

VeGIN Webinar Stakeholder Event

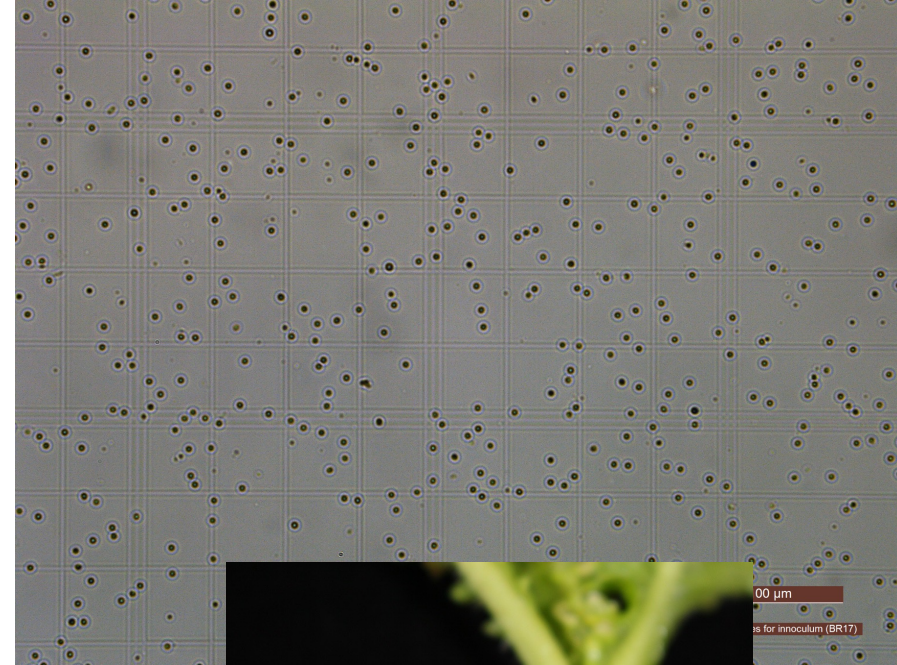
**Progress update on Clubroot resistance in Brassica and
Nasonovia ribisnigri resistance in lettuce**

1st December 2021

Graham Teakle

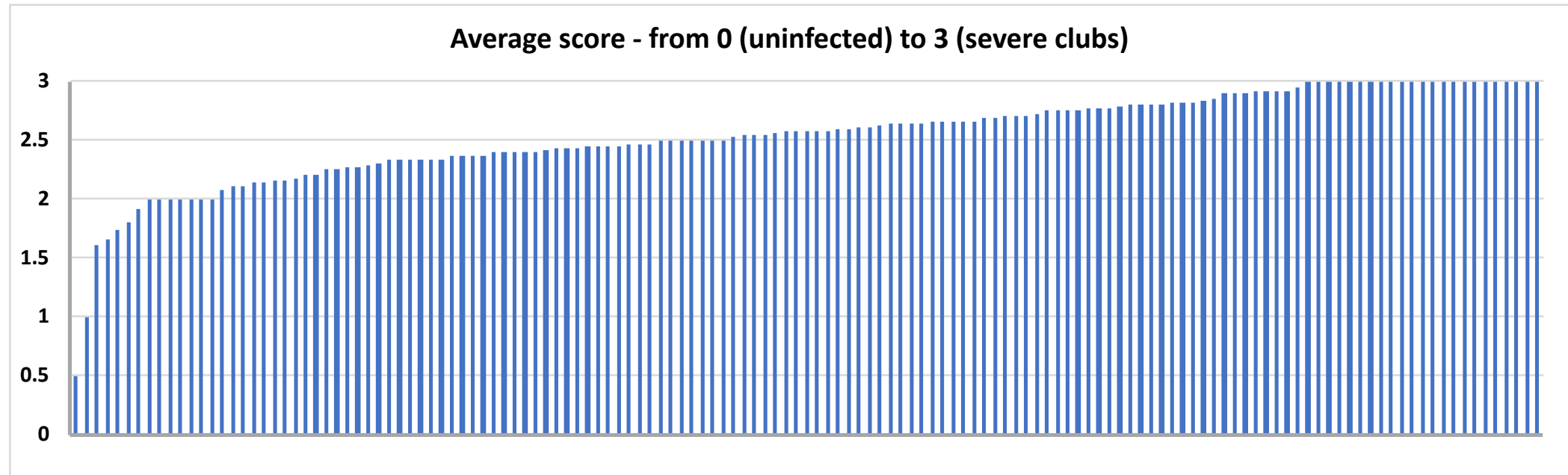
Clubroot

- ▶ Caused by soil-borne obligate biotroph *Plasmodiophora brassicae*
- ▶ Affects roots of vegetable brassicas and oilseed rape
- ▶ Reduces yield and ultimately kills the plant
- ▶ Once a field is infected resting spores survive for years
- ▶ There is no effective chemical control
- ▶ High pH (liming) reduces pathogenicity
- ▶ Genetic resistance has been deployed from *Brassica rapa*
- ▶ There is a new resistance-breaking strain of the pathogen (CN isolate)



2018 VeGIN clubroot field trial

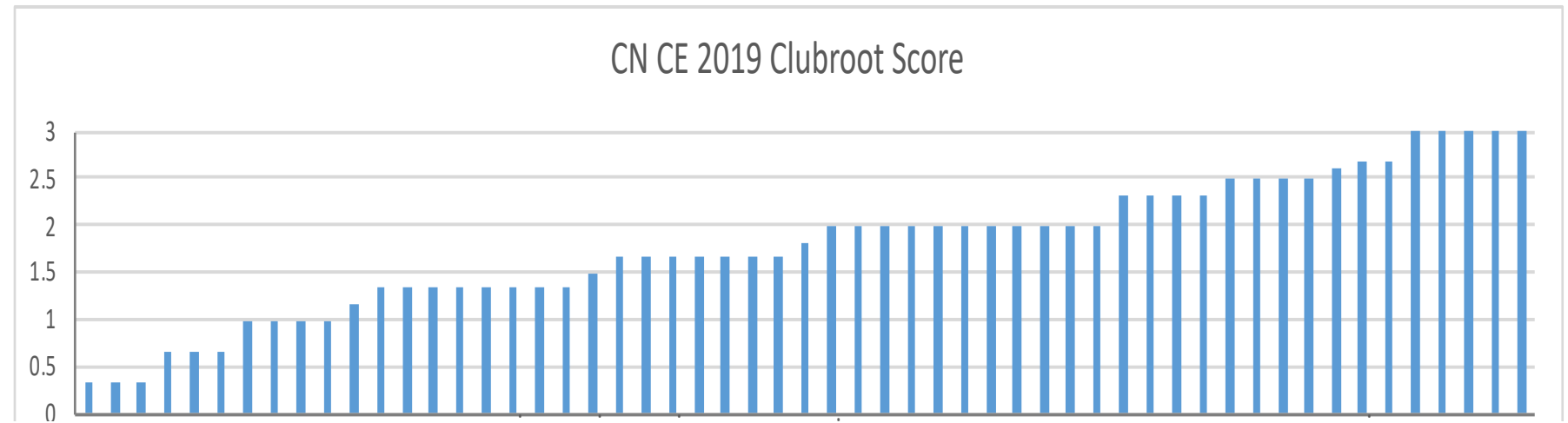
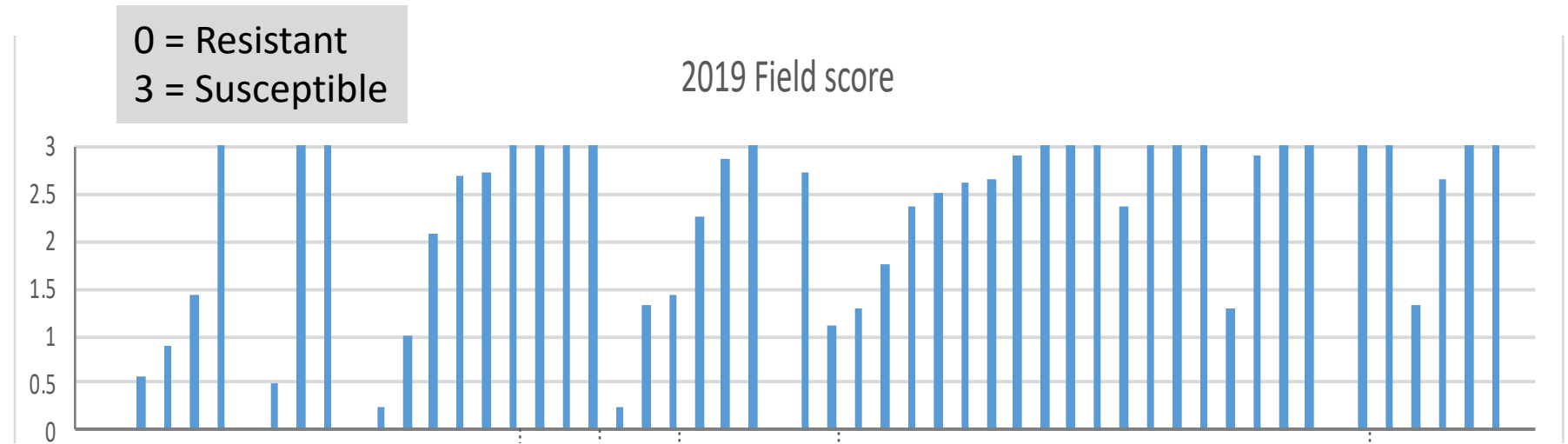
- ▶ 4 reps of 3 plants per accession (some had fewer plants)
- ▶ Comprises 148 accessions:
 - 70 *B. oleracea* DFFS accessions
 - 69 wild C genome founder accessions
 - 9 other lines
- ▶ Guard = clubroot resistant red cabbage (Lodero F1) provided by Elsoms Seeds



Comparison of 2019 Field Trial with *B. rapa* resistance-breaking isolate

Included:

- ▶ Resistant varieties
- ▶ Clubroot differential set from National Vegetable Genebank



New strategy for finding resistance

- ▶ Small scale screen of genebank accessions identified in above screens with the CN isolate
- ▶ Identify accessions that showed variation between individuals and screen a larger number of plants
- ▶ Genotype the plants to see if we can map resistance loci

Alternatively make a segregating population by crossing (slow!):

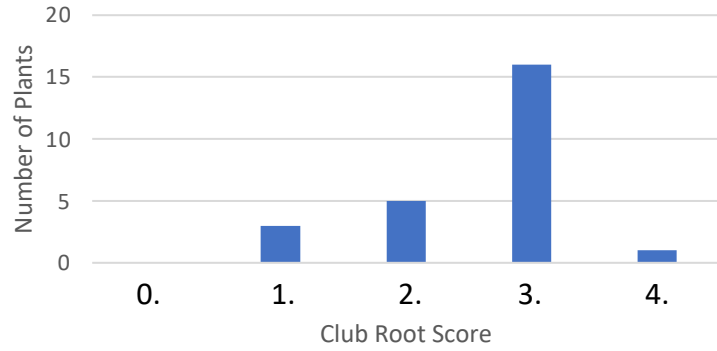


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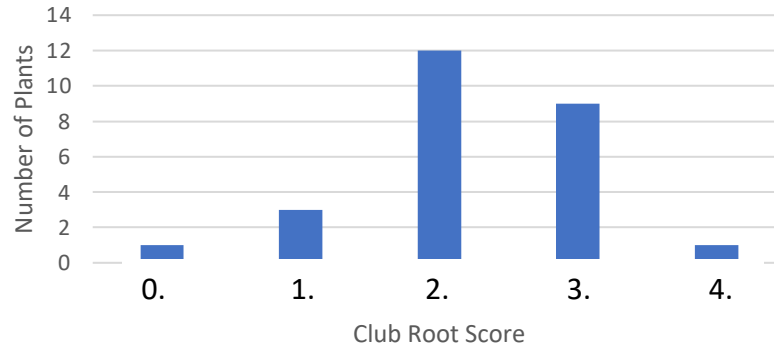


CN isolate clubroot screen in controlled environment cabinets

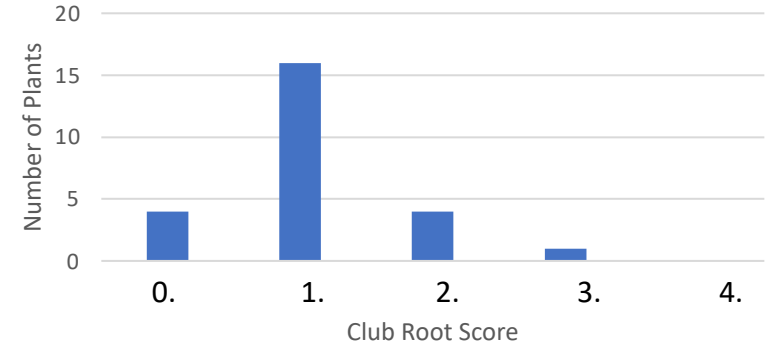
Line 1



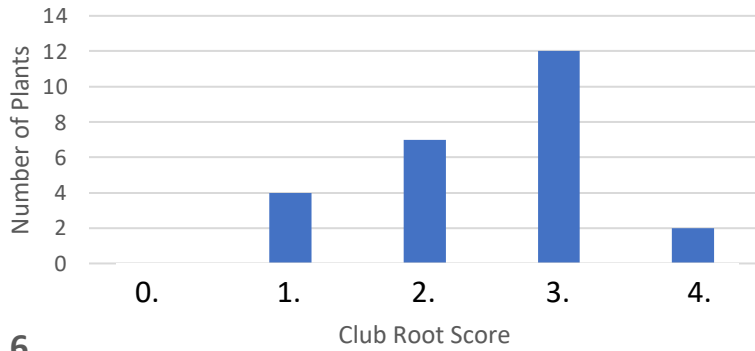
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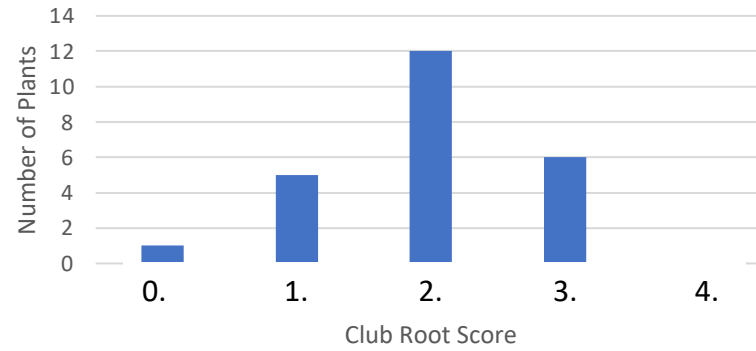
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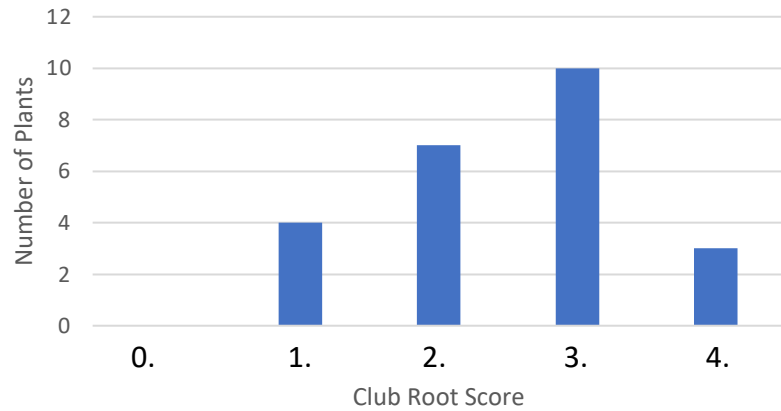
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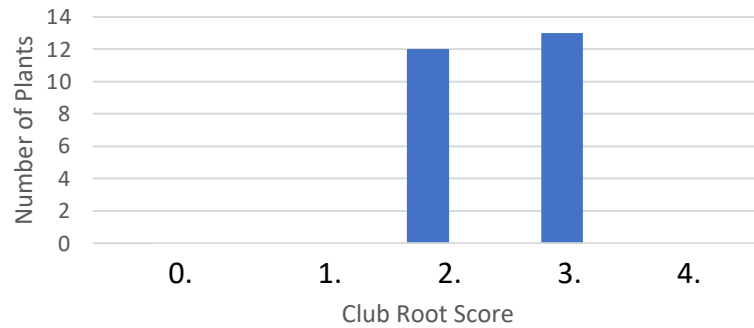
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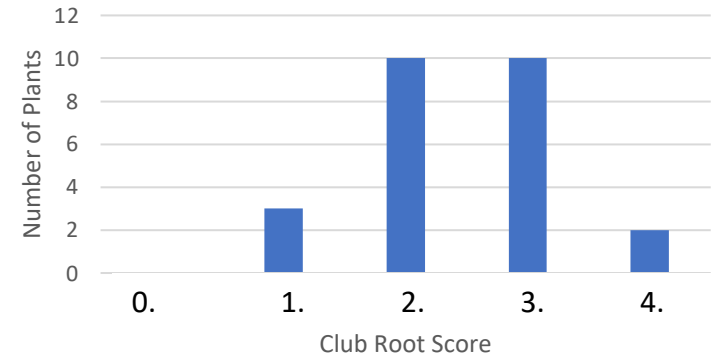
Line 6



Line 7



Line 8

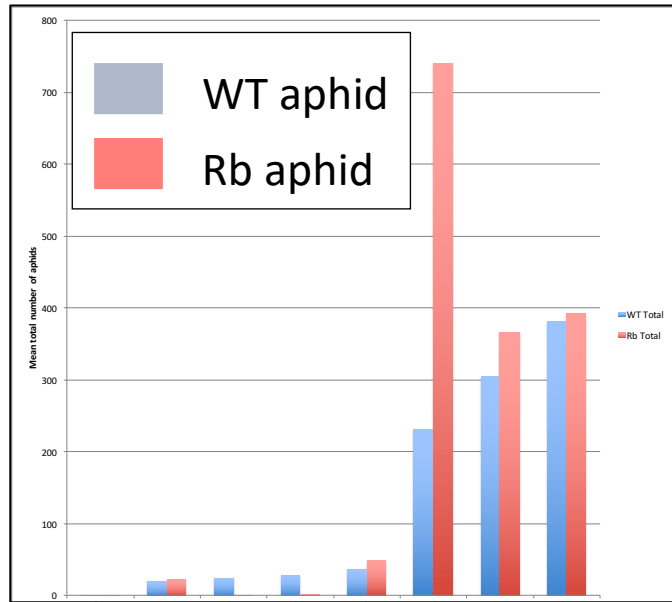


Lettuce-currant aphid (*Nasonovia ribisnigri*)

- ▶ Specialist pest of lettuce (summer host)
- ▶ Difficult to control with pesticides
- ▶ *Nr* resistance gene bred into many lettuce vars
- ▶ The *Nr*:1 resistance-breaking biotype is now becoming a significant pest of UK outdoor lettuce production



Develop new *Nasonovia ribisnigri* resistance resources



Extreme lines selected for crossing

	S1			S2			S3		
	F1	F2	F3	F1	F2	F3	F1	F2	F3
R1									
R2	16	1	1	5	3		7	1	
R3	23			1					
R4	8			2					
R5									

- ▶ Performed Resistant x Susceptible crosses
- ▶ Confirmed F1 plants were genuine crosses by genotyping
- ▶ Generate recombinant inbred line mapping populations to map resistance loci



Know your enemy: *Nasonovia ribisnigri* genetics & genomics

F1 crosses		Resistance-breaking biotype (Nr:1)	
		UK361	Kent Cl
Susceptible biotype (Nr:0)	WT Kent	3	3
	Nr 8	0	6

- ▶ Each colony was raised from a single fundatrix
- ▶ All F1s not able to grow on *Nr* lettuce => Rb phenotype is recessive

PhD Student Dion Garrett, RRES

- ▶ Genome sequencing
- ▶ Gene expression
- ▶ Population genetics
- ▶ Alternative host plants
- ▶ Sampling/modelling

Generation of F2 aphid population

Aphid F1 clone no.	Female	Biotype	Male	Biotype	No. Eggs	Hatched	Surviving colonies
11.3	UK631	Rb	WT Kent	WT	57	5	0
12.2	WT Kent	WT	Kent Cl	Rb	19	2	0
12.4	WT Kent	WT	Kent Cl	Rb	1	0	0
13.1	Nr 8	WT, Insecticide R	UK361	Bb	414	69	2
13.6	Nr 8	WT, Insecticide R	UK631	Rb	0	0	0

- ▶ Repeating this – another 80 eggs laid so far

Acknowledgements

Clubroot work

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Nasonovia ribisnigri work

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