Survey of Red Root Rot of Corn in Ontario

Purpose:

Red Root Rot (RRR) of corn is caused by a complex of fungi of which *Phoma Terrestris* (syn. *Pyrenochaeta terrestris*) is the most important (2) while Exserohilum pedicellatum and Bipolaris sorokiniana can also be problematic. The disease typically causes a destruction of the roots leading to yield losses in the field of up to 15 to 20% (1, 3). This disease is known in onion under the name of pink root rot (5). The occurrence of *P. terrestris* on corn was first reported in 1961 in southern Ontario (9). Since RRR of corn has been previously observed in Ontario (10, 11, 7), the objective of this project was to extensively survey corn fields in south western Ontario to determine the distribution of this and other corn root rot diseases in this region.

Methods:

Corn fields were selected at random and the root systems and adhering soil were collected from three corn plants in each field. The samples were packaged and sent to the AAFC laboratory in Québec for analysis. Roots were carefully washed and examined for symptoms. Severity of root diseases was determined using a root rot index of 0 to 9. Each root was assessed and a mean root rot index calculated for each field. To confirm the presence of *P. terrestris,* pieces of symptomatic root tissue were plated on potato dextrose agar (PDA) medium amended with benomyl and on Spezieller-Nährstoffarmer agar (SNA) medium in Petri dishes. Roots on modified PDA were incubated in the dark and those on SNA under a mixture of fluorescent and NUV tubes. Growth of the pathogen was checked after 7 to 10 days on PDA and after 3 weeks on SNA. Presence of *Exserohilum pedicellatum* and of *Bipolaris sorokiniana* was also noted on PDA. A second approach consisted of checking for the presence of microsclerotia of *P. terrestris* inside root cells by direct observation under a compound microscope. Search for miscrosclerotia or pathogen detection on agar media were not performed on 13 samples showing low rot index.

Results and Summary:

Sixty-onefield samples were collected from 20 counties in South-western Ontario and processed. Symptoms of root diseases when observed appeared as a dark brown or black discolouration (Figure 1) rather than the typical red or pink discolouration normally associated with RRR (7). Severity of symptoms ranged from 0.0 to 5.3, but in general, root diseases levels were low and only nine samples had an average of rot index equal or higher than 4.0 (Table 1). Almost half of the samples (28 / 61) have a rot index lower than 2. These observations indicate an important variability of root health among the scouted fields. Microsclerotia of *P. terrestris* were detected in 29 of the 48 fields analysed and pycnides with setae, typical to *P. terrestris* were observed in 47 of the 48 fields analysed, but *P. terrestris* were isolated on PDA only in 10 of these 48 fields (Table 1). We don't know why *P. terrestris* didn't grow from root samples in which two types of typical fungal structures of this pathogen were observed. A possibility is a low level of colonization by *P. terrestris* combined with the presence of other microorganism that prevent the mycelia from growing on the media. Microsclerotia detected at low or intermediate level could be an indication the pathogen was not abundant. During a

previous survey of RRR in the province of Quebec , *P. terrestris* was isolated on PDA most often when mircrosclerotia were numerous and easy to observe (6). Comparing these results with previous surveys of RRR in Quebec, it seems that *P. terrestris* is less abundant in this part of Ontario. Based on the frequency of isolation of *P. terrestris* on PDA, it seems this pathogen is not the only or primary cause of the observed symptoms. Many factors could explain the differences in recovery rates of *P. terrestris* between Quebec and Ontario. Some of these factors include differences in environmental conditions (climate), hybrid sensitivity to the disease and crop rotations.

Figure 1 – Corn roots displaying a range of Red Root Rot symptoms from severe (two top rows) to minimal (bottom row)

Exserohilum pedicellatum was identified in 50 % of the samples analysed (24 / 48) (Table 1). These results confirm the presence of this pathogen in Canada as in previous surveys (6, 7, 11). In some cases, as in the field no 1 of the Essex County, where the rot index was high and the pathogen abundant, it seems to be the primary (unique) cause of the symptoms we observed. This pathogen is known to be the cause of the *Helminthosporium pedicellatum* root rot of corn (4, 8). In certain incidences we observed a high root rot index and the fungi were abundant, it would be useful to know the impact this situation had on yield. This information could help determine the importance of the disease.

Bipolaris sorokiniana was also detected in the survey but at low levels (7 / 48 samples (Table 1)) indicating it may have a low frequency in south western Ontario fields. In other incidences in which other fungi were isolated, except those forming pycnides on SNA, the root diseases observed were most likely caused by other pathogens which

were not investigated in this study. For example, the medium used were not appropriate to isolate *Rhizoctonia* sp., *Pythium* sp. and *Fusarium* sp.

Table 1. Observations on root diseases of corn and their casual agents in Ontario in 2008/09

Location County / Town / Field	Root Rot Index (0-9)	Microsclerotia of *P. terrestris*	Isolation on culture media		
			Phoma terrestris	*Exserohilum pedicellatum*	*Bipolaris sorokiniana*
			PDA / SNA	PDA	PDA
Brant, Canning, field 2	4.7	+	– / ++	–	–
Brant, St. George, field 3	1.3	–	– / +	–	–
Brant, Perry's Corners, field 5	4.7	+++	– / +	–	–
Bruce, Elmwood, field 1	0.3	Ne	Ne	Ne	Ne
Bruce, Solway field 2	0.3	Ne	Ne	Ne	Ne
Bruce, Walkerton, field 3	1.0	Ne	Ne	Ne	Ne
Chatham Kent, Ridgetown, field 2	2.7	+	– / +	++	–
Chatham Kent, Desden, field 3	3.7	–	– / ++	++	–
Chatham Kent, Tilbury, field 5	3.0	+	– / ++	+	+
Dufferin, Marsville, field 1	1.0	+	– / +	–	–
Dufferin, Cardwell, field 2	0.0	Ne	Ne	Ne	Ne
Dufferin, Jessopville, field 3	4.7	–	– / +	–	–
Elgin, New Glasgow, field 1	3.7	–	– / +	++	–
Elgin, Fingal, field 2	1.7	+	– / ++	–	–
Elgin, Central Elgin, filed 3	0.3	Ne	Ne	Ne	Ne
Essex, Olinda, field 1	5.3	–	– / ++	+++	–
Essex, Harrow, field 3	0.3	Ne	Ne	Ne	Ne
Essex, Weathley, field 4	0.0	Ne	Ne	Ne	Ne
Grey, Keady, field 1	1.0	Trace	– / +	–	–
Grey, Kilsyth, field 2	1.7	+	– / ++	–	–
Grey, Chateworth, field 3	2.3	++	– / +++	–	+
Haldimand, Tyneside, field 1	3.0	++	+ / ++	+	+
Haldimand, Caledonia, field 2	0.7	Ne	Ne	Ne	Ne
Haldimand, Cranston, field 3	1.3	–	– / ++	++	–
Halton, Zimmerman, field 2	3.0	–	+ / ++	+++	–
Halton, Acton, field 3	3.3	–	++ / ++	–	–
Halton, Glenorch, field 5	0.7	–	– / ++	++	–
Hamilton, Alberton, field 2	0.7	–	– / +	–	–
Hamilton, Ancaster, field 3	1.7	–	+ / ++	++	–
Hamilton, Christie's Corner, field 4	3.0	Trace	– / +	+	+
Huron, Bayfield, field 1	3.7	++	– / +	+	–
Huron, Bayfield, field 2	3.0	Trace	– / ++	+	–
Huron, Hiresville, field 3	3.0	–	– / +++	–	–
Lambton, Alvinston, field 1	3.0	–	– / +++	–	+
Lambton, Watford, field 2	2.7	+	– / ++	–	–
Lambton, Forest, field 4	2.7	+	– / ++	+	–
Lambton, Wanstead, field 5	2.0	+	– / +	+	–
Middlesex, Fanshaw, field 1	2.0	+	– / +	+++	–
Middlesex, Clanderboye, field 2	2.3	++	+ / +	+	–
Middlesex, beachwood, field 3	2.3	Trace	– / +	–	–
Niagara, Gasline, field 1	0.7	–	– / –	–	–
Niagara, Port Colborne, field 2	1.3	–	+ / +	–	+

Niagara, Winger/Mt. Carmel, field 3	4.0	+	+ / +++	+	–
Norfolk, Marburg, field 1	2.5	–	– / ++	–	+
Norfolk, Marburg field 2	0.0	Ne	Ne	Ne	Ne
Norfolk, Renton, field 4	4.0	+	– / +	++	–
Oxford, Woodstock, field 1	4.0	++	+ / ++	++	–
Oxford, Burgessville, field 2	0.3	Ne	Ne	Ne	Ne
Oxford, Norwich, field 3	2.3	–	– / +++	+++	–
Peel, Caledon, field 1	0.3	Ne	Ne	Ne	Ne
Peel, Sleswick, field 2	0.7	Ne	Ne	Ne	Ne
Peel, Cheltenham, field 5	4.3	Trace	– / ++	+	–
Perth, Stratford, field 1	1.0	–	+ / +	–	–
Perth, Mitchel, field 2	0.3	Ne	Ne	Ne	Ne
Perth, Mitchel, field 3	2.3	+	– / ++	–	–
Waterloo, Kossuth, field 1	1.0	+	– / +	–	–
Waterloo, Crosshill, field 2	1.0	++	– / ++	–	–
Waterloo, St. Agatha, field 3	3.7	–	– / +	–	–
Wellington, Arkell, field 1	1.0	++	– / +++	–	–
Wellington, Metz, field 2	3.0	+	– / ++	+	–
Wellington, Elora, field 5	4.3	+	+ / +	+	–

Next Steps:

This survey shows corn roots can be colonized by various pathogenic fungi. However, the impact of these pathogenic fungi depends on their distribution (frequency) and infection levels (severity). It also confirmed the presence of *Phoma terrestris* and *Exserohilum pedicellatum* in southwestern Ontario. Further studies are required to better understand corn root pathogen interactions and the overall impact of these root diseases on a corn crop and ultimately yield.

Acknowledgements:

We would like to thank Dr. Stéphan Pouleur with Agriculture and Agri-Food Canada in Quebec City for his hard work and for the technical assistance of Lucie Lévesque also with AAFC in Quebec City. The technical assistance by Cheryl Van Herk and various OMAFRA summer research assistants are also greatly appreciated as well as, all the grower co-operators who allowed the sampling of their fields.

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Location of Project Final Report:

Please contact Dr. Stéphan Pouleur or Albert Tenuta for final report or visit the Canadian Phytopathological Society website at www.cps-scp.ca and look under Plant Disease Survey.

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