pea processing company in this area. Since peas were grown exclusively for the company on contracts, the growers' fields which were to be surveyed were selected randomly from lists provided by the company.

Surveys were conducted between late May and mid-June each year. For each field, four replications of 10 plants were dug up and the incidence and severity of root rots were assessed. The severity was determined using a 0 to 4 scale where 0 = healthy, 1 = 0-10%, 2 = 11-25%, 3 = 26-50% and 4 = 51-100% root discolored.

A large scale isolation was conducted in 1983 in conjunction with the disease survey. A total of 465 samples was collected randomly from 33 pea fields. Isolations were made by cutting small pieces (ca., 1 mm^3) of discolored root tisue. The tissue pieces were surface sterilized in 1.65% sodium hypochloride solution for 1 min, rinsed in distilled water and placed on an agar plate containing potato dextrose agar (PDA) and 40 μg/ml of novobiocin. For each petri plate, 4 pieces of tissue were plated. The plates were incubated at 22°C. After 4 days of incubation, the fungi that grew out of the tissue pieces were isolated and later identified.

Results and discussion

Root rot survey. The incidence of pea root rot varied widely from field to field, and differed largely form one cultivar to the other. Variation among fields ranged from 0 to 98.5% and cultivars from 15.8 to 53.5% (Table 1). Similarly, the disease severity also varied widely among cultivars. For example, GG 451 had an average root rot severity rating of 1.6 versus a 3.3 rating for GG 313 on a 0 to 4 scale (Table 1). The differences in incidence and severity among pea cultivars indicate that some cultivars may be more tolerant to one or more root rot pathogens present in the fields.

There is no doubt that root rot is severe, and incidence of this disease is high in the fields in Essex and Kent counties.

isolation of root rot organisms. Isolations were made on 465 samples collected from 33 pea fields, from which 782 fungal cultures were isolated. Of the 782 fungal cultures 356 were *Fusarium solani,* 201 were *F. oxysporum,* 58 were *Apha-*

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Table 1. Incidence and severity of pea root rot in 1983 and 1984 in Essex and Kent counties.

Cultivar	Area (ha)				% Surveyed		Root rot			
	Total		Surveyed				Incidence (%)		Severity[a]	
	1983	1984	1983	1984	1983	1984	1983	1984	1983	1984
E.J. 235	92.7	90.9	45.9	67.7	50.0	73.6	53.5	34.1	2.1	2.7
Sparkle	131.8	66.4	80.5	48.2	60.6	72.7	15.8	21.1	3.2	2.8
Mini 381	207.7	135.0	111.4	99.5	53.6	74.1	21.3	22.8	2.0	2.1
G.G.313	188.2	[b]	74.5	-	39.9	-	43.3	-	3.3	-
G.G.451	10.0	422.0	0.0	320.0	0.0	75.8	NA	20.2	NA	1.6
G.G. 512	387.3	307.0	222.3	248.2	57.3	80.8	20.7	21.1	2.2	1.8

[a] Root rot rating based on a scale of 0-4 where 0 = healthy, 1 = 0-10%. 2 = 11-25%. 3 = 26-50% and 4 = 51-100% of the root discolored.
[b] Cultivar discontinued in 1984.

nomyces euteiches, 48 were ***Pythium*** spp. (mostly ***P. ultimum).*** 6 ***Rhizoctonia solani,*** 5 ***Thielaviopsis basicola,*** and the remainder (108) were non-pathogenic fungi, mostly common soil inhabitants.

F. solani was isolated from all pea fields with root rot. F. ***oxysporum, Pythium*** spp. and ***A. euteiches*** were isolated from 23, 18 and 13 of the 33 fields, respectively. A. ***euteiches*** was isolated for the first time in southwestern Ontario (5) and it was not as widely distributed as ***F. solani*** and ***F. oxysporum.*** It must be noted, however, that A. ***euteiches*** is a very serious pea root rot pathogen in Wisconsin and Minnesota (3).

In addition, the near wilt (caused by F. ***oxysporum*** f. sp. ***pisi*** race 2) which was reportedly only of sporadic occurrence in Ontario by McNeill in 1959, (1) has now been found to be widely distributed in the area surveyed.

There is no doubt that most of the cultivars in use appear to be susceptible to the root rot complex. This is due to our lack of understanding of the etiology of this disease complex. This investigation has identified many severely infested fields, and has also established the relative incidence of each fungal component in the complex. These findings enable the growers to avoid planting peas in heavily infested fields and to select cultivars with specific tolerance or resistance to one or more important pathogens in their fields. This survey will help in establishing research priorities for controlling pea root rot diseases.

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