Sclerotinia Stem Rot of Canola:
Challenges and Opportunities

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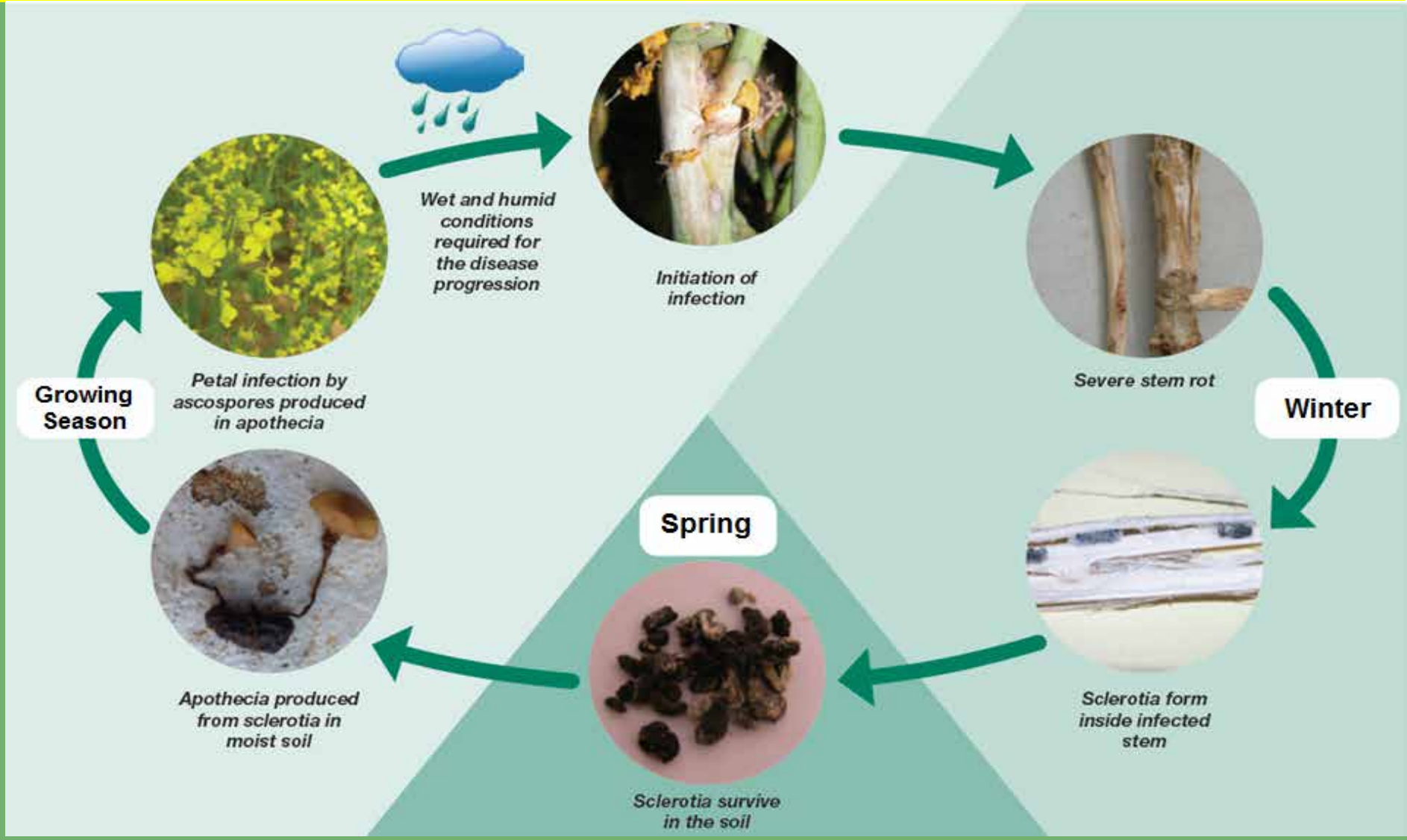
Sclerotinia Stem Rot

Life Cycle



Adapted from Pest and Disease Information Service (PaDIS), South Perth, WA

Sclerotinia in Saskatchewan

	Prevalence (%)			Incidence (%)		
	2016	2015	2014	2016	2015	2014
Sclerotinia Stem rot	**92**	**66**	**79**	**26**	**11**	**18**
Blackleg	**61**	**59**	**55**	**12**	**15**	**15**

Sclerotinia
Saskatchewan 2016 Survey

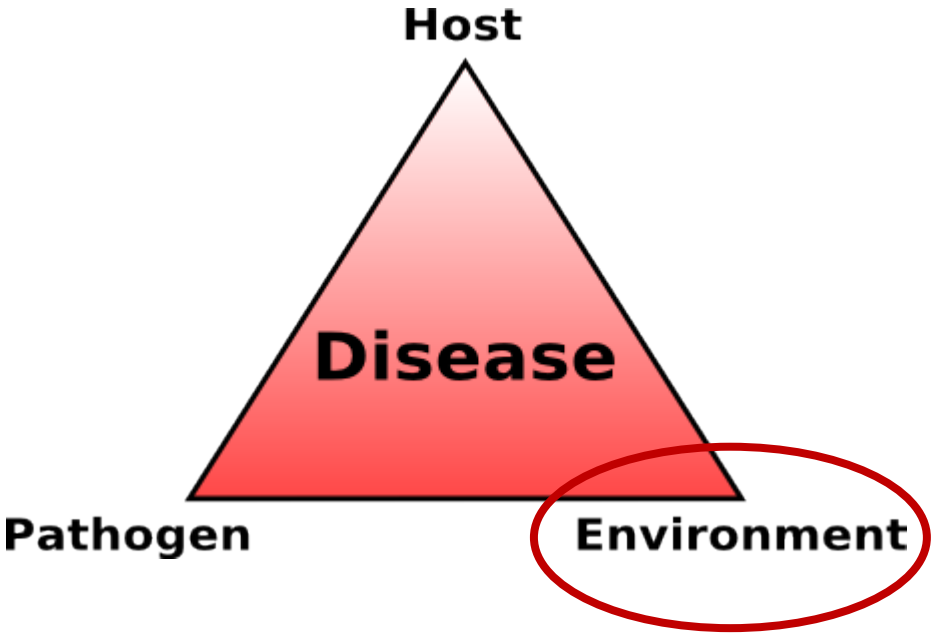
- **Prevalence** - % of fields infected
- **Incidence** – In the affected fields % of plants infected
- **Severity** – Disease rating average of infected plants
- In 2016 Sclerotinia was the most important disease of Canola. In 2017 Sclerotinia was not a major issue

Yield Loss (%) =
0.5 x Disease Incidence (%)

Region (number of fields)	Prevalence (%)	Average incidence in infected fields (%)	Severity of infected fields (0 – 5 scale)
Northwest (44)	98	32	2.1
Northeast (23)	91	22	3.5
West central (24)	100	43	3.3
East central (64)	90	20	3.6
Southwest (36)	94	22	3.0
Southeast (33)	82	23	2.9
Overall (224)	92.4	26	3.0
Potential yield loss (overall): 12%			

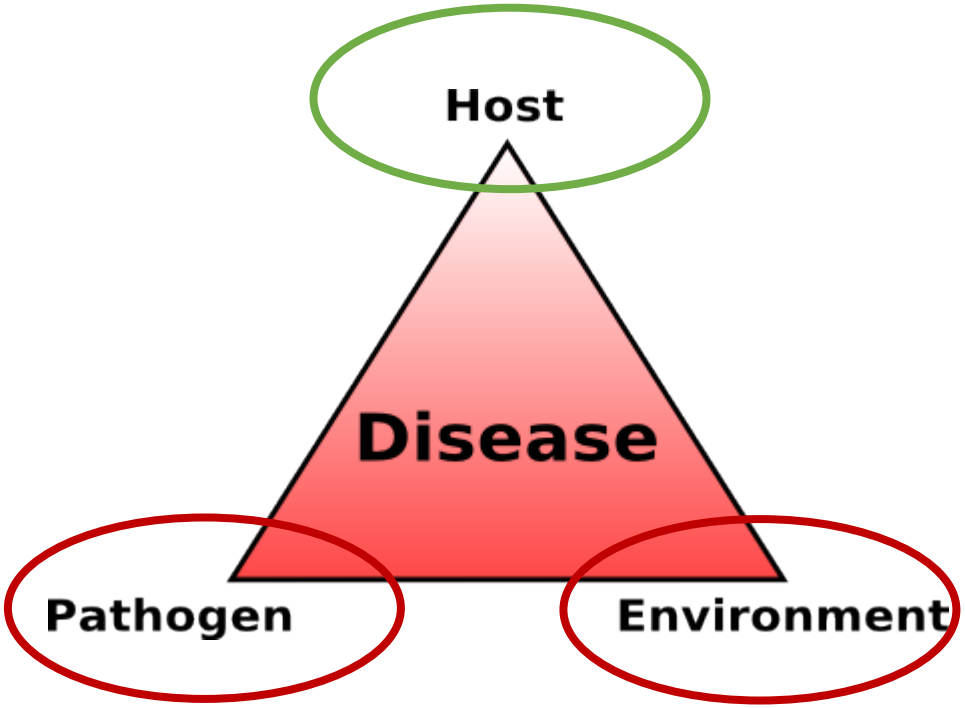
Sclerotinia Challenge: Environmental Variation

- “Sclerotinia stem rot of canola is extremely variable in occurrence and severity from year-to-year, region-to-region and field-to-field” CCC



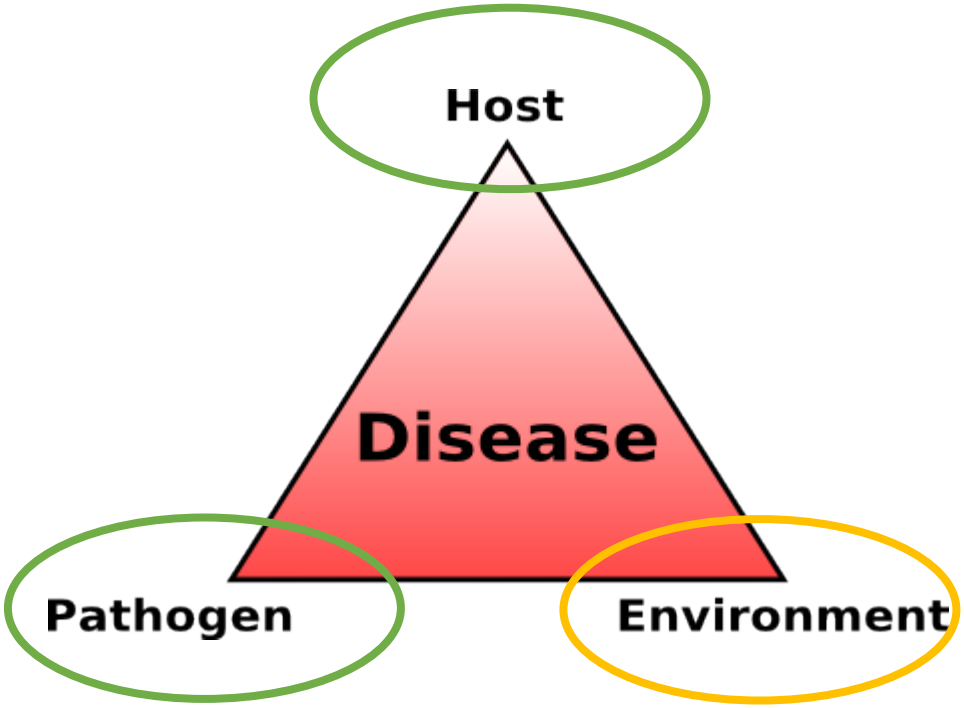
Sclerotinia Challenge: Evaluation of Material Field Natural & Ascospore Method

- Prior to 2011 the WCC/RRC attempted to evaluate a field inoculation protocol with the collaboration of private seed companies and public institutions
  - After multiple years with multiple collaborators there were inconsistent results
  - Difficulty with infection: Environment; Natural & Artificial inoculation
  - Entries were inconsistently significantly better or non-significant between trials
  - PR check and Susceptible check did not show consistent differences
  - A lot of data needed to achieve a reliable conclusion

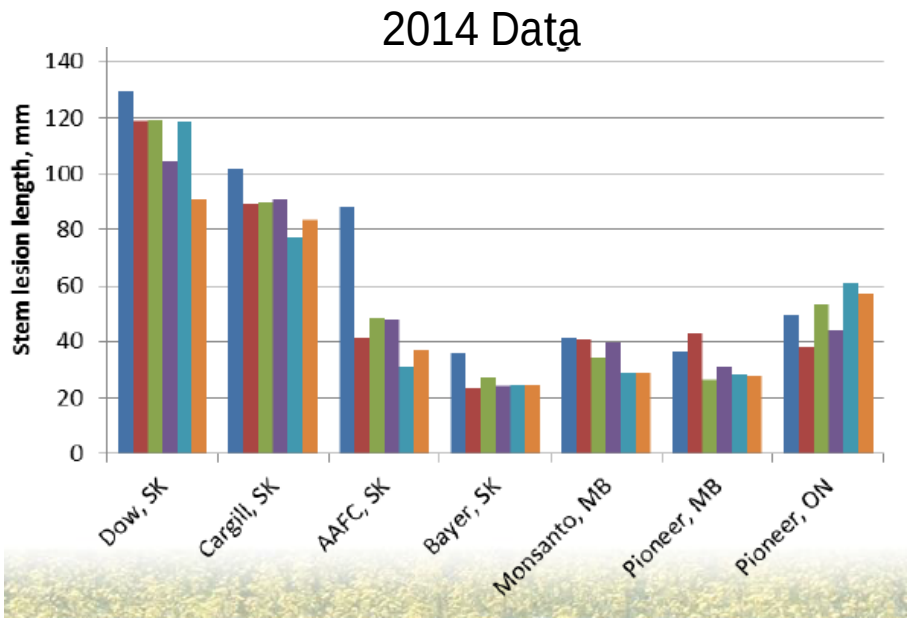


Sclerotinia Challenge: Evaluation of Material Field Stem Inoculation Method

- Prior to 2011-2014 the WCC/RRC attempted to evaluate a field based stem inoculation protocol with the collaboration of private seed companies and public institutions
  - Field stem inoculation protocol: all plant inoculated artificially by hand
  - Different sites across western Canada: misting optionally used
  - Single pathogen isolate provided to all collaborators (#321, Olds, AB)
  - Data was better but still not completely uniform



Sclerotinia Challenge: Evaluation of Material Field Stem Inoculation Method



	Number of locations where the line is significantly better than the susceptible check
Partially resistant check	3 of 7
Test line	4 of 7
Test line	3 of 7
Test line	2 of 7
Test line	2 of 7
Test line - late flowering	6 of 7

All 9 locations		
Lesion length,mm		%s+c
56	**B**	**25**
45	C	20
42	C	21
45	C	23
47	C	21
46	C	22
73	**A**	**34**
48	BC	24

	Test number			
	2011 (3)	**2012 (4)**	**2013 (7)**	**2014 (9)**
Alberta Innovates, AB	1	4	8	15
Monsanto, MB	2	5	9	16
AAFC, SK	3	6	10	17
Dow, SK		7	11	18
Cargill, SK			12	19
Bayer, SK			13	20
DL Seeds, MB			14	21
Pioneer, ON				22
Pioneer, MB				23

Sclerotinia Phenotyping – WCC/RRC Recommended Stem Inoculation Protocol

Resistant / Tolerant

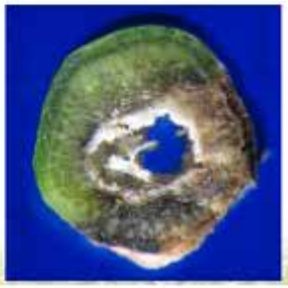
Black Firm

Susceptible

Soft Collapsed

Disease traits

1) Lesion length 7 dai
2) Lesion length 14 dai
3) Lesion length 21 dai
4) AUDPC of lesion length
5) % soft+collapsed lesions

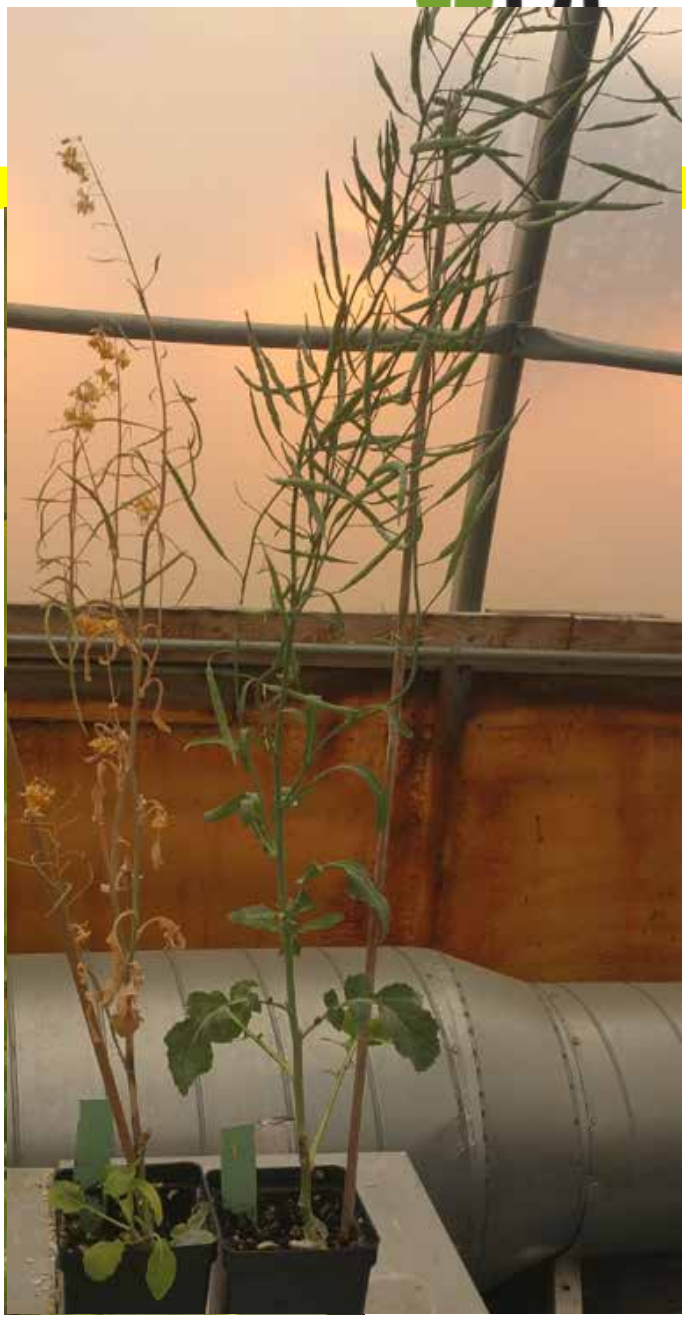


Ratings Scale: Lesion Length (mm) - Stem Rigidity (1-firm, 3-soft, 5-collapse)

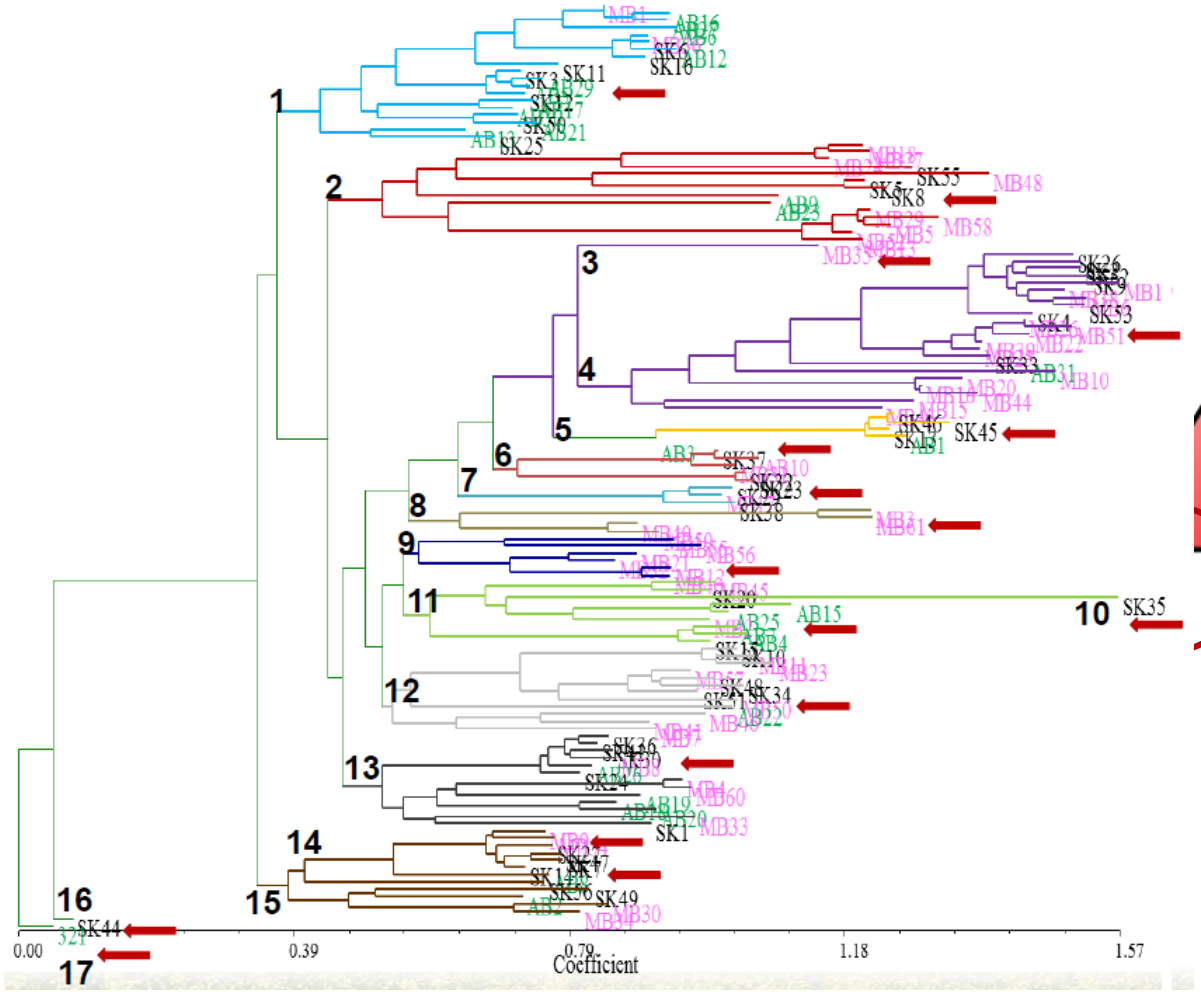
Field Reactions

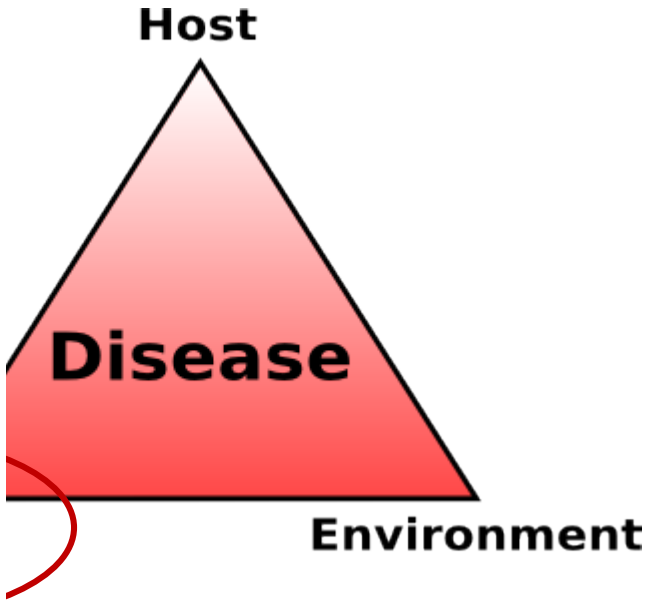



Indoor Reactions



Sclerotinia Challenge: Pathogen Variation?

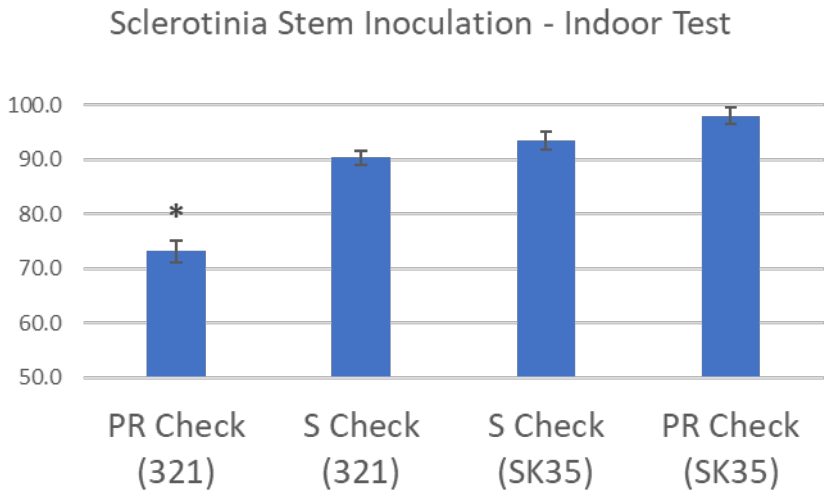


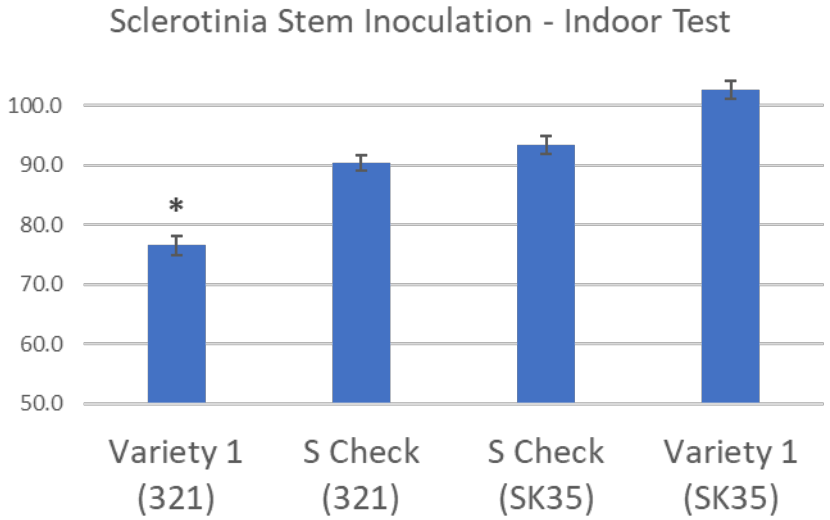


Sclerotinia Challenge: Pathogen Variation?

Sub-population	Number of isolates in sub-population	Isolate name	Number of susceptible reactions	PAK54				PAK93				K22				DC21				Tanto				Topas			
3	8	AB7	1	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MS	MR	R	R
1	1	321	5	R	R	R	R	R	R	R	R	MR		MR	S	R	MR	R	R	R	MR	R	S	R	MS	MS	MS
13	1	MB35	7	R	R	R	R	R	R	R	R	R	R	R	MR	R	R	R	S	MR	R	S	S	S	S	S	S
10	1	SK44	8	R	R	R	R	R	R	MS	R		MS	R	MR	R	MS	MR	R	R	MR	R	S	S	S	S	S
2	1	AB3	10	R	MR	R	R	R	R	R	R	MS	S	S	R	R	S	MS	S	R	MS	MR	S	S	R	S	S
16	12	MB57	10	R	R	R	R	MR	R	MR	R	MR	MS	MR	R	MR	MR	S	S	S	S	S	R	S	S	S	S
17	4	MB61	10	MR	MR	MR	R	MR	S	R	R	R	MR	R	R	MR	MR	MR	S	S	S	S	S	S	S	S	S
7	5	SK23	11	R	R	MR	R		MR	R	S	R	S	MS	R	R	S	R	MR	R	S	MS	S	S	S	S	S
15	15	MB52	11	R	R	MR	R	MR	MS	MS	R	R	R	S	R	R	R	MS	S	MR	MR	S	S	S	S	S	S
5	19	AB29	13	MR		MR	MS	MS		S	S	MR		S	MR	S		S	S	S		S	S	S		S	S
6	12	SK14	13	S	R	R	R	S	S	MR	R	S	R	R	R	S	MS	MR	MR	S	S	S	R	S	S	S	S
14	22	MB51	13	R	MR	MR	MR	R	MR	S	MR	MR	MR	MS	S	R	S	R	S	S	S	S	S	S	S	S	S
8	1	SK35	14	R	S	S	S	R	MS	R	R		S	S	S	R	S	R	MS	R	S	R	MS	S	S	S	S
11	4	SK45	16	R	MS	S	MR		MS	S	S	MR	S	R	MR	S	S	S	S	S	S	S	MR	S	S	S	S
12	6	MB21	17	R	MR	R	R	S	S	S	MS	MR	MS	S	R	MS	S	MR	S	S	S	S	MS	S	S	S	S
9	3	SK38	18	R	MS	S	R		S	R	MR	S	S	S	S	S		S	S	S	S	S	S	S	S	S	S
4	13	AB19	19	MR	MR	S	R	S	S	S	S	S	S	MR	MR	S	S	S	S	S	S	S	S	S	S	S	S
% susceptible reactions				15% (10)				34% (23)				37% (25)				50% (34)				66% (46)				91% (62)			

Sclerotinia Challenge: Pathogen Variation?





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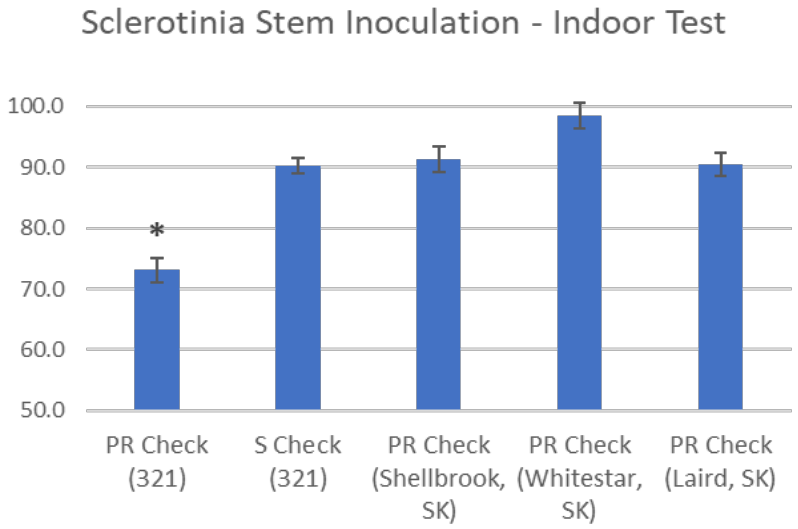
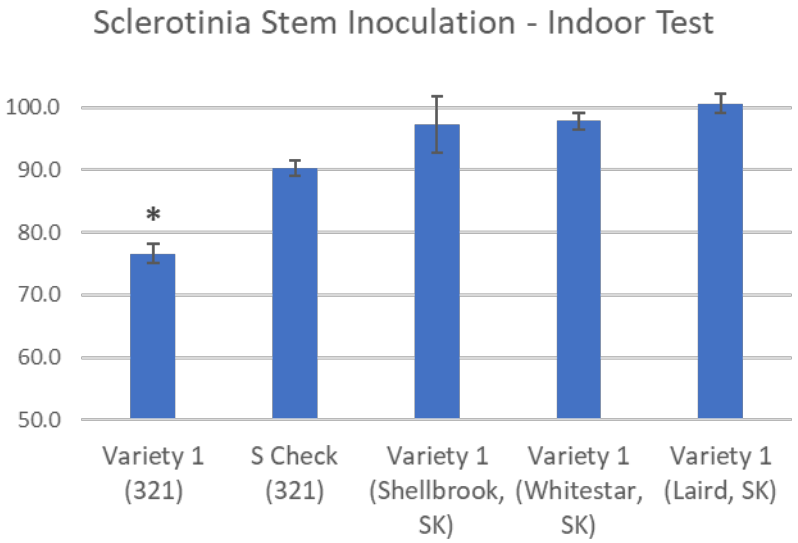
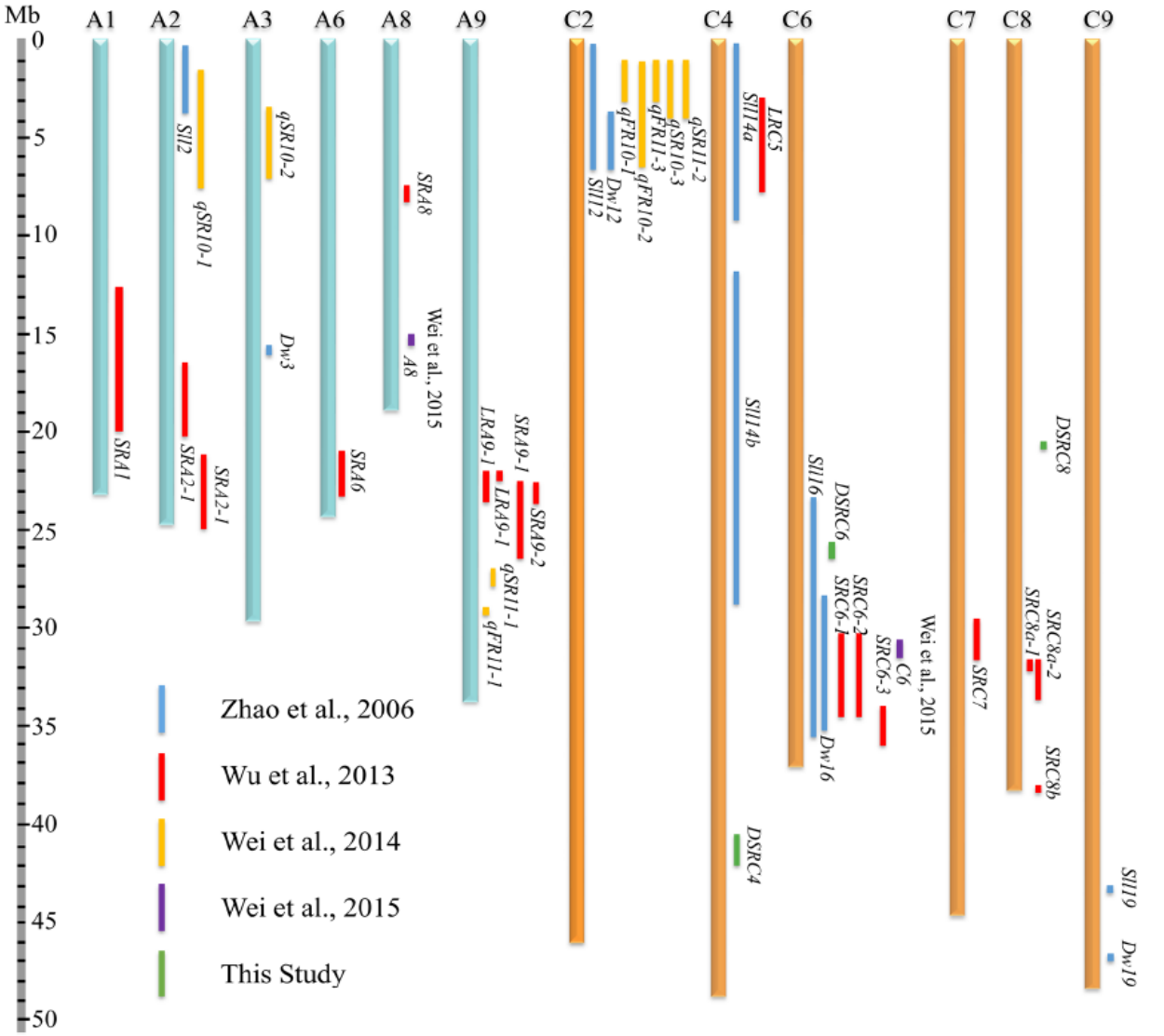




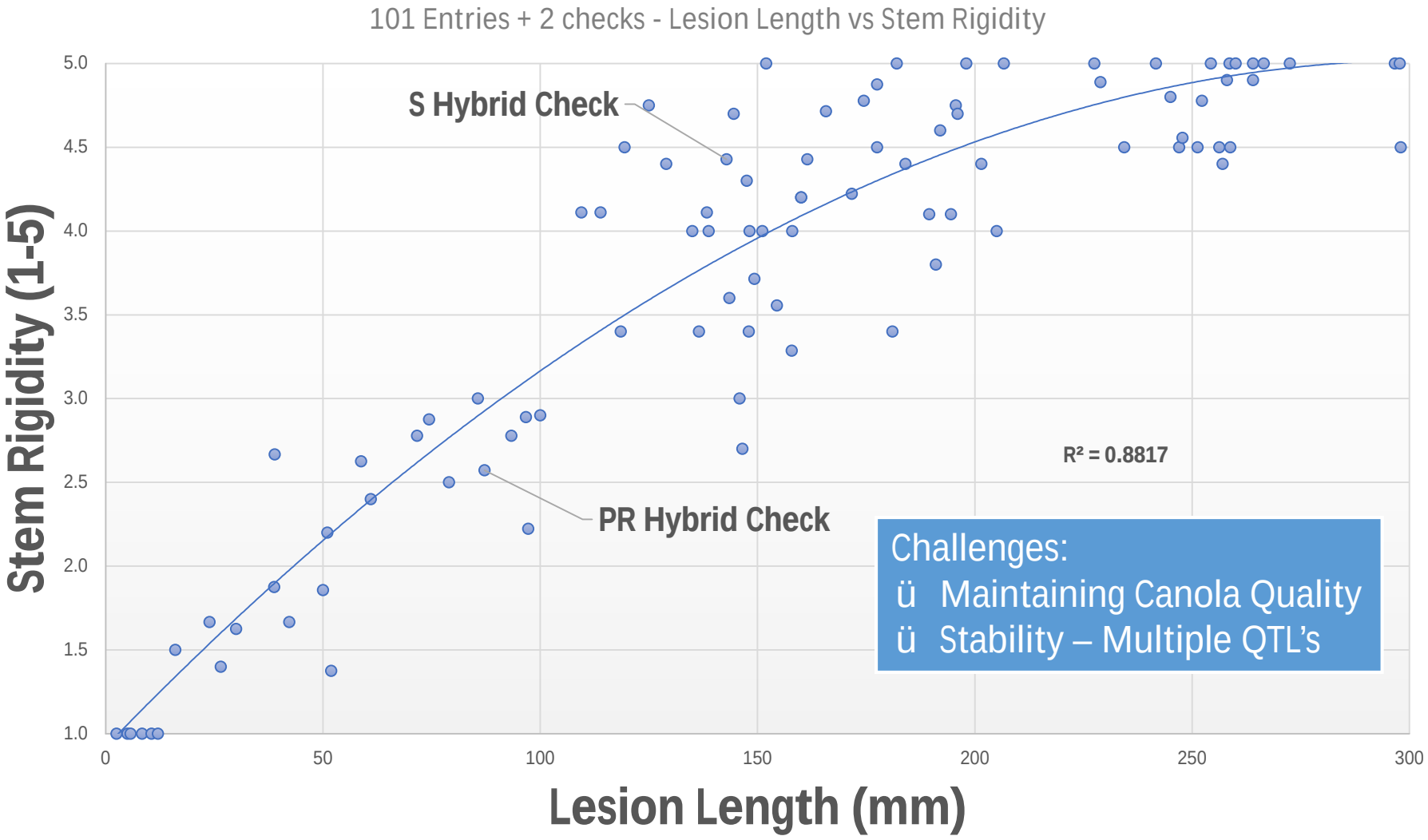
Challenge:
Genetics of Sclerotinia Resistance in *B. napus*



- ü Resistance is controlled by multiple genes spread across the genome of *Brassica napus*
- ü Resistance alleles have an additive effect

Wu et al. 2016

Sclerotinia Opportunity: Population Development



Sclerotinia in Canada Summary

- **Sclerotinia is variable year to year but can cause significant yield losses**
  - The disease is a common yield robber
  - No dominant resistance is available: all sources of resistance in the literature offer quantitative resistance with an intermediate response
- Resistant varieties reduce the risk of Sclerotinia but not a guarantee
  - Resistant varieties are not intended to replace other management tools
  - Field scouting and agronomic practices are important in assessing and preventing Sclerotinia infection.
- Breeding for Sclerotinia resistance is a challenge but steady improvements are being made
- The level of Sclerotinia resistance in commercially available hybrids is expected to improve with time as new resistance sources are introgressed into Canadian germplasm.

Acknowledgements

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