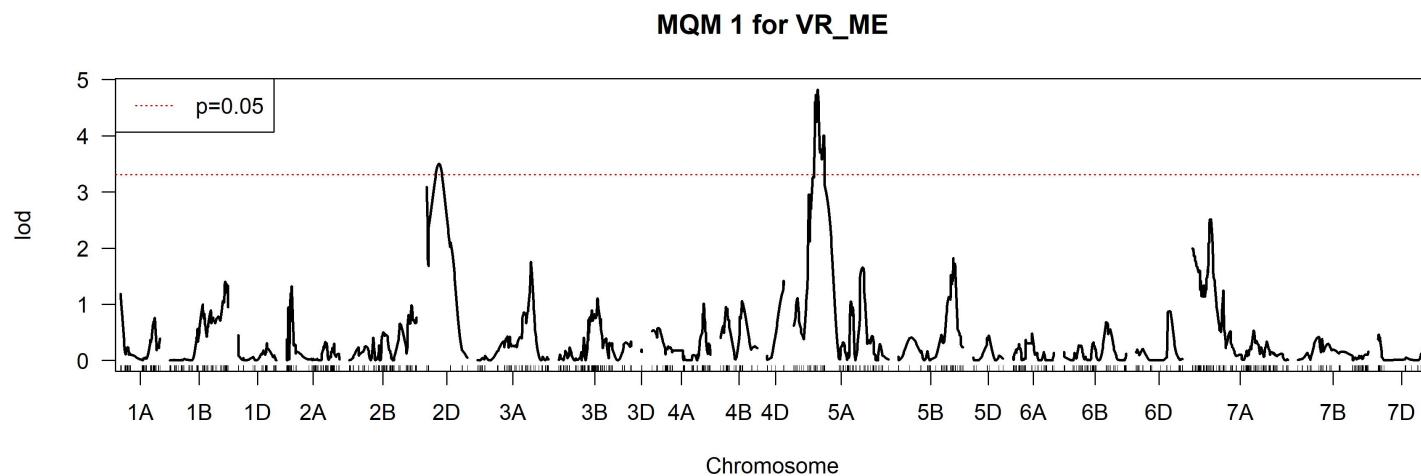
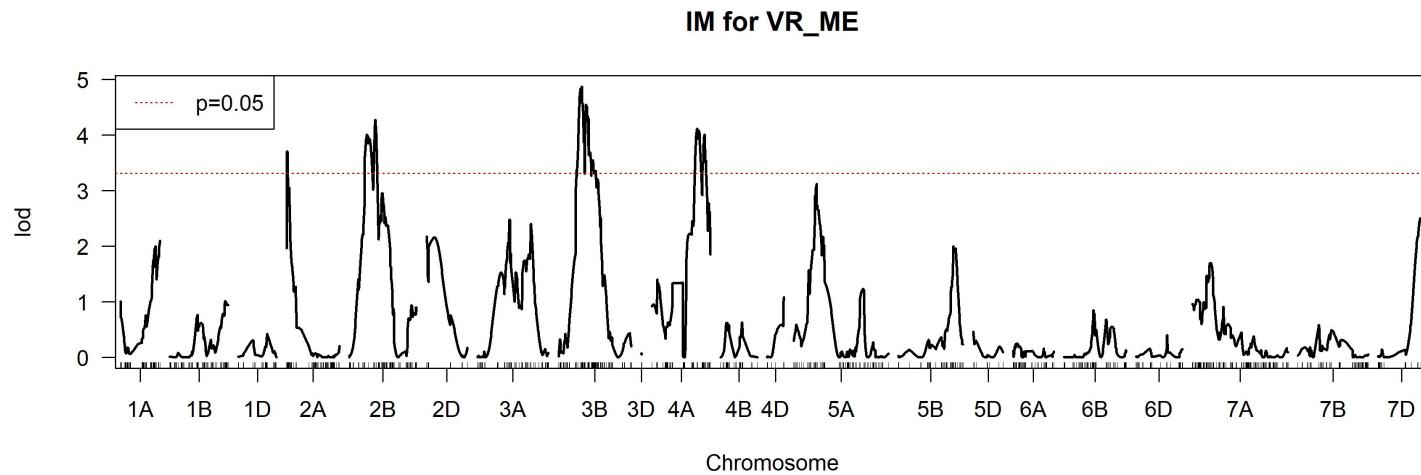


Supplemental Information 5

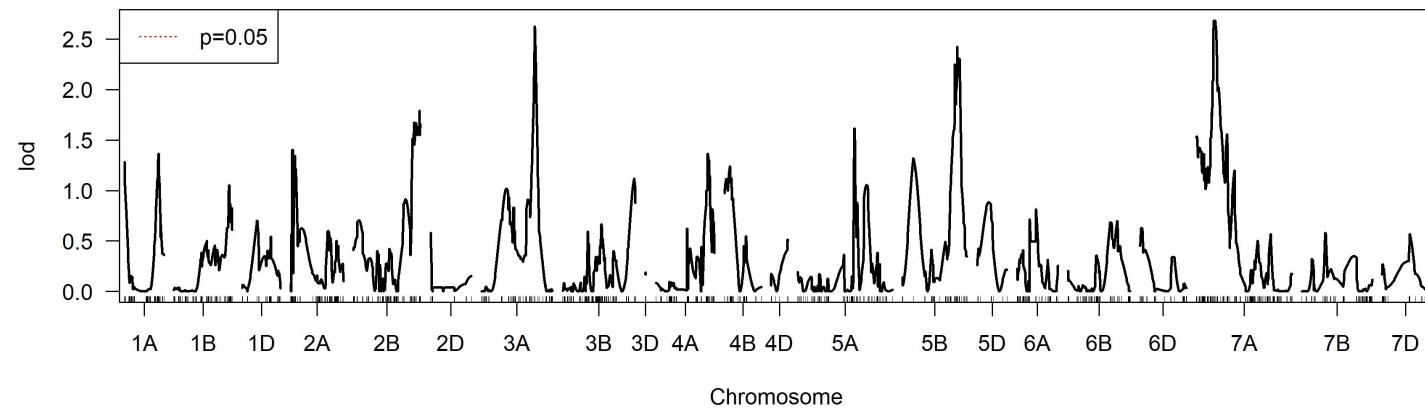
Description

Interval mapping (IM) and multiple-quantitative-trait-locus mapping (MQM) scans for Fusarium head blight (FHB) disease resistance traits visual rating (VR), Fusarium-damaged kernels (FDK), and deoxynivalenol (DON) content quantitative trait loci (QTL) with heading date and plant height marker covariates. Environments assessed include: Kinston, NC 2019 (KIN19) and 2020 (KIN20); Raleigh, NC 2019 (RAL19) and 2020 (RAL20); Warsaw, VA 2019 (WAR19) and 2020 (WAR20); and the multi-environment (ME). The number following MQM titles indicates which round of MQM the scan belongs to (e.g., MQM 2 is the second round of multiple QTL mapping). The y-axis displays the likelihood-of-odds (LOD) score of every position across the genome. The dotted line denotes the 1,000-permutation significance threshold at alpha = 0.05. If the significance threshold is not displayed within the graph, all peaks detected in the QTL scan were below the significance threshold. This is usually apparent in the last MQM scan performed. The x-axis displays each linkage group, designated by their corresponding chromosome names (e.g., 1A, 1B, 1D, etc.). The rug of hash marks denotes the cM position of each marker in the recombination map. All information regarding location, LOD and effect appears at the end of the document.

Visual Ratings Across All Environments

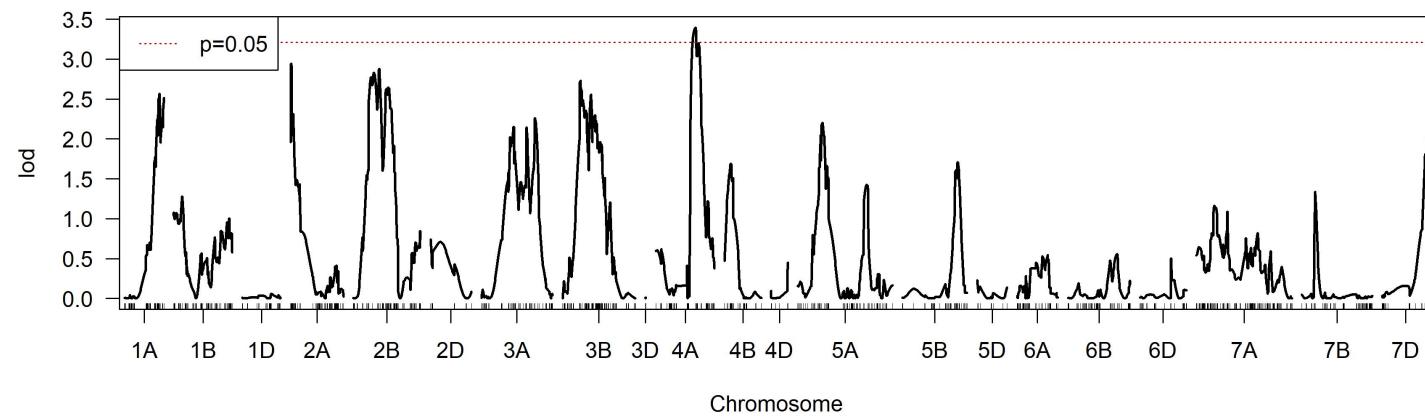


MQM 2 for VR_ME

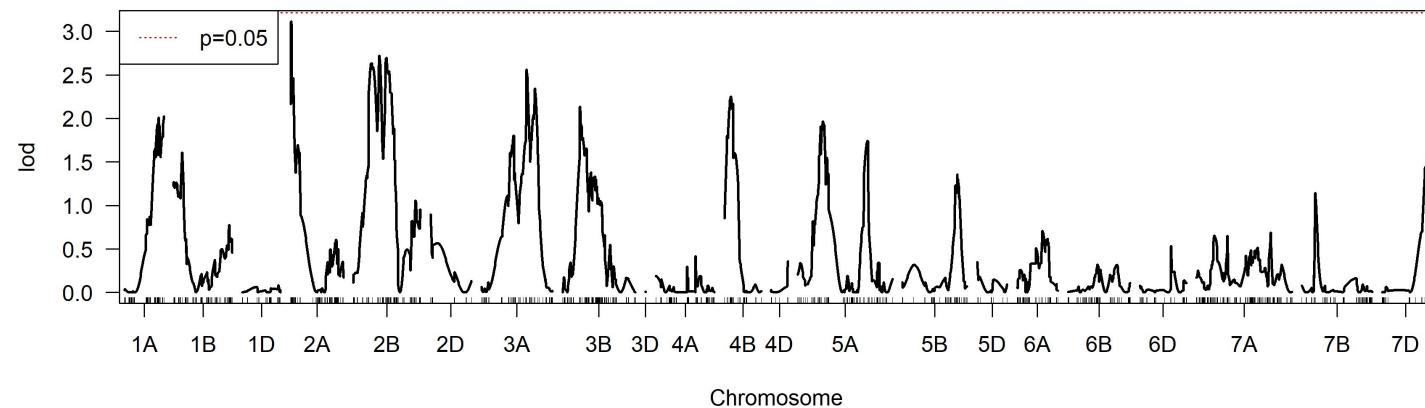


Visual Ratings in Kinston, NC - 2019

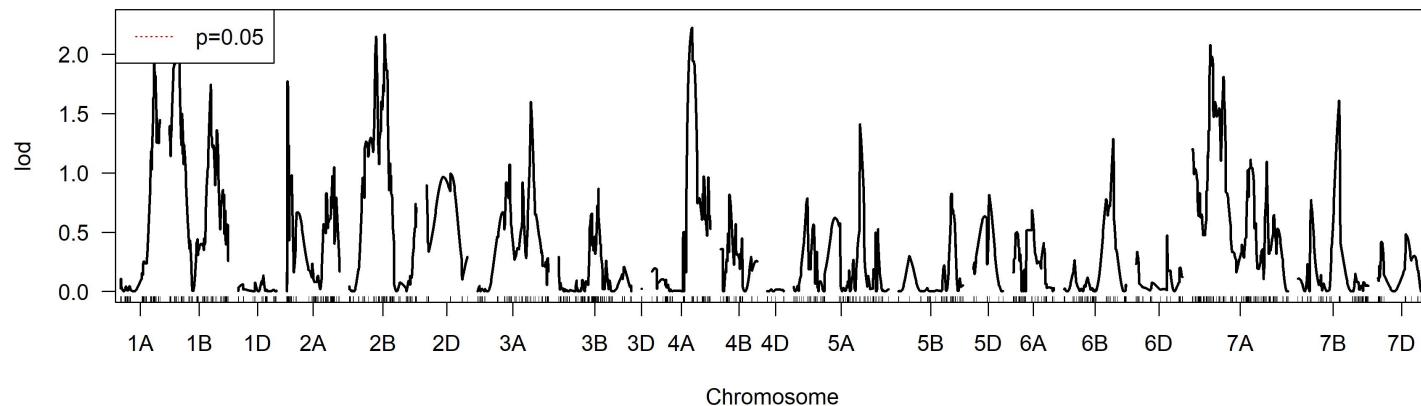
IM for VR_KIN19



MQM 1 for VR_KIN19

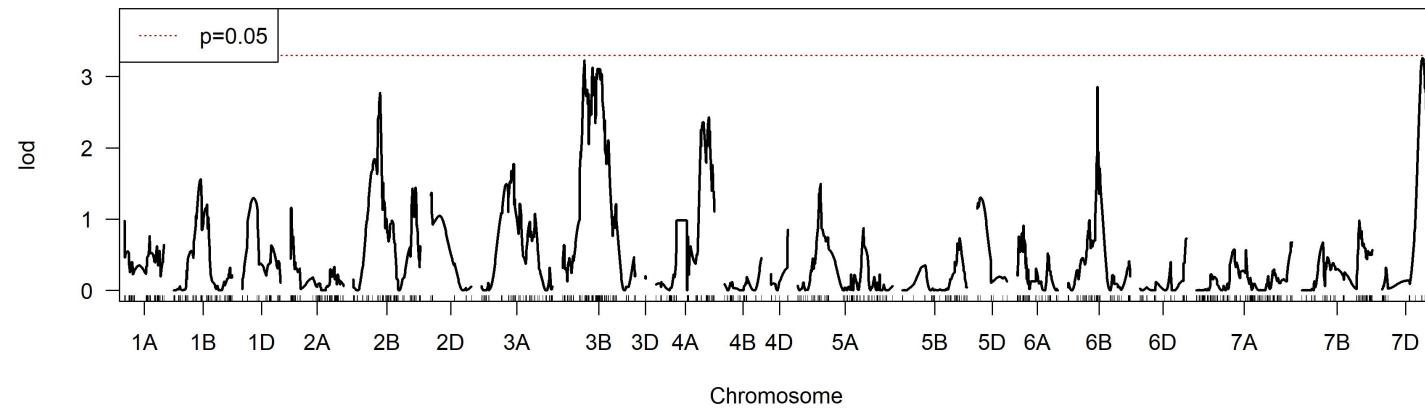


MQM 2 for VR_KIN19

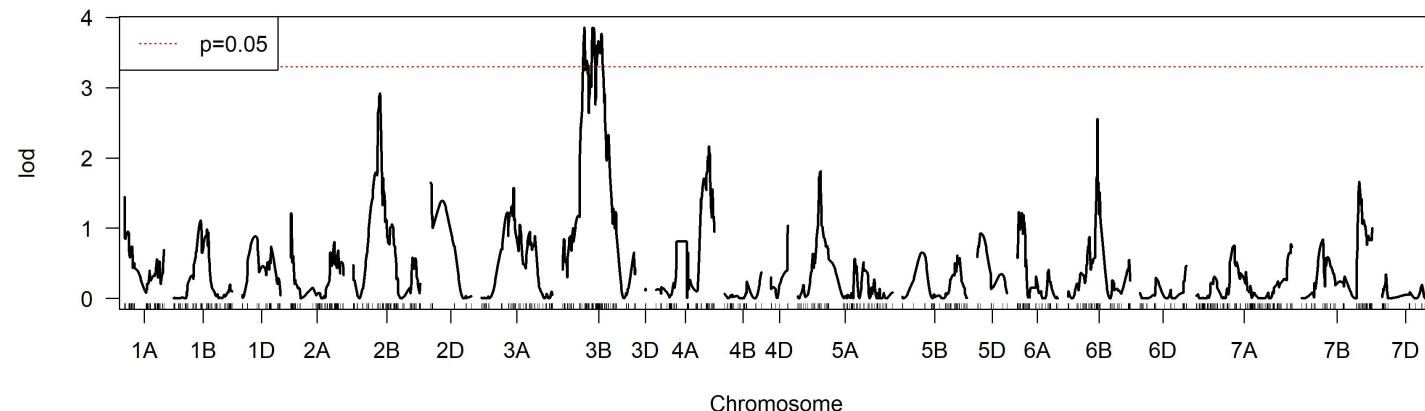


Visual Ratings in Kinston, NC - 2020

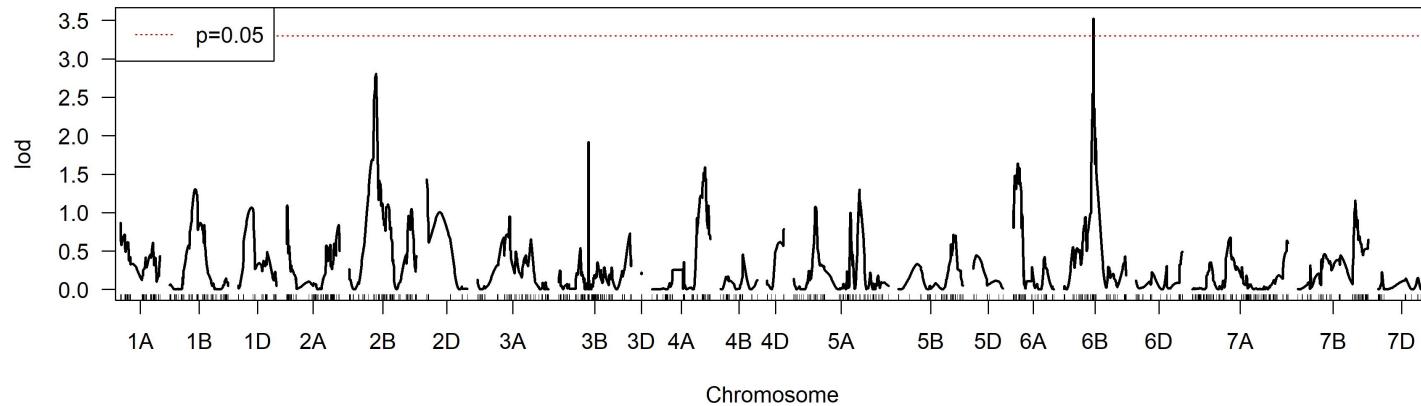
IM for VR_KIN20



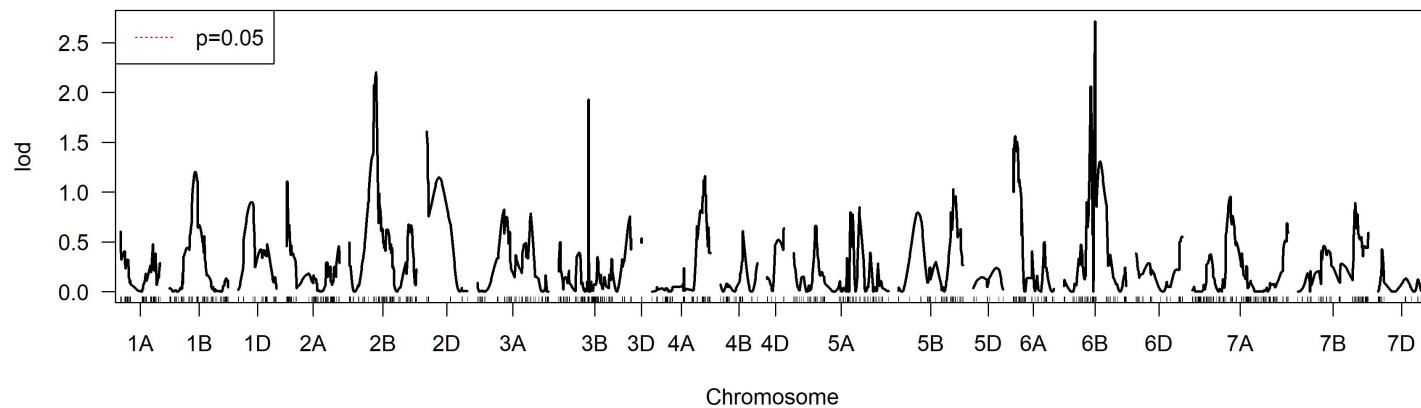
MQM 1 for VR_KIN20



MQM 2 for VR_KIN20

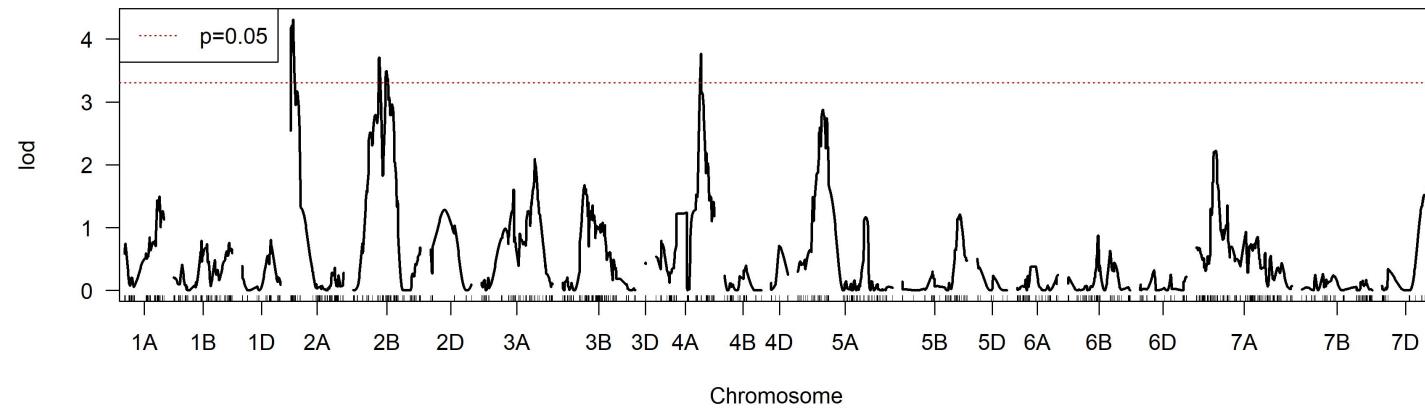


MQM 3 for VR_KIN20

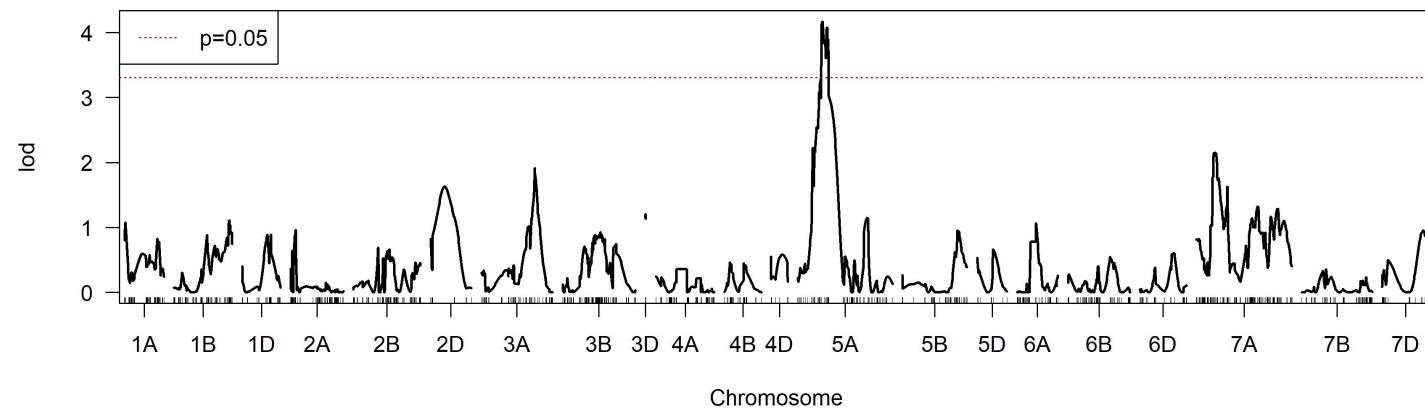


Visual Ratings in Raleigh, NC - 2019

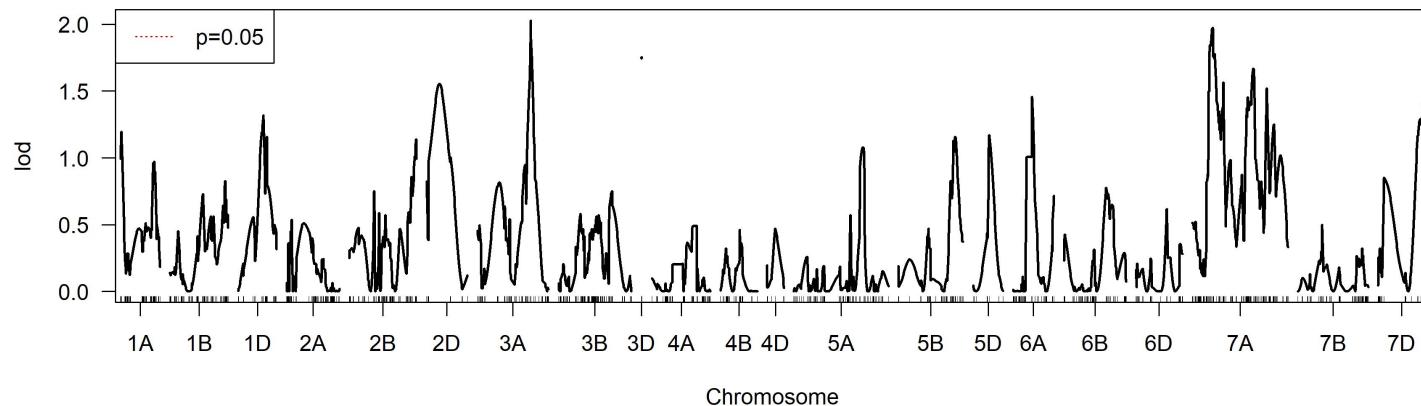
IM for VR_RAL19



MQM 1 for VR_RAL19

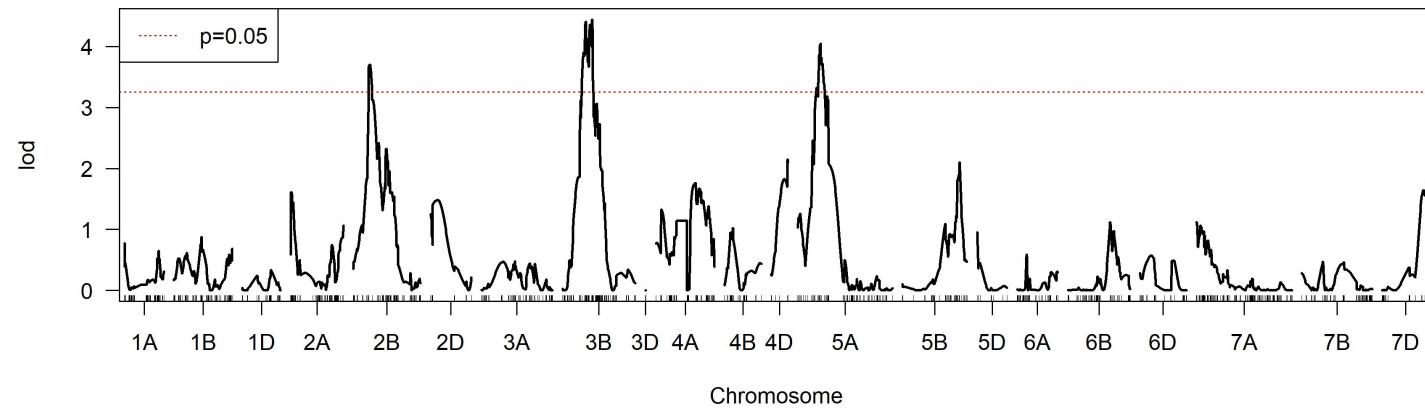


MQM 2 for VR_RAL19

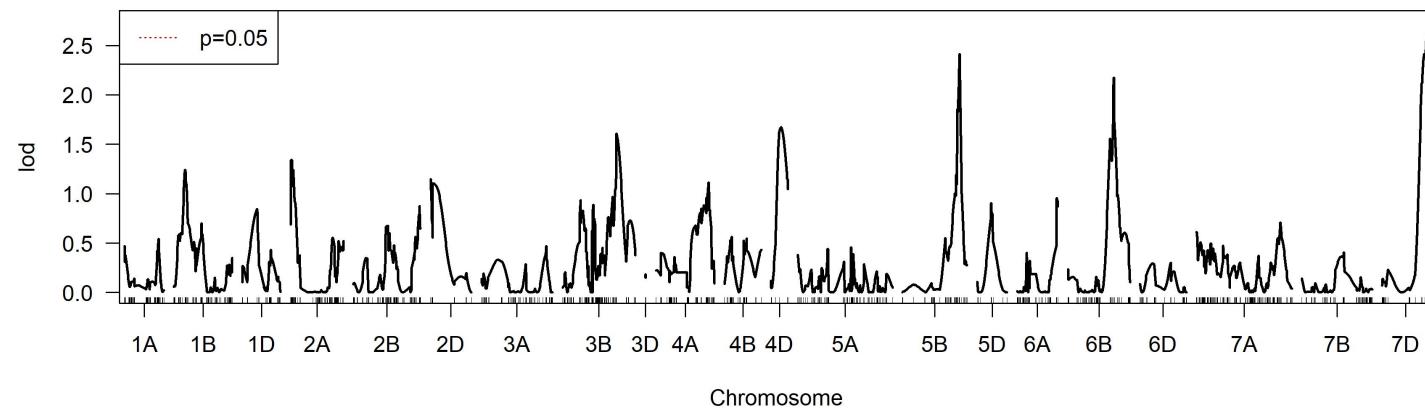


Visual Ratings in Raleigh, NC - 2020

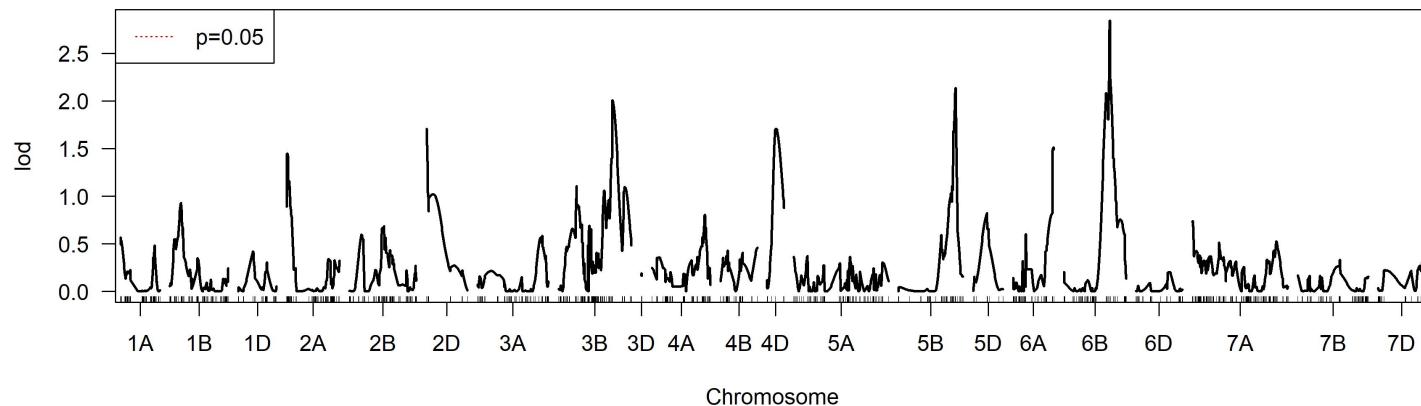
IM for VR_RAL20



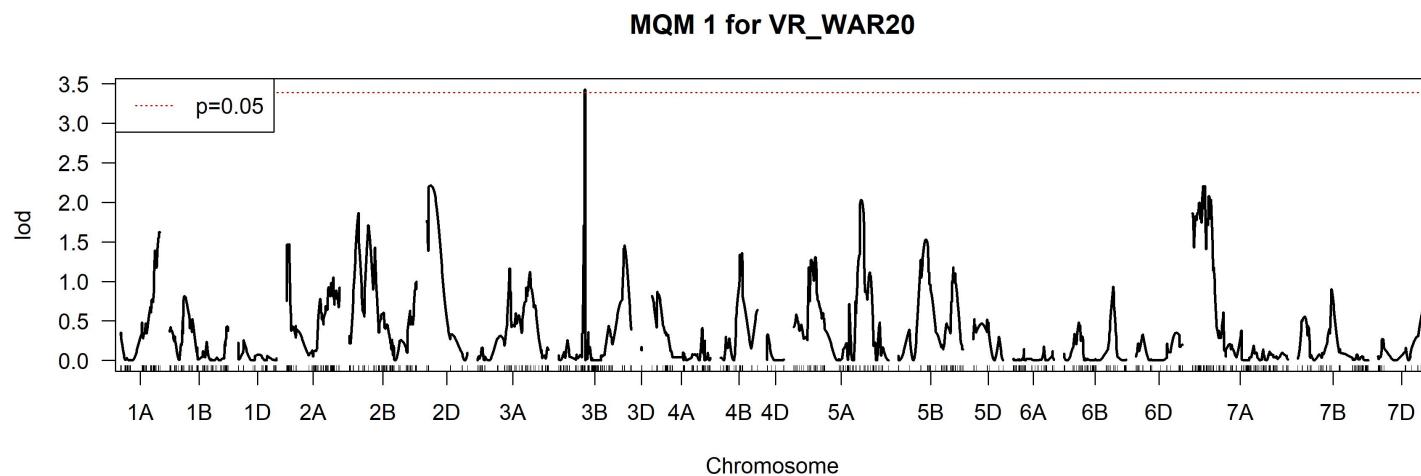
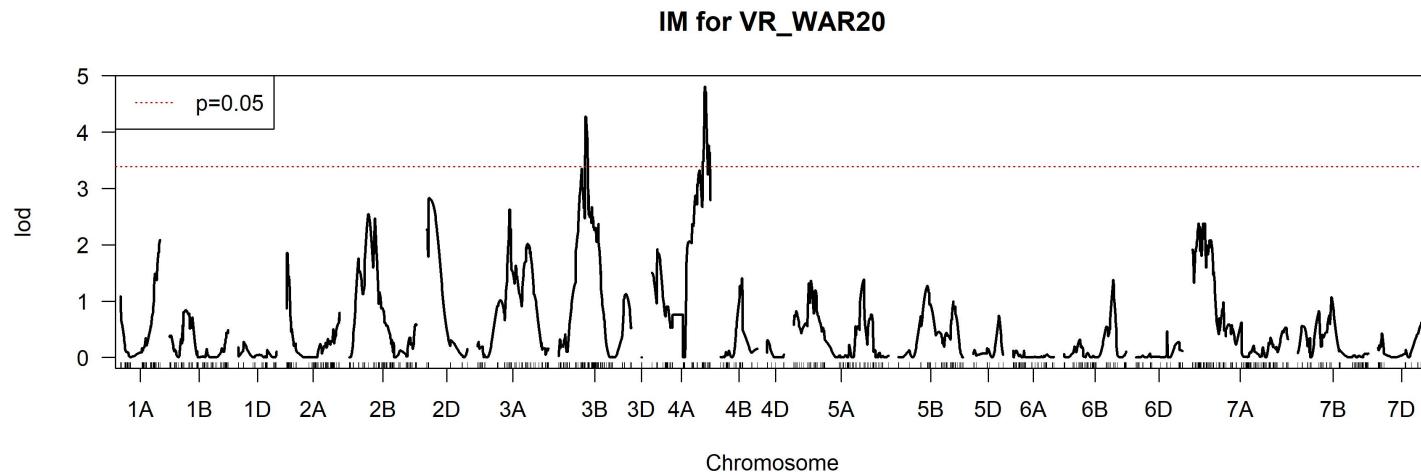
MQM 1 for VR_RAL20



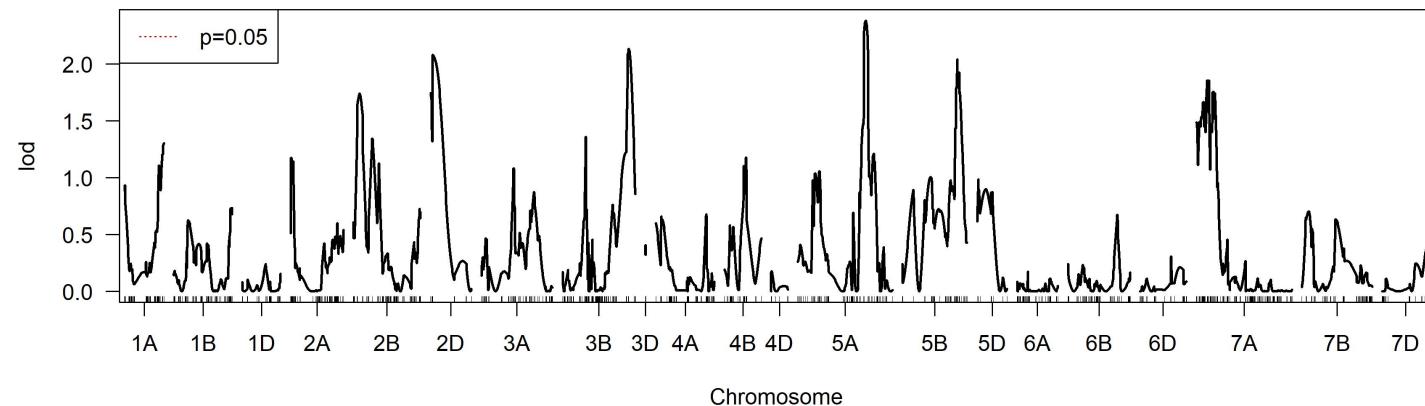
MQM 2 for VR_RAL20



Visual Ratings in Warsaw, VA - 2020

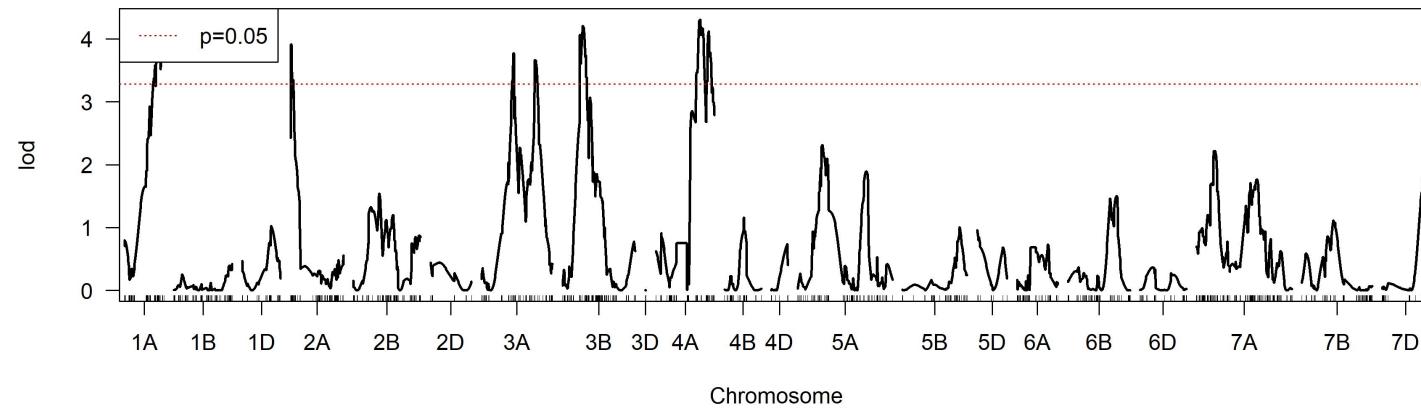


MQM 2 for VR_WAR20

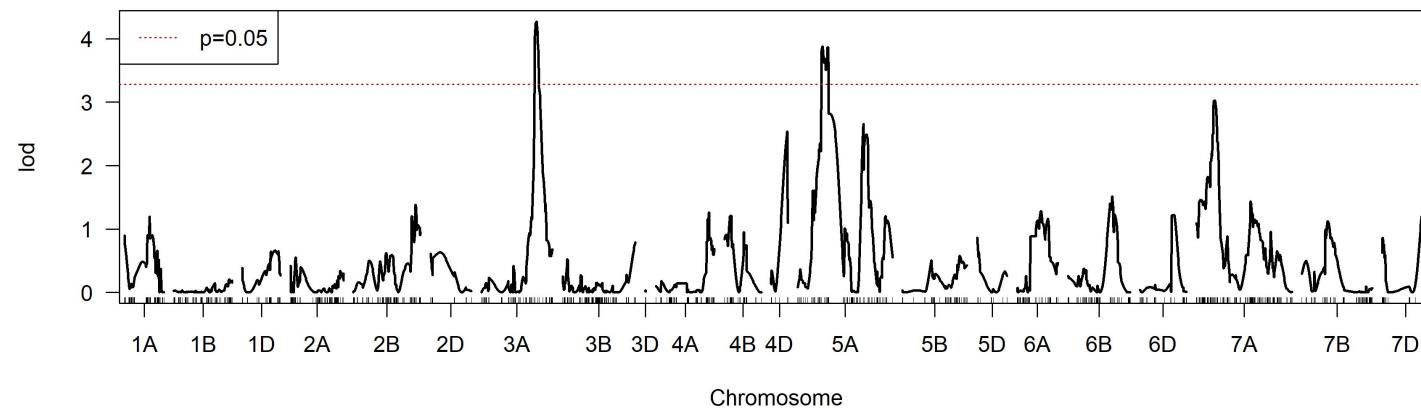


Fusarium Damaged Kernels Across All Environments

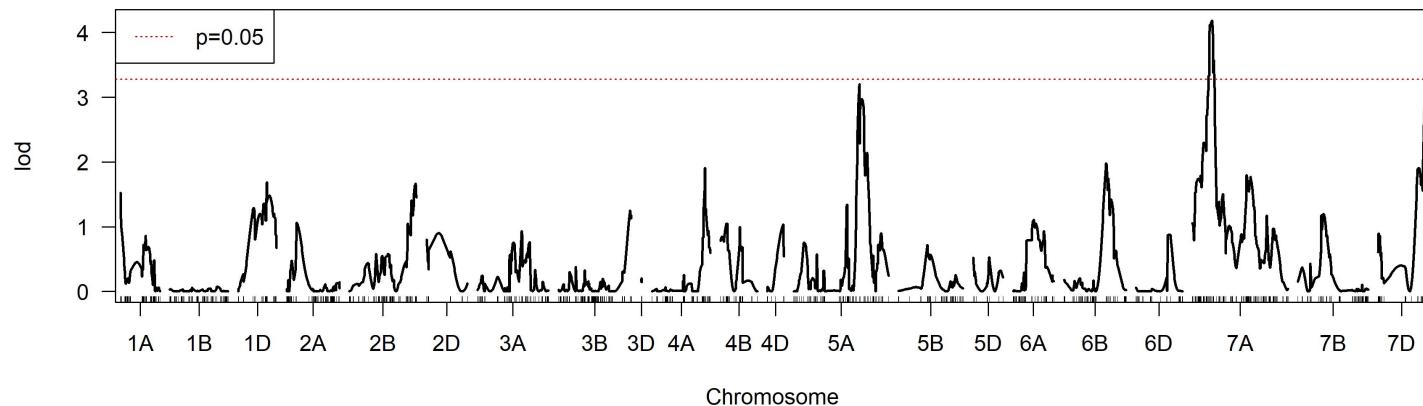
IM for FDK_ME



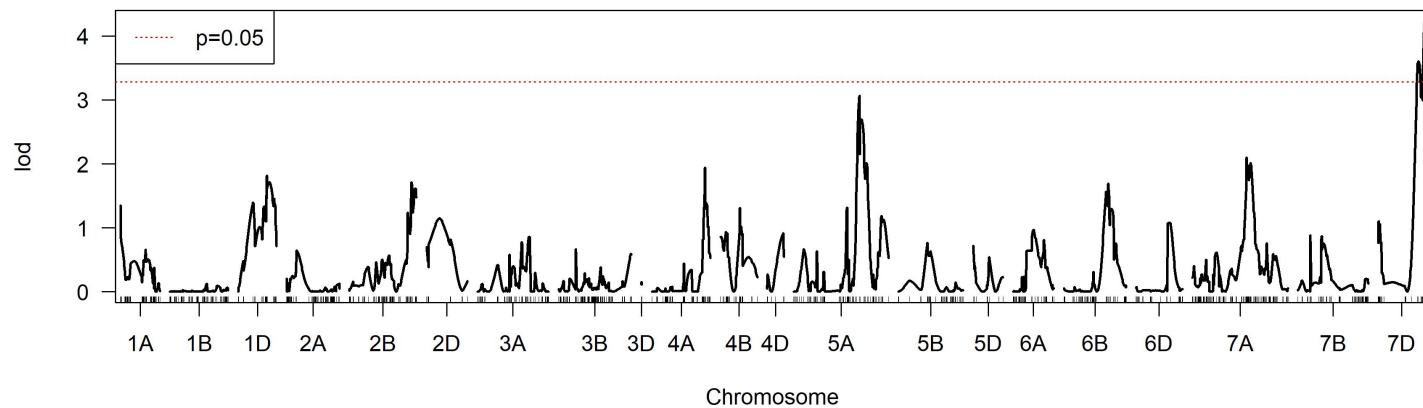
MQM 1 for FDK_ME



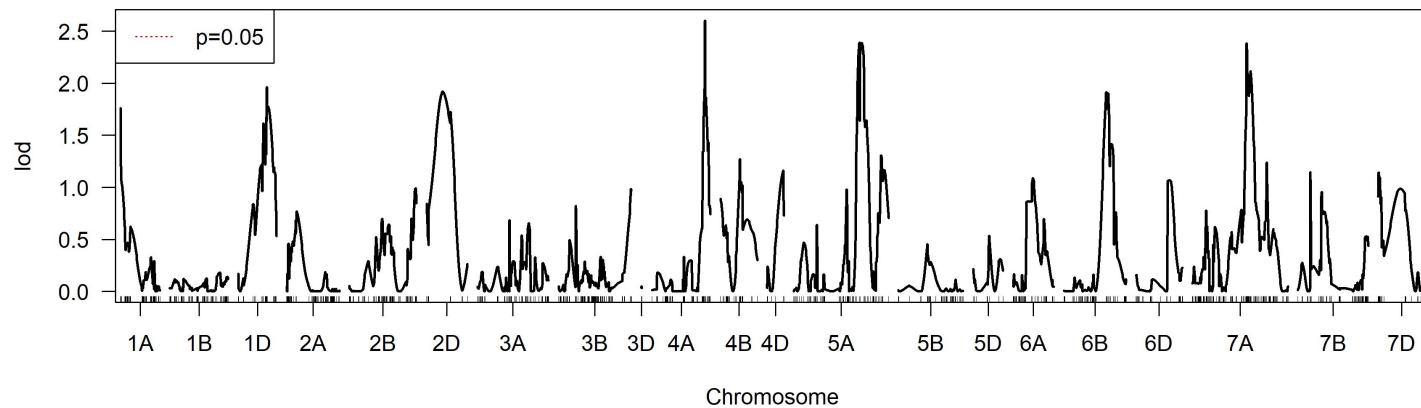
MQM 2 for FDK_ME



MQM 3 for FDK_ME

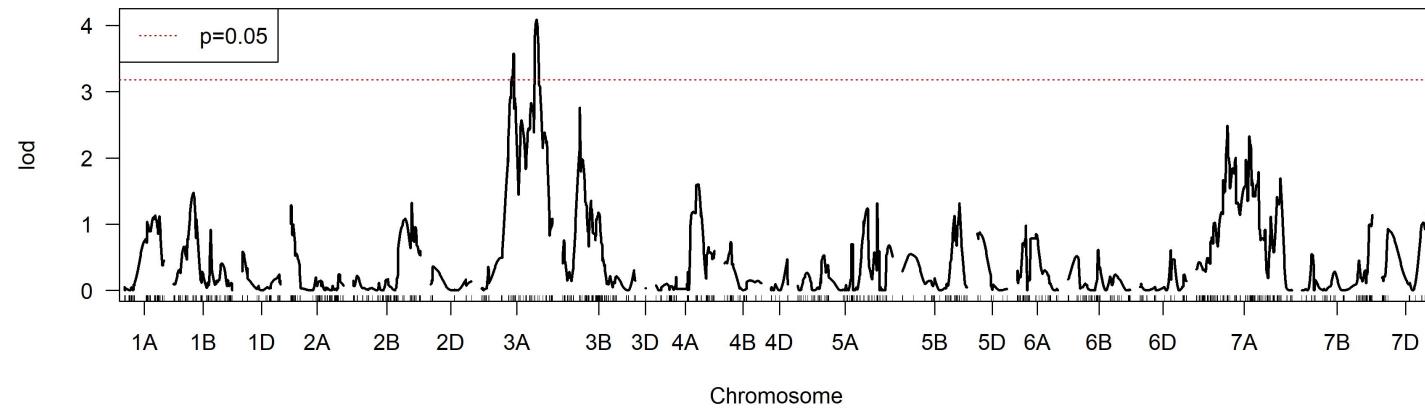


MQM 4 for FDK_ME

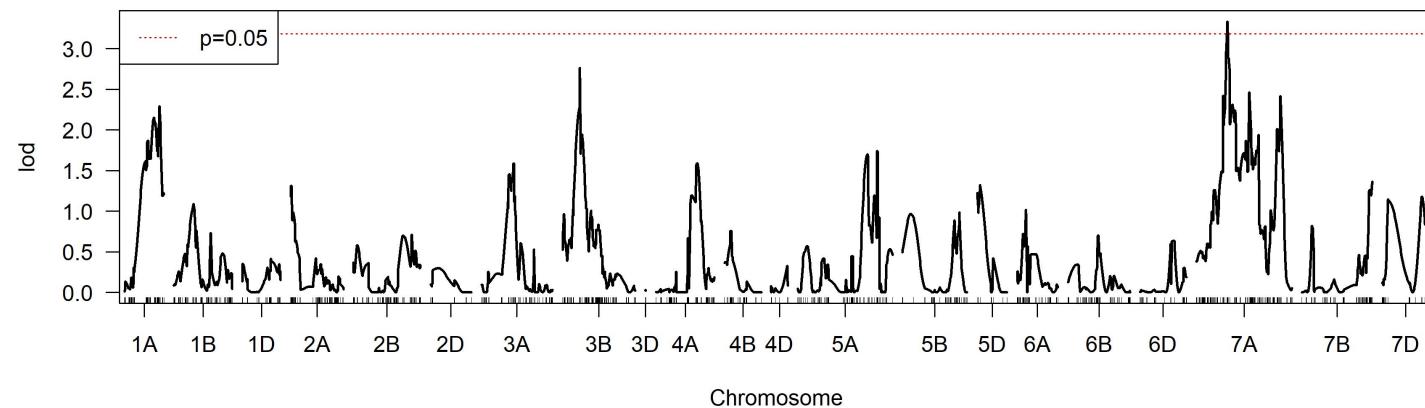


Fusarium Damaged Kernels in Kinston, NC - 2019

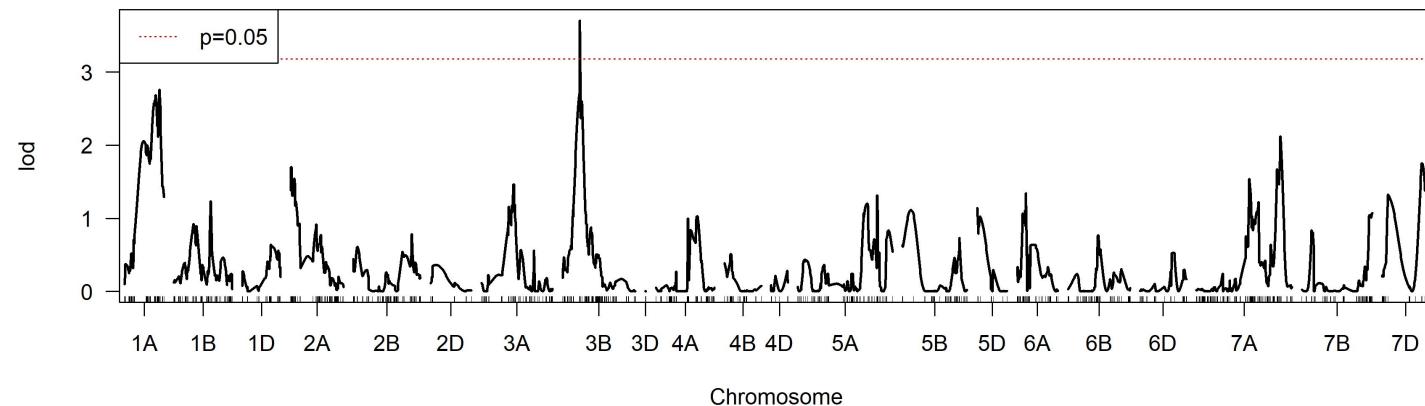
IM for FDK_KIN19



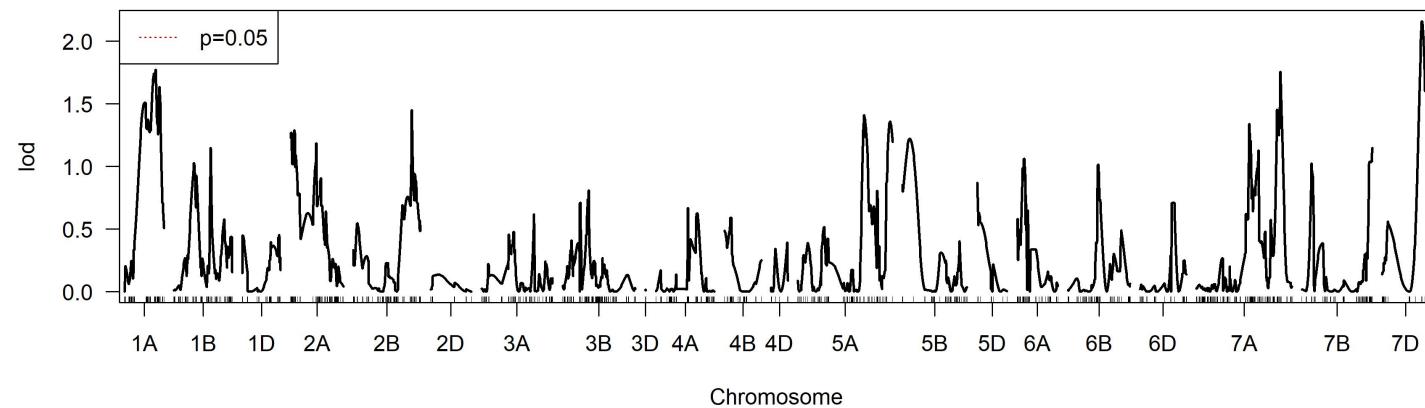
MQM 1 for FDK_KIN19



MQM 2 for FDK_KIN19

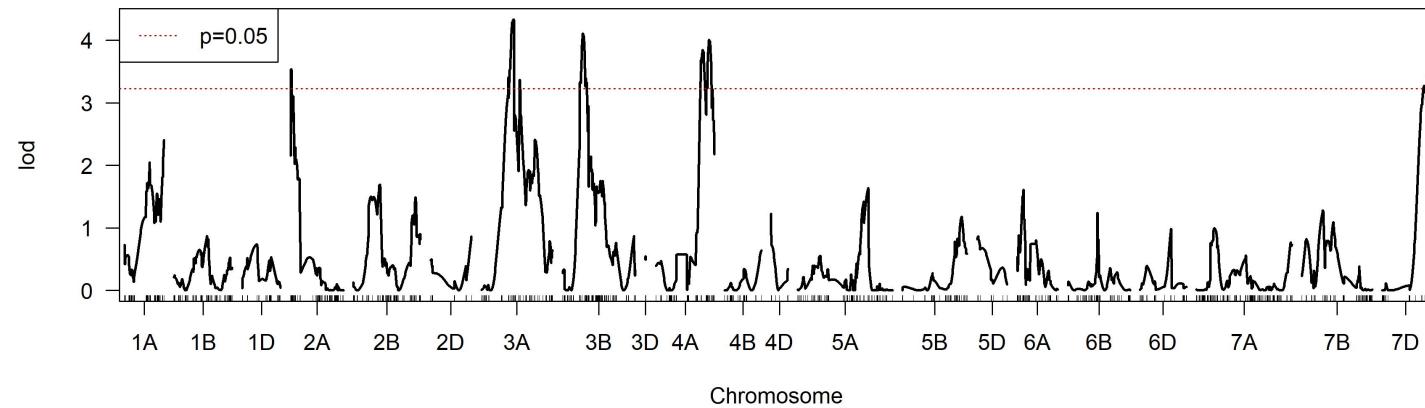


MQM 3 for FDK_KIN19

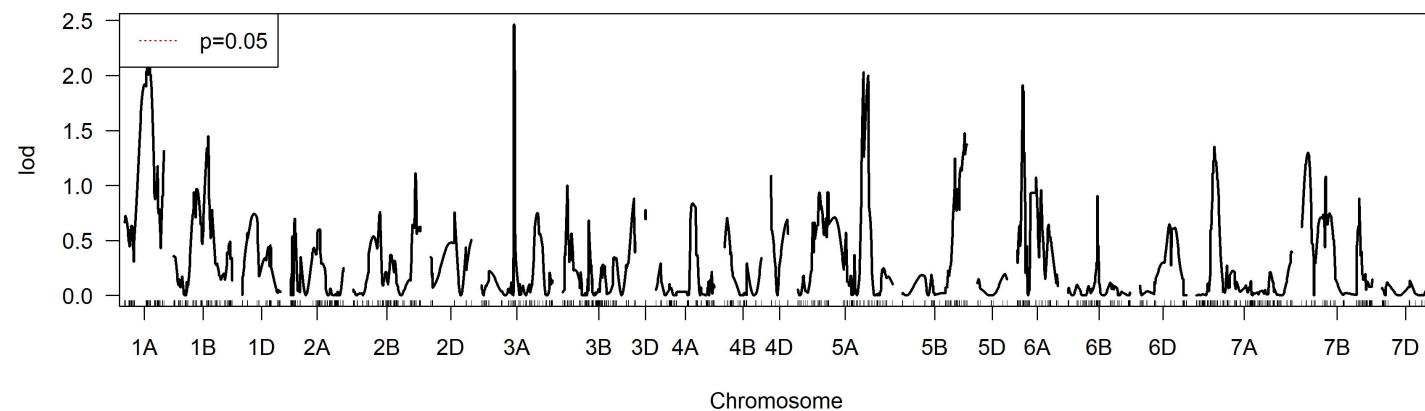


Fusarium Damaged Kernels in Kinston, NC - 2020

IM for FDK_KIN20

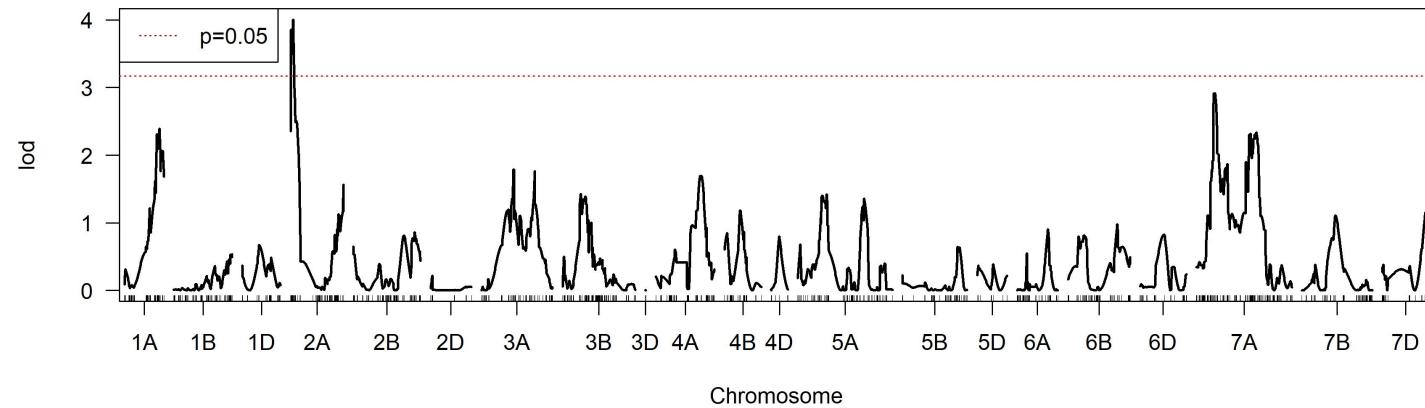


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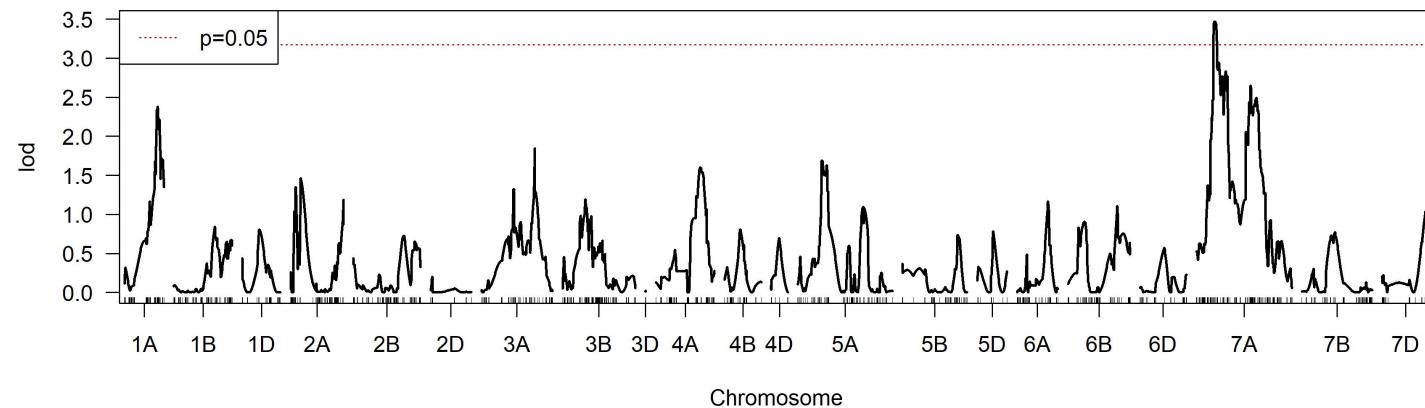


Fusarium Damaged Kernels in Raleigh, NC - 2019

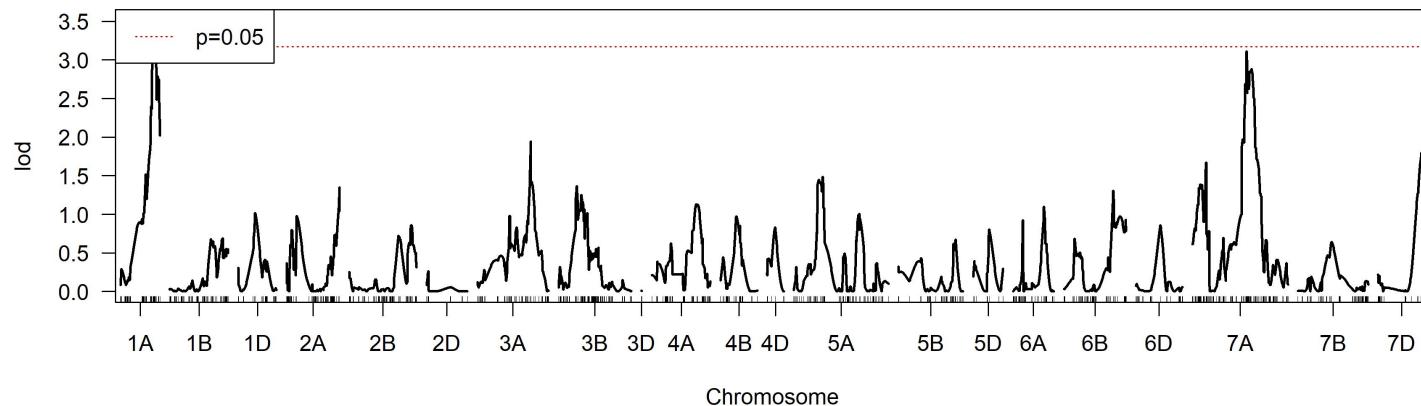
IM for FDK_RAL19



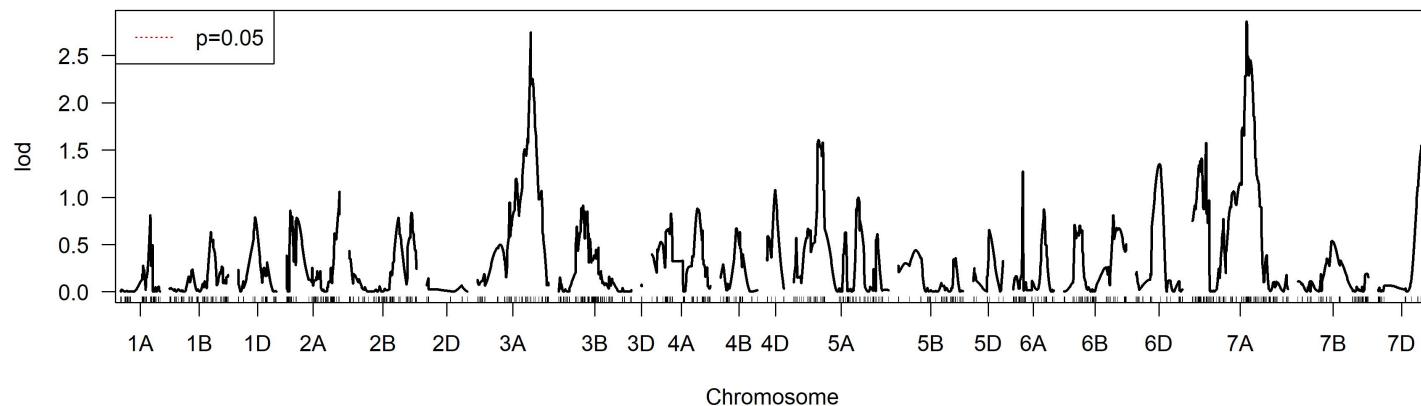
MQM 1 for FDK_RAL19



MQM 2 for FDK_RAL19

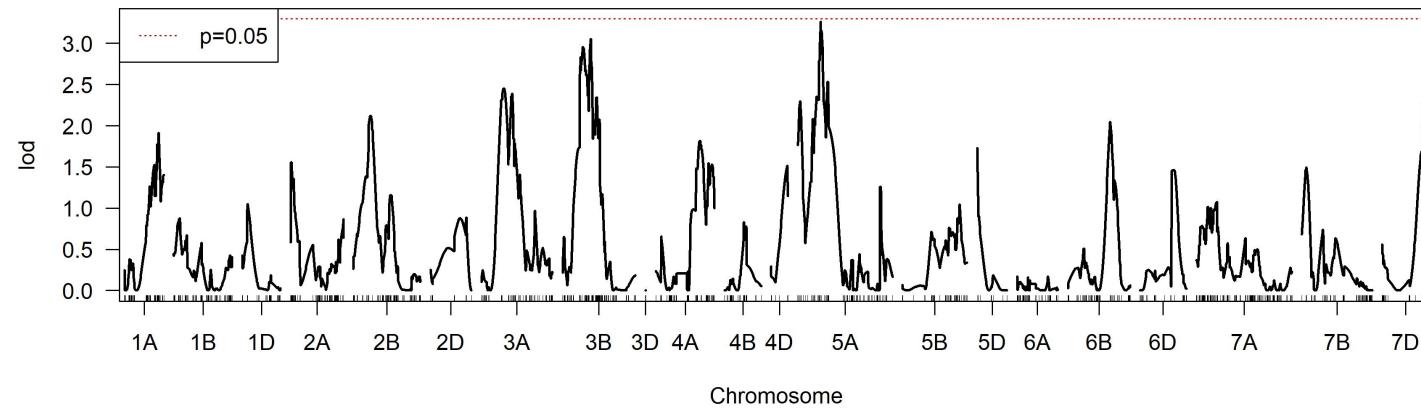


MQM 3 for FDK_RAL19

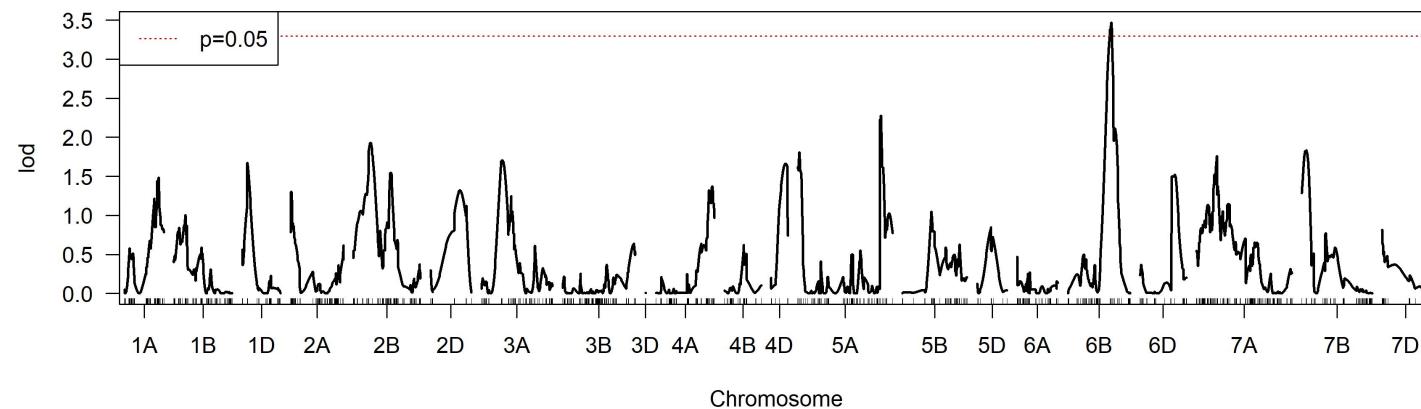


Fusarium Damaged Kernels in Raleigh, NC - 2020

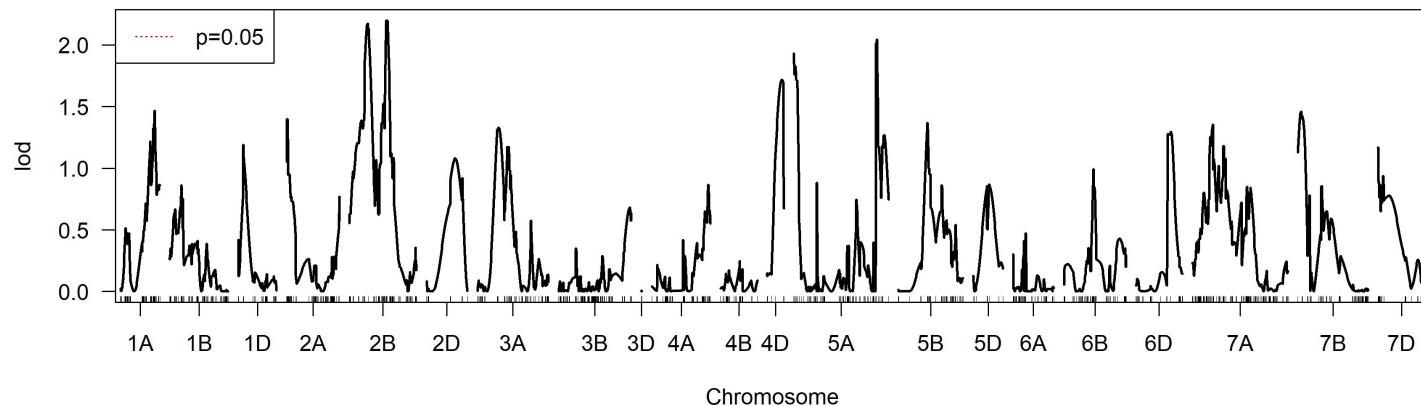
IM for FDK_RAL20



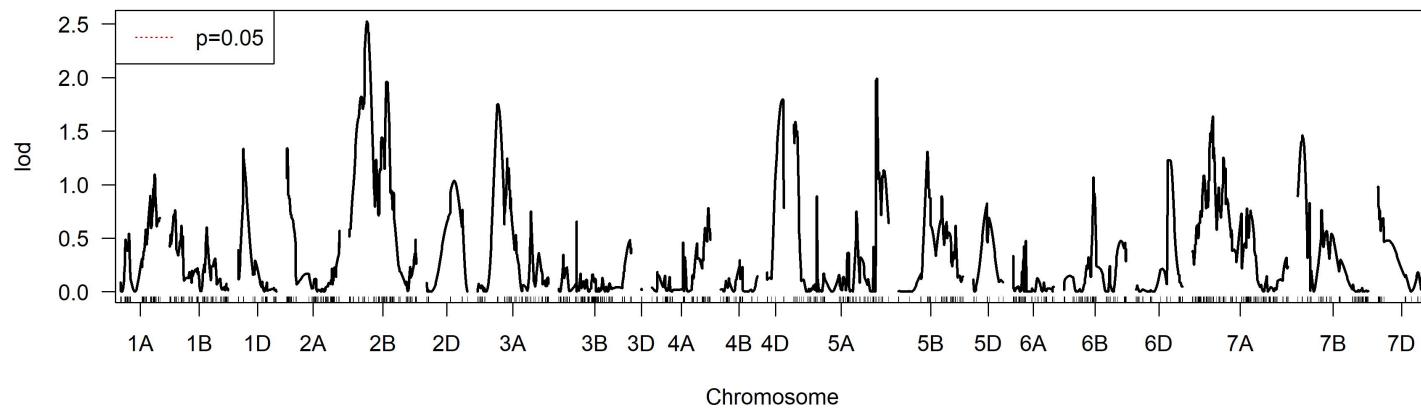
MQM 1 for FDK_RAL20



MQM 2 for FDK_RAL20

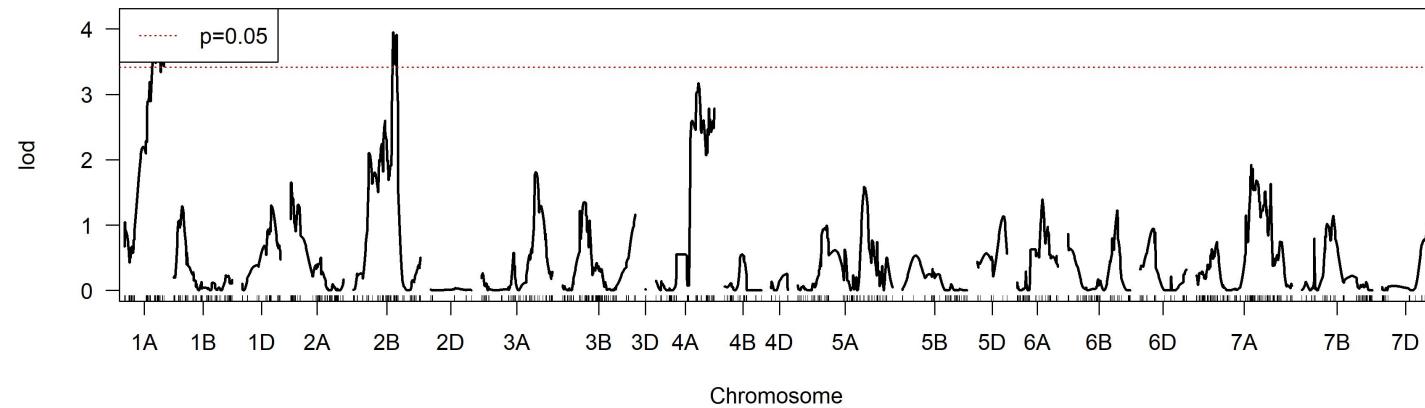


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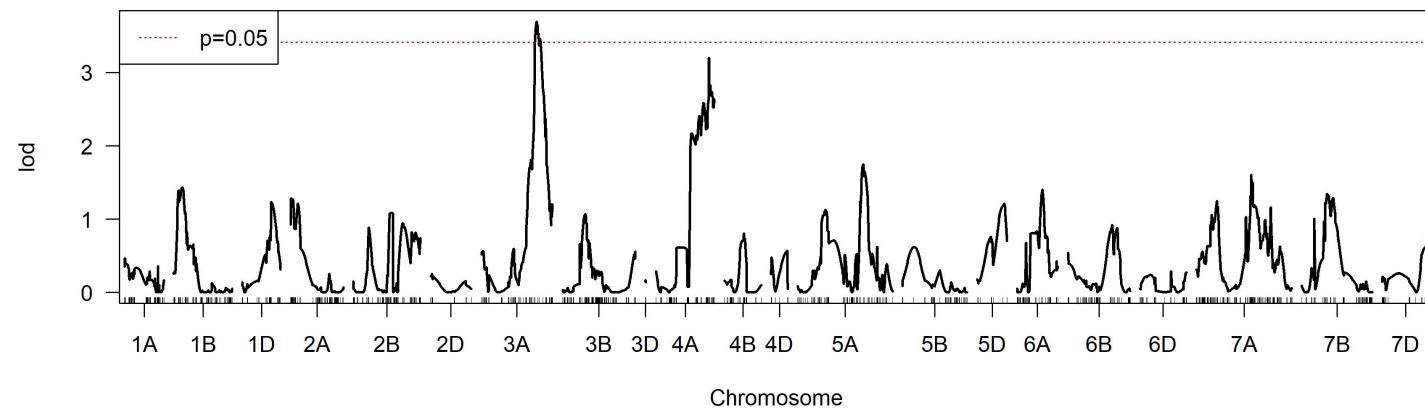


Fusarium Damaged Kernels in Warsaw, VA - 2019

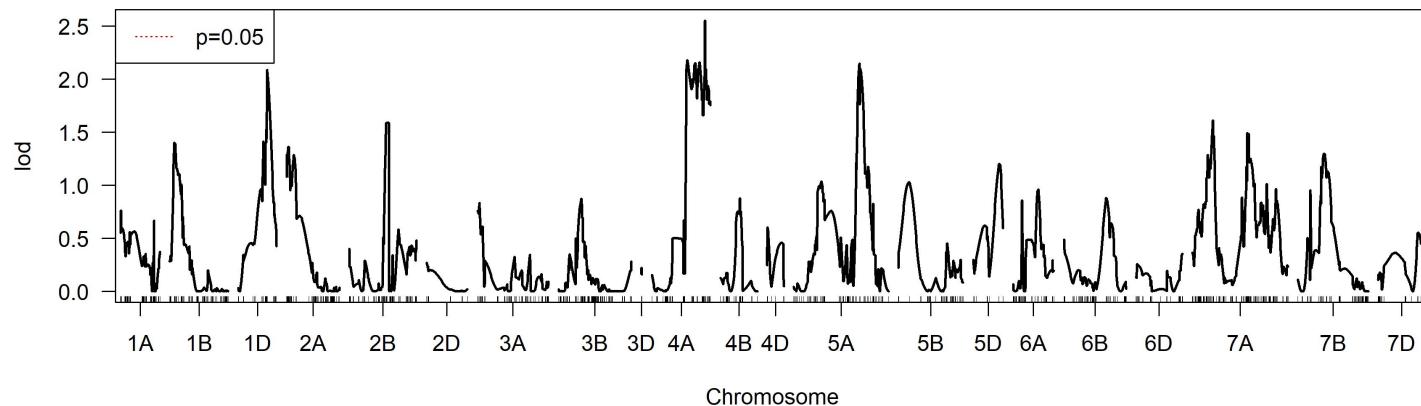
IM for FDK_WAR19



MQM 1 for FDK_WAR19

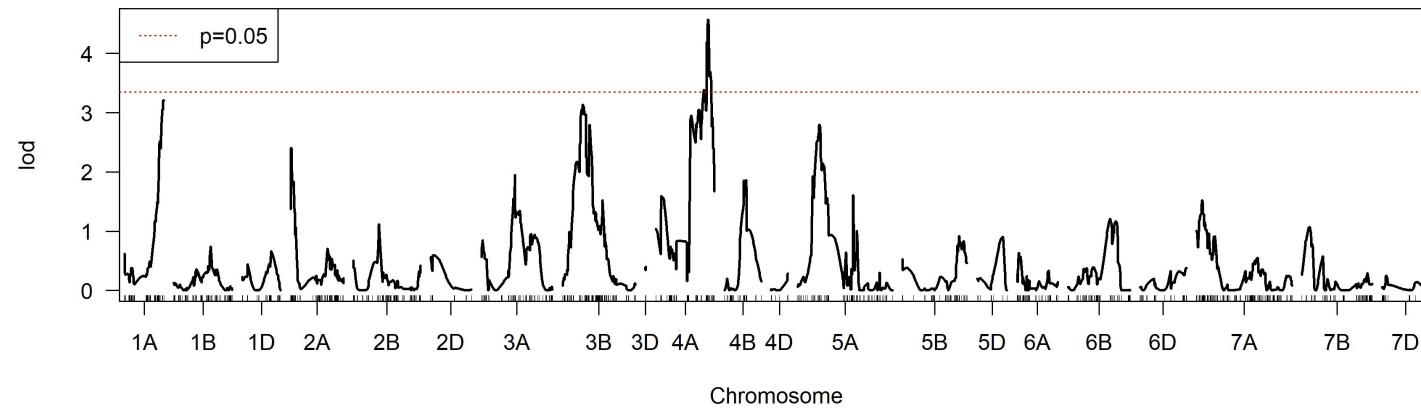


MQM 2 for FDK_WAR19

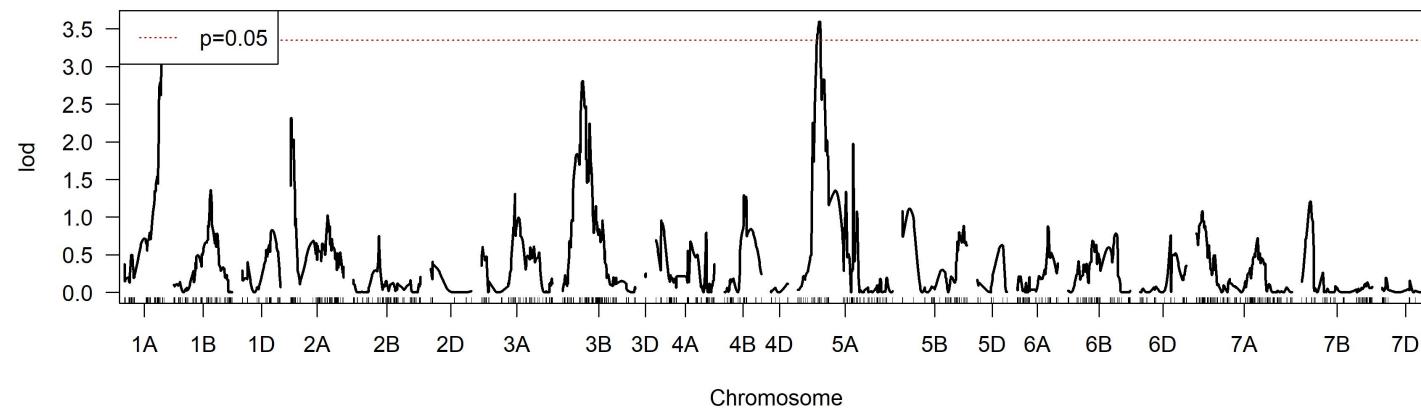


Fusarium Damaged Kernels in Warsaw, VA - 2020

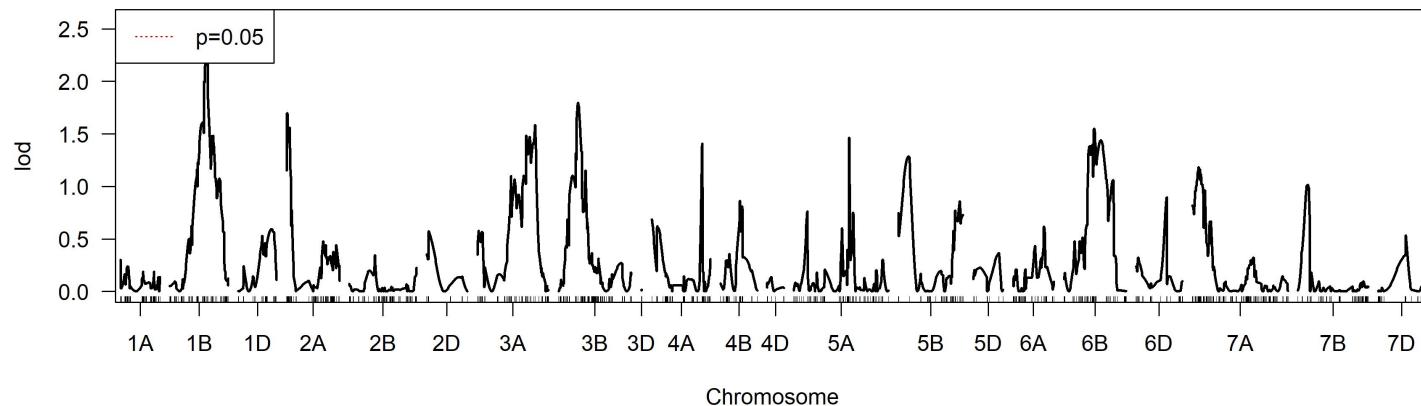
IM for FDK_WAR20



MQM 1 for FDK_WAR20

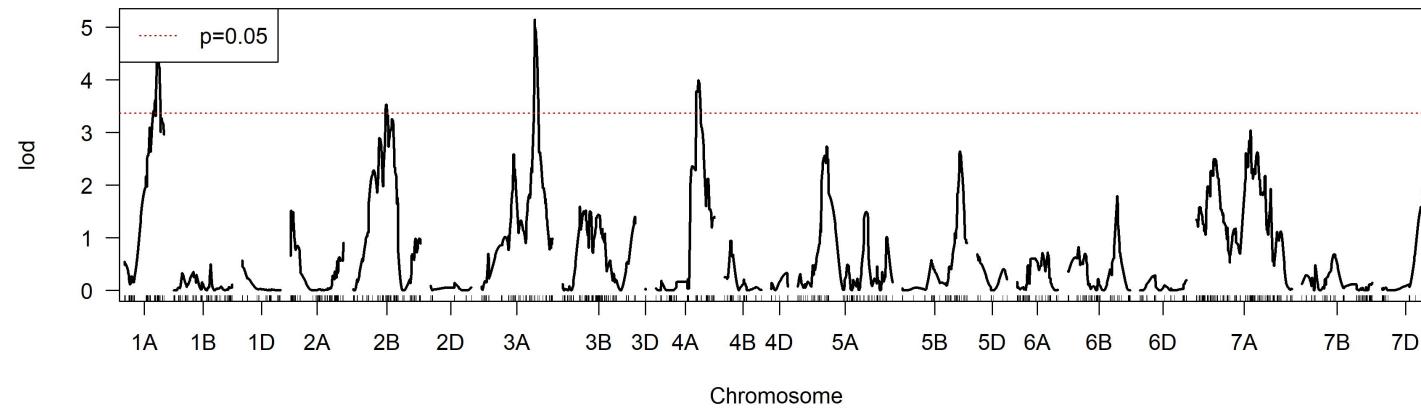


MQM 2 for FDK_WAR20

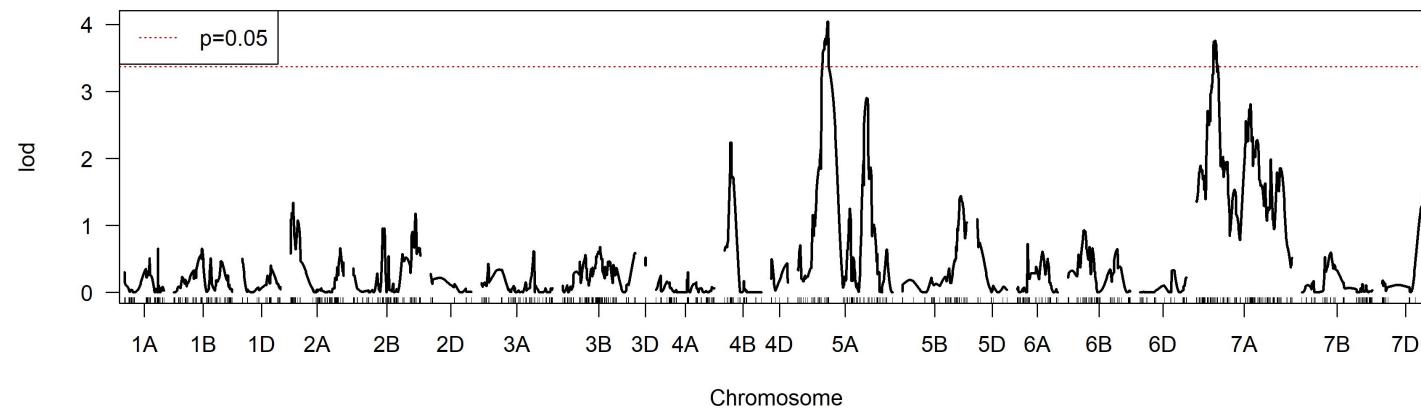


Deoxynivalenol Content Across All Environments

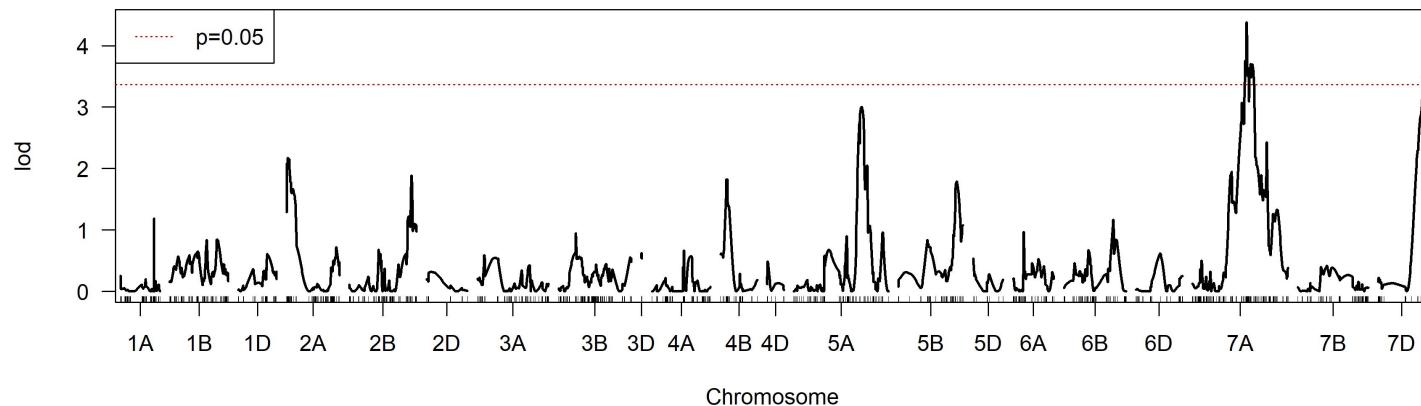
IM for DON_ME



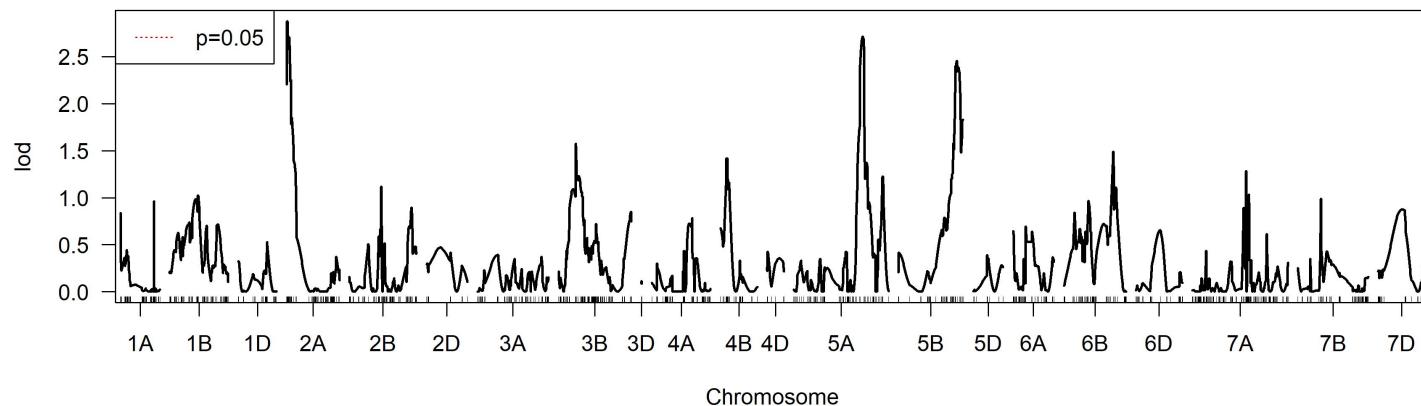
MQM 1 for DON_ME



MQM 2 for DON_ME

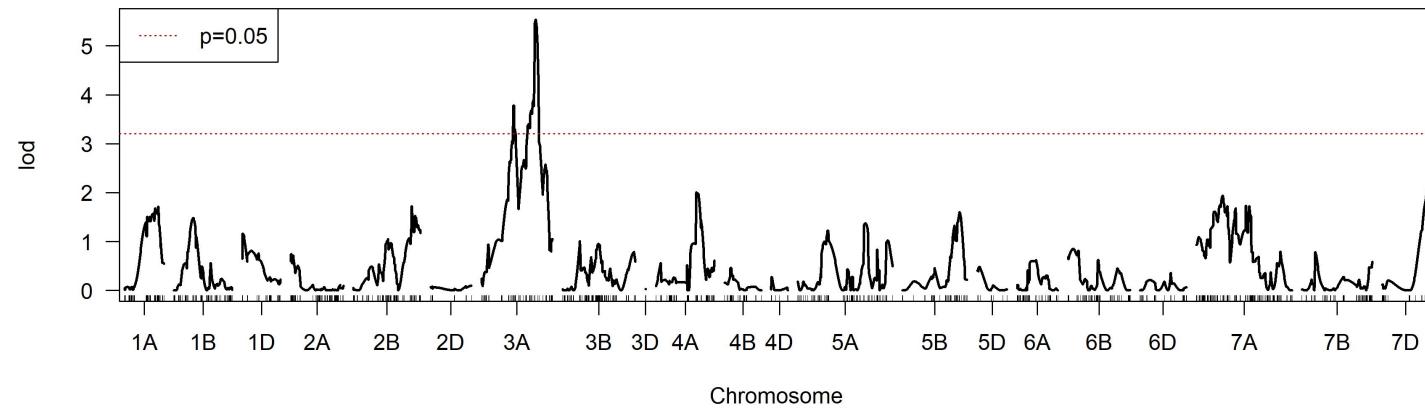


MQM 3 for DON_ME

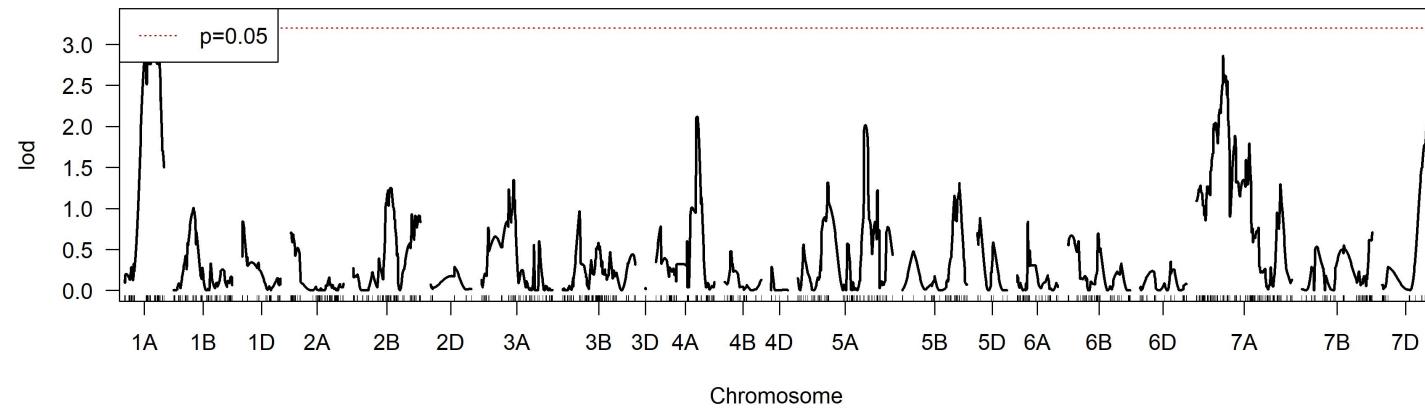


Deoxynivalenol Content in Kinston, NC - 2019

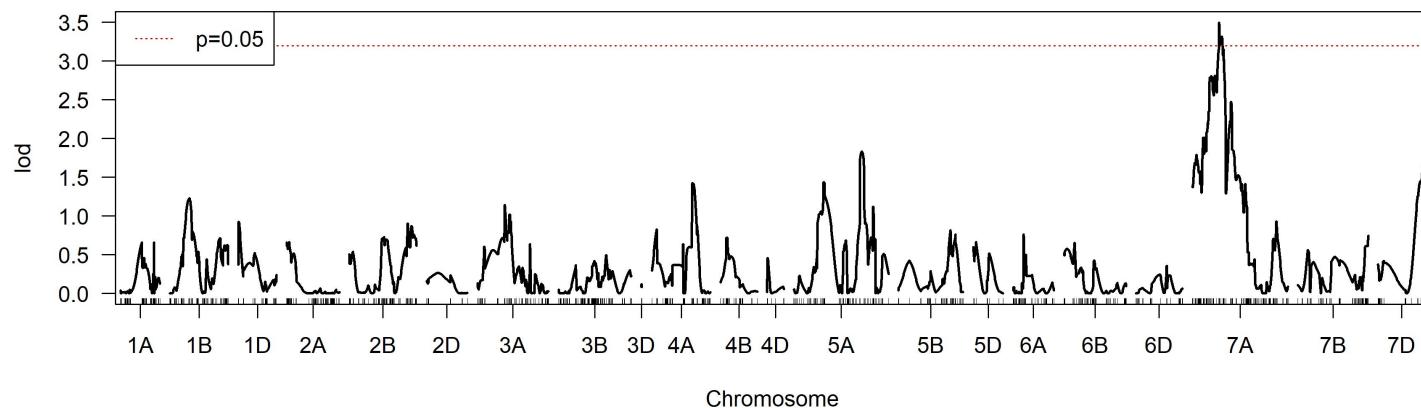
IM for DON_KIN19



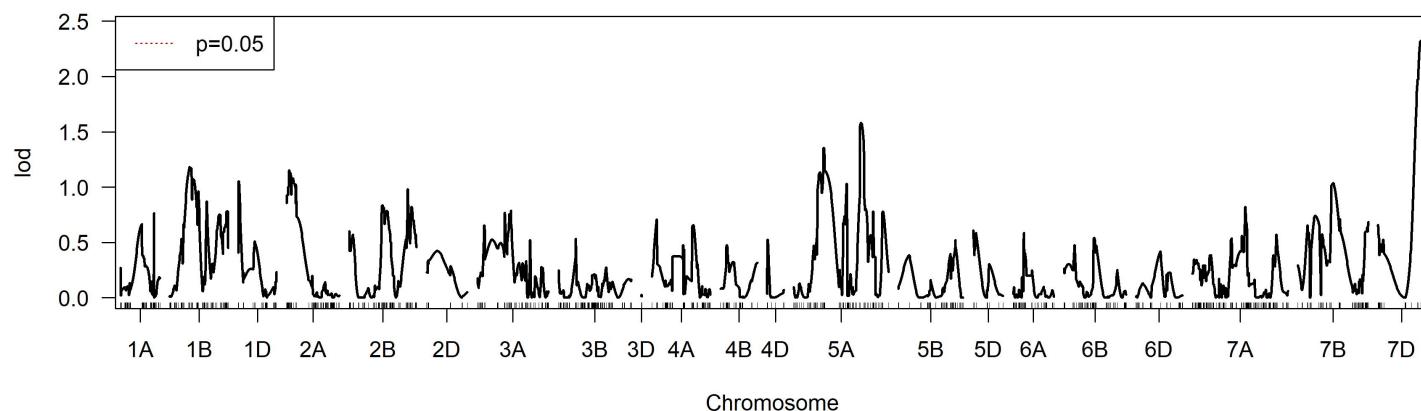
MQM 1 for DON_KIN19



MQM 2 for DON_KIN19

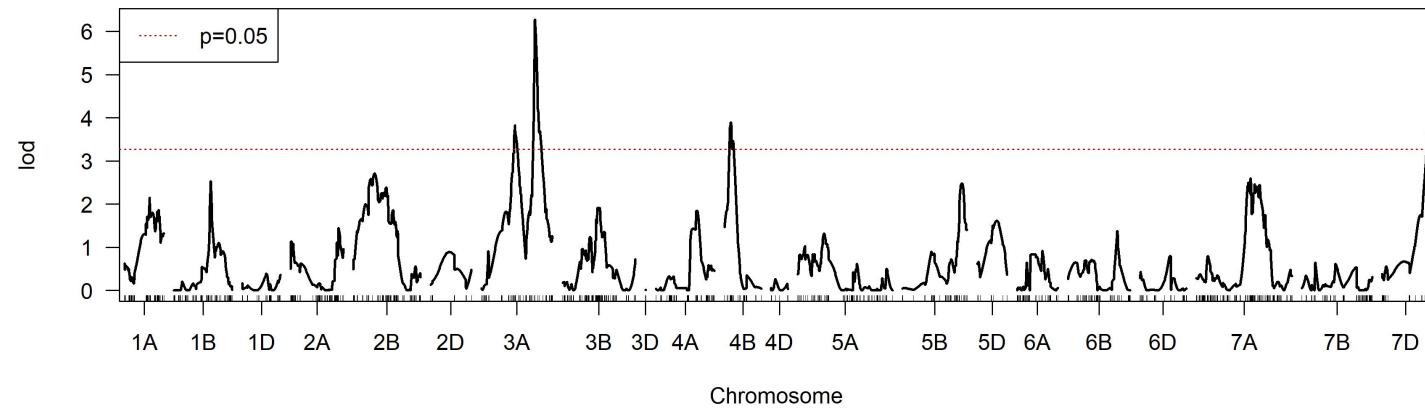


MQM 3 for DON_KIN19

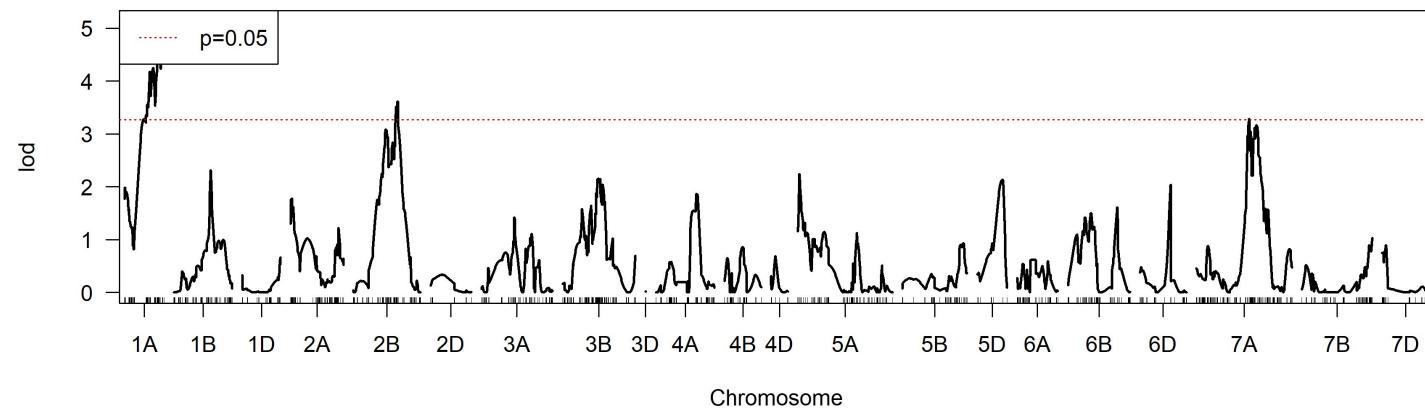


Deoxynivalenol Content in Kinston, NC - 2020

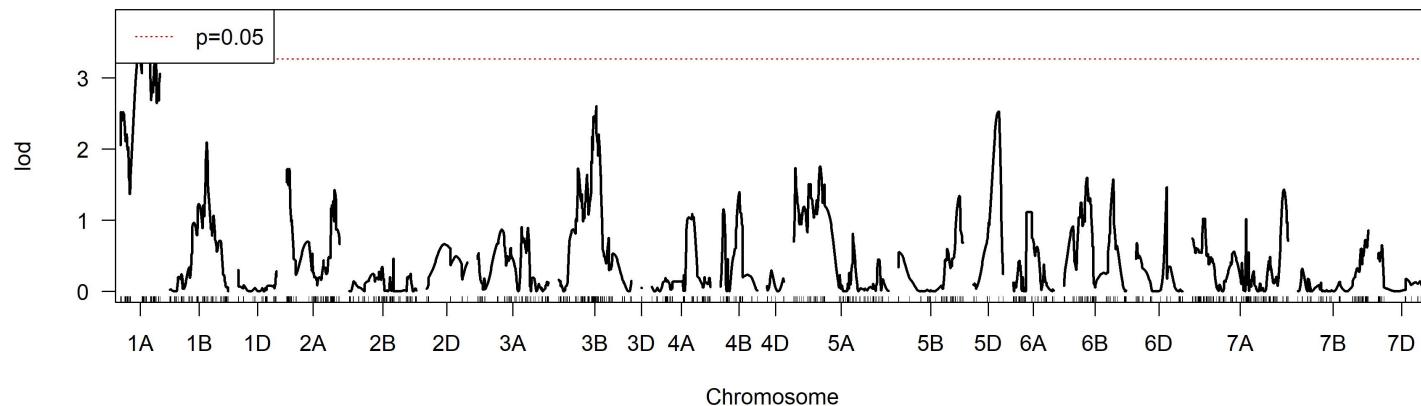
IM for DON_KIN20



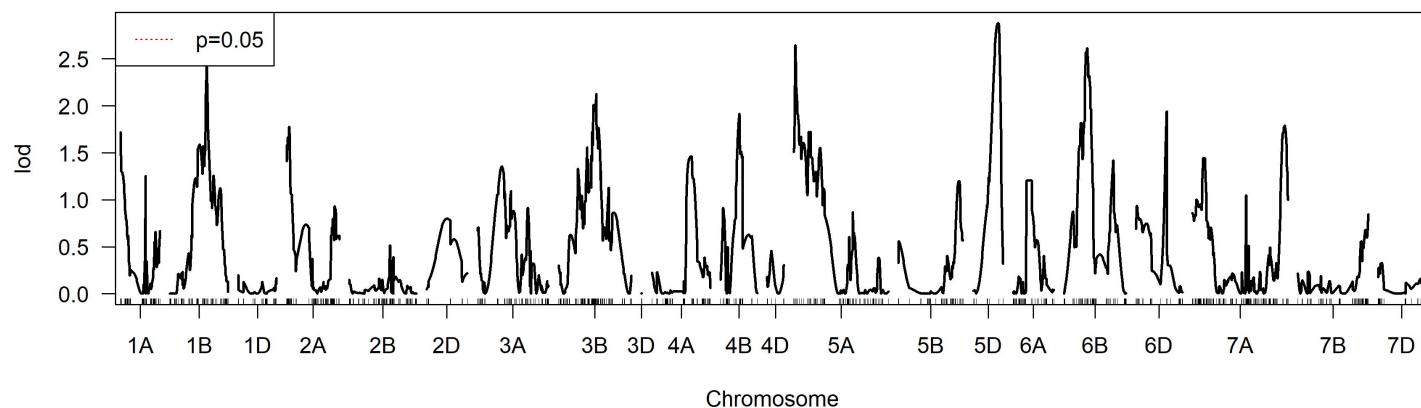
MQM 1 for DON_KIN20



MQM 2 for DON_KIN20

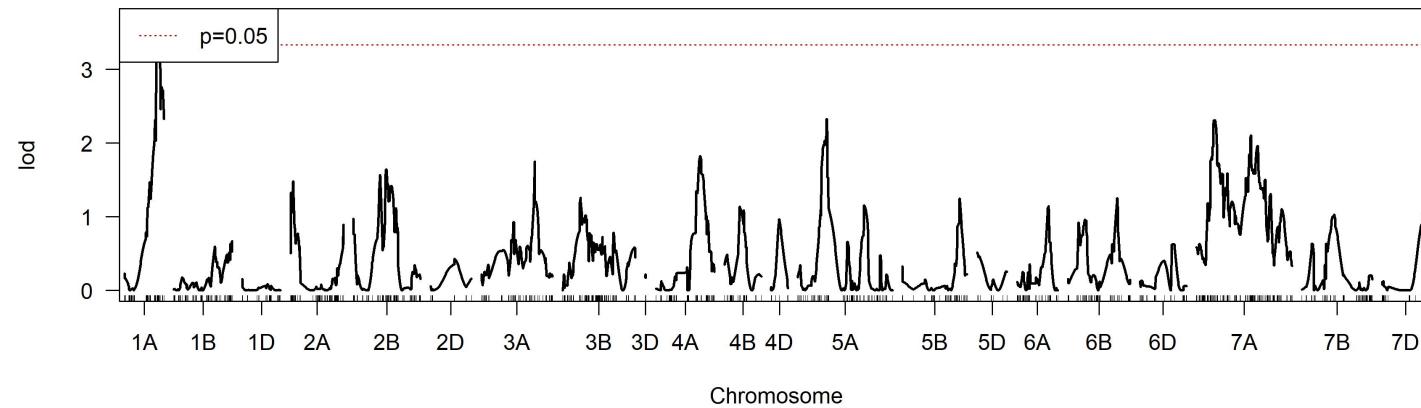


MQM 3 for DON_KIN20

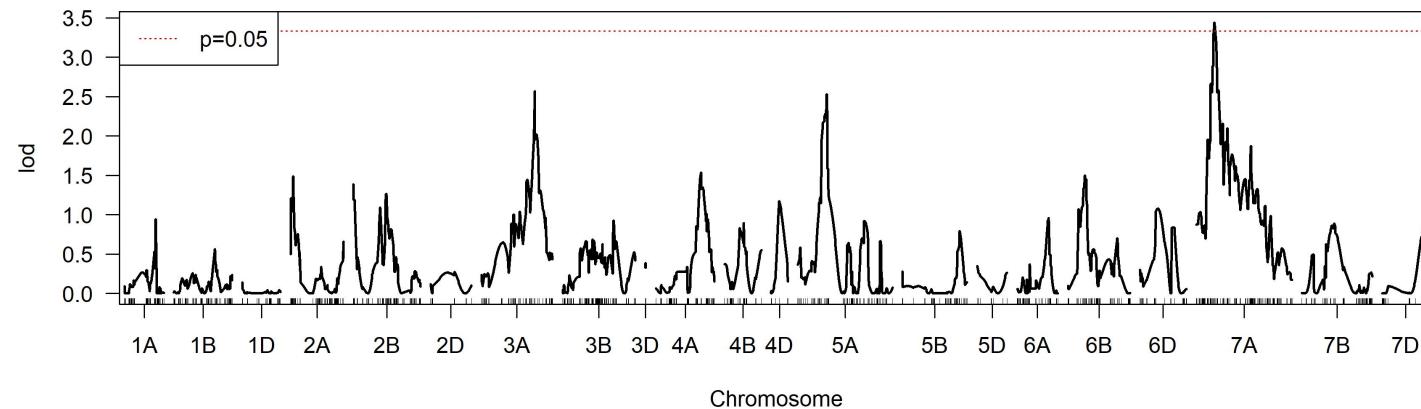


Deoxynivalenol Content in Raleigh, NC - 2019

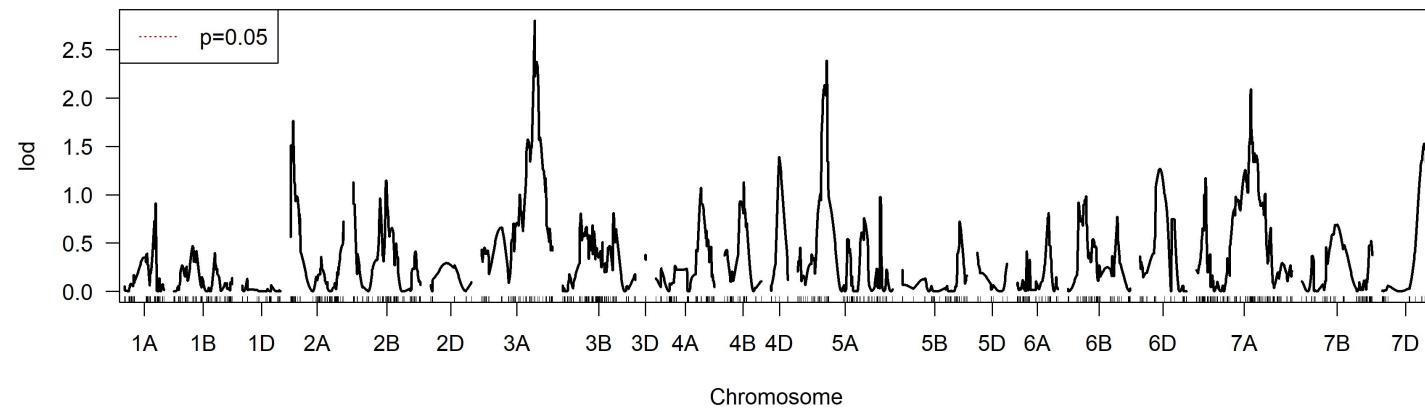
IM for DON_RAL19



MQM 1 for DON_RAL19

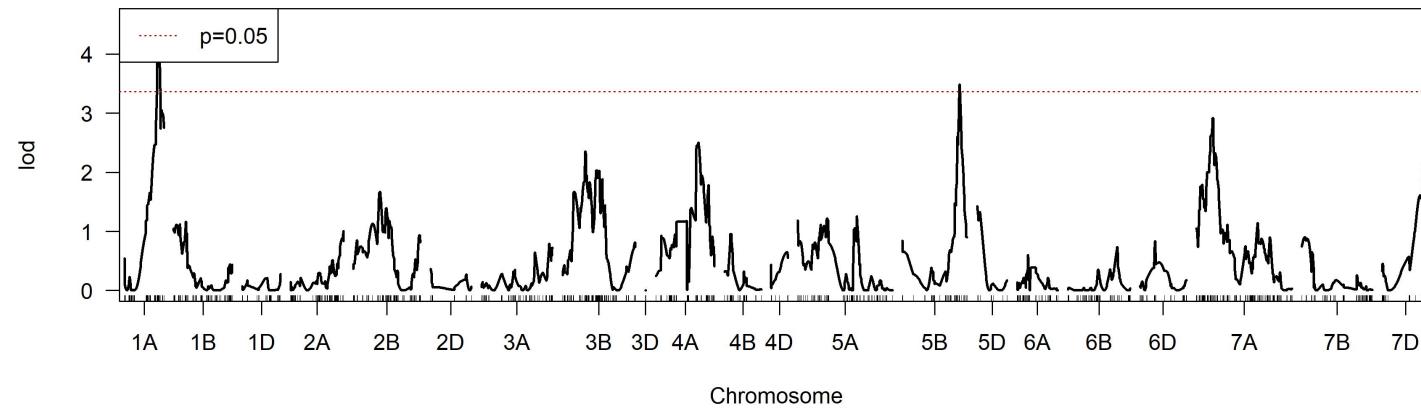


MQM 2 for DON_RAL19

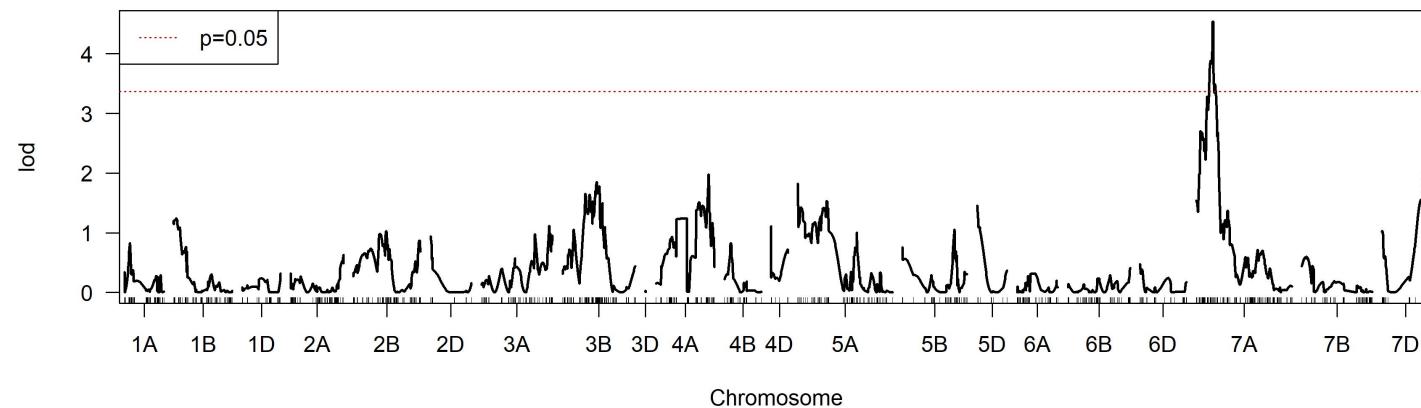


Deoxynivalenol Content in Raleigh, NC - 2020

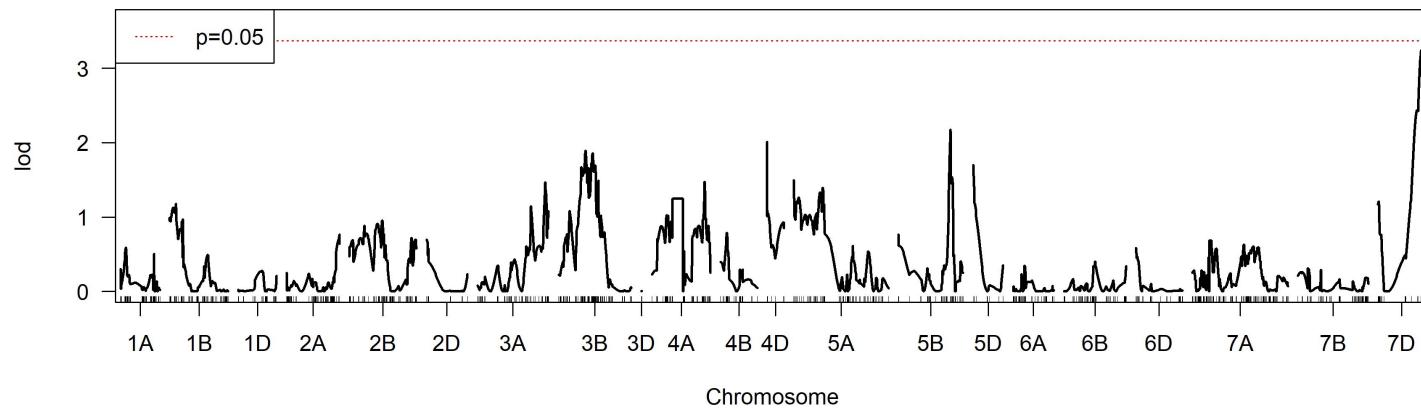
IM for DON_RAL20



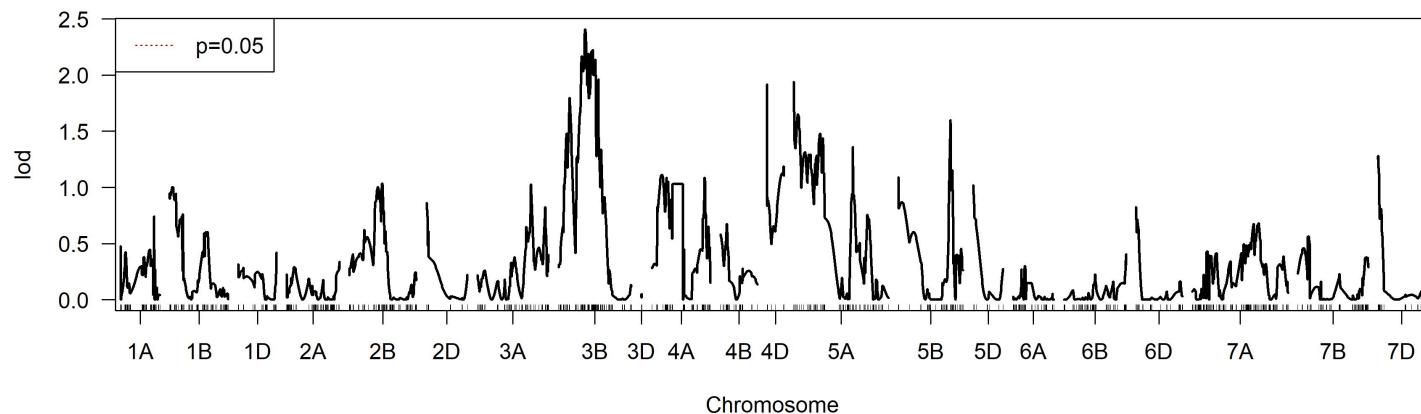
MQM 1 for DON_RAL20



MQM 2 for DON_RAL20

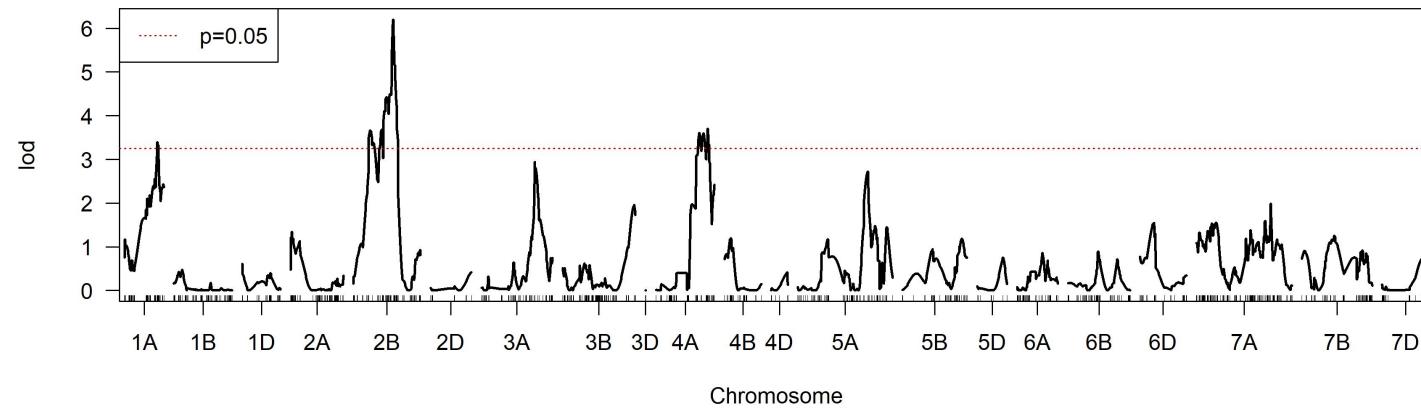


MQM 3 for DON_RAL20

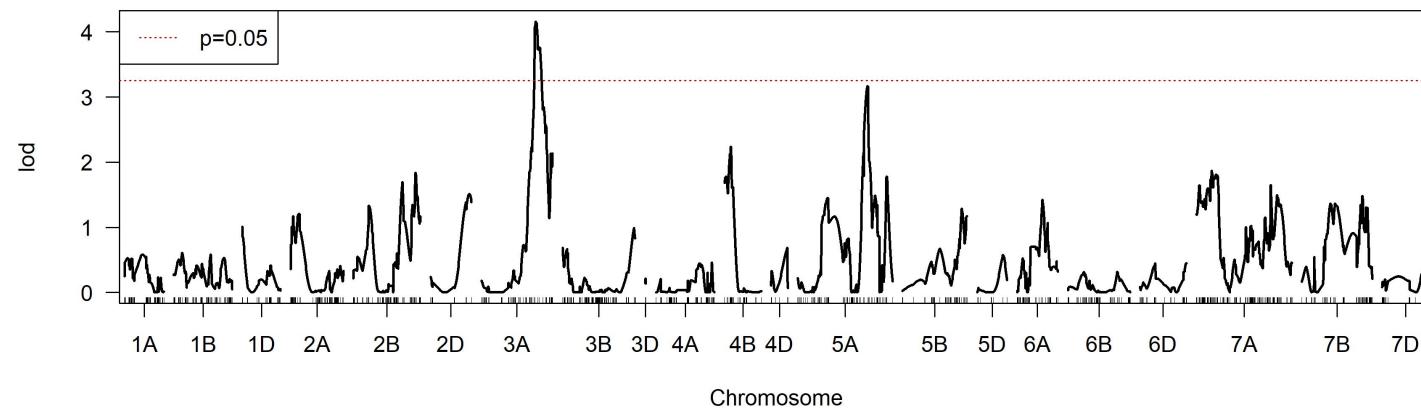


Deoxynivalenol Content in Warsaw, VA - 2019

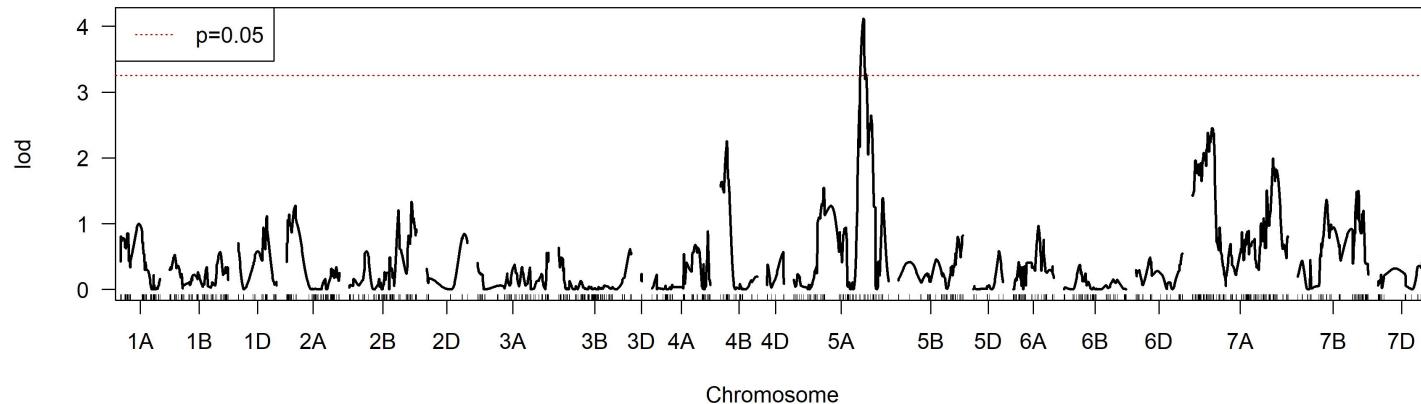
IM for DON_WAR19



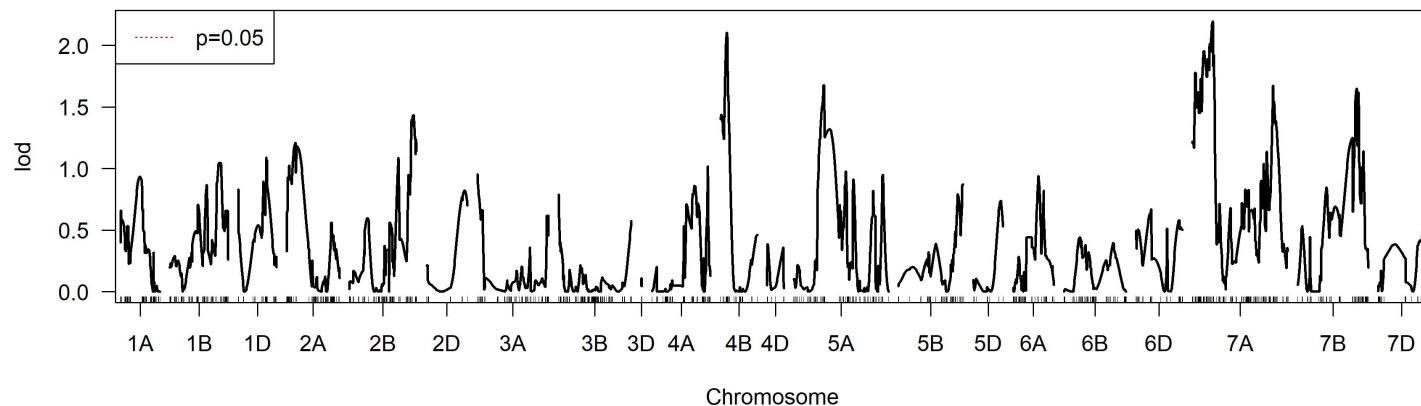
MQM 1 for DON_WAR19



MQM 2 for DON_WAR19

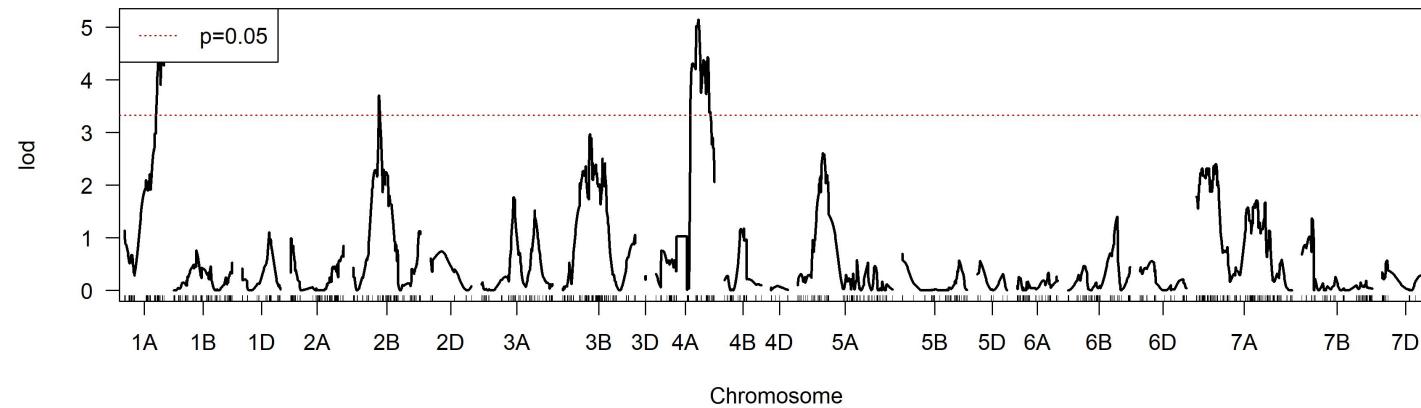


MQM 3 for DON_WAR19

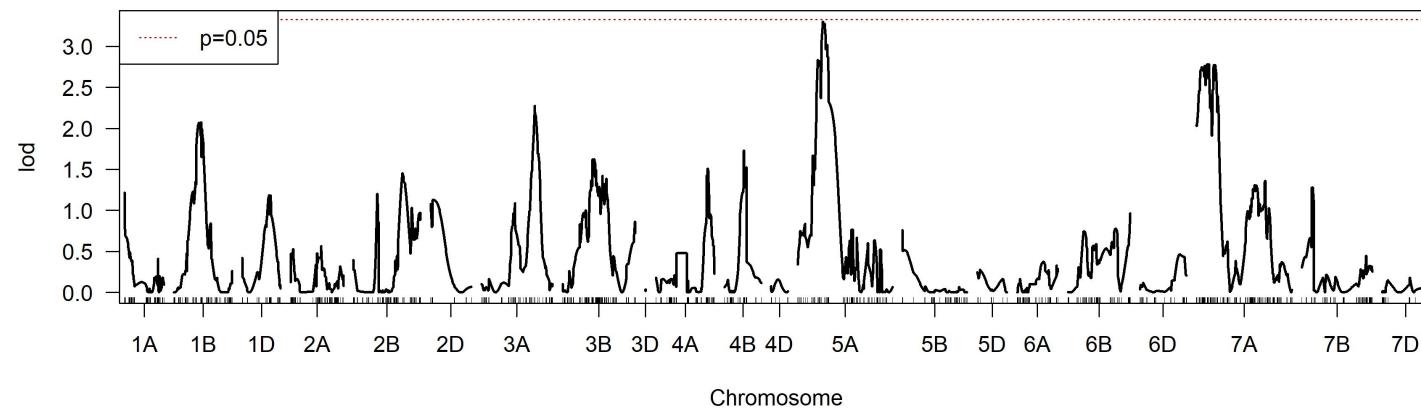


Deoxynivalenol Content in Warsaw, VA - 2020

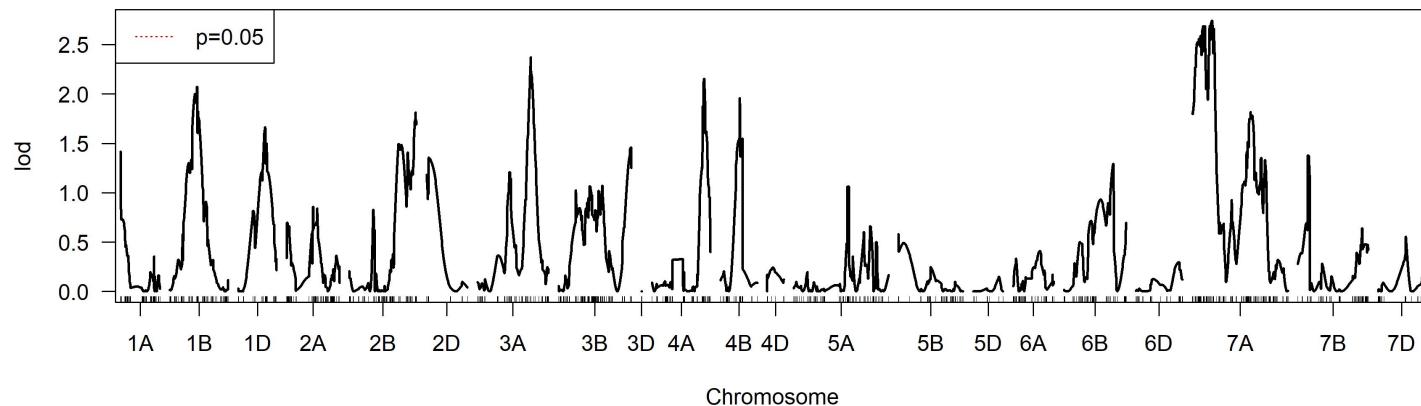
IM for DON_WAR20



MQM 1 for DON_WAR20



MQM 2 for DON_WAR20



QTL Scan Information

The following table displays the output results of each scan from each environment-by-trait combination. Traits assessed are heading date (HD) and plant height (PH), Fusarium head blight (FHB) visual ratings (VR), Fusarium-damaged kernels (FDK), and deoxynivalenol (DON). Environments assessed are Kinston, NC 2018-2019 (KIN19) and 2019-2020 (KIN20); Raleigh, NC 2018-2019 (RAL19) and 2019-2020 (RAL20); and Warsaw, VA 2018-2019 (WAR19) and 2019-2020 (WAR20). Multi-environment scans are denoted as “ME”. The column “QTL” column denotes the name of the QTL, the trait to which it belongs (e.g., Hd=HD, Pht=PH, Fvr=VR, Fdk=FDK, Don=DON) and the chromosome on which the QTL is located.

QTL	Environment	Left Position (cM)	Peak Position (cM)	Right Position (cM)	LOD	PV	Effect
QDon.nc-1A	ME	66.4	86.0	99.6	7.07	8.24	-0.14
QDon.nc-2B	ME	39.3	84.0	109.0	4.79	5.41	-0.11
QDon.nc-3A	ME	133.7	135.8	146.1	8.33	9.88	-0.15
QDon.nc-4A	ME	100.1	108.0	127.2	6.01	6.90	-0.13
QDon.nc-5A	ME	58.5	75.7	178.3	8.53	10.15	-0.19
QDon.nc-7A.1	ME	23.4	48.0	155.0	4.41	4.94	-0.11
QDon.nc-7A.2	ME	124.7	137.8	159.8	4.36	4.89	-0.10
QDon.nc-7D	ME	108.6	117.2	118.0	4.81	5.42	0.11
QDon.nc-1A	KIN19	25.1	85.6	95.5	2.27	5.31	-0.17
QDon.nc-3A	KIN19	133.7	138.0	146.1	5.66	13.91	-0.28
QDon.nc-7A	KIN19	23.4	67.7	101.4	1.65	3.82	-0.14
QDon.nc-1A	KIN20	0.0	63.4	99.6	3.49	5.28	-0.12
QDon.nc-2B	KIN20	67.9	111.1	124.0	3.14	4.73	-0.12
QDon.nc-3A	KIN20	133.7	136.2	143.5	9.96	16.56	-0.22
QDon.nc-4B	KIN20	9.0	16.0	34.3	5.31	8.24	-0.15
QDon.nc-7A	KIN20	126.0	134.0	170.9	3.60	5.45	-0.12
QDon.nc-7D	KIN20	112.3	118.0	118.0	4.57	7.02	0.14
QDon.nc-1A	RAL19	75.9	83.0	99.6	4.39	10.98	-0.21
QDon.nc-7A	RAL19	27.9	46.0	80.8	2.74	6.70	-0.17
QDon.nc-1A	RAL20	78.5	86.6	91.5	4.94	10.45	-0.23
QDon.nc-5B	RAL20	137.4	145.0	155.5	2.15	4.35	-0.15
QDon.nc-7A	RAL20	23.4	42.1	52.5	6.14	13.21	-0.26
QDon.nc-7D	RAL20	83.3	118.0	118.0	2.75	5.63	0.17
QDon.nc-1A	WAR19	56.3	83.0	99.6	2.56	3.97	-0.12
QDon.nc-2B	WAR19	95.6	100.7	107.8	8.35	14.10	-0.21
QDon.nc-3A	WAR19	128.2	138.0	162.2	4.98	8.02	-0.16
QDon.nc-4A	WAR19	100.1	131.3	148.6	6.65	10.96	-0.20
QDon.nc-5A	WAR19	158.3	176.0	200.1	4.88	7.84	-0.16
QDon.nc-1A	WAR20	78.5	87.6	99.6	4.48	9.60	-0.15
QDon.nc-2B	WAR20	47.7	64.7	86.1	1.07	2.19	-0.08
QDon.nc-4A	WAR20	83.2	108.0	135.8	6.79	15.06	-0.19
QFdk.nc-1A	ME	61.8	88.1	99.6	9.12	10.31	-0.13
QFdk.nc-2A	ME	0.0	0.8	11.0	5.59	6.01	-0.10
QFdk.nc-3A	ME	133.7	140.0	155.4	7.07	7.76	-0.12
QFdk.nc-3B	ME	42.9	52.0	74.9	3.94	4.13	-0.09
QFdk.nc-4A	ME	83.2	112.0	148.6	5.33	5.71	-0.10
QFdk.nc-5A	ME	58.5	62.0	177.9	7.80	8.65	-0.12
QFdk.nc-7A	ME	34.7	50.0	62.1	6.48	7.05	-0.11
QFdk.nc-7D	ME	83.3	117.2	118.0	5.64	6.07	0.10
QFdk.nc-3A	KIN19	69.8	140.0	155.4	4.46	10.45	-0.19
QFdk.nc-3B	KIN19	28.0	43.7	55.5	3.35	7.72	-0.16
QFdk.nc-7A	KIN19	66.8	79.0	228.4	2.56	5.84	-0.14
QFdk.nc-2A	KIN20	0.0	0.8	18.7	2.36	4.58	-0.10
QFdk.nc-3A	KIN20	52.1	81.2	99.4	1.81	3.50	-0.09
QFdk.nc-3B	KIN20	42.9	52.0	66.9	2.41	4.68	-0.10
QFdk.nc-4A	KIN20	105.8	134.7	148.6	3.27	6.43	-0.12
QFdk.nc-7D	KIN20	83.3	118.0	118.0	3.11	6.11	0.11
QFdk.nc-1A	RAL19	75.9	82.2	99.6	3.18	7.04	-0.11
QFdk.nc-2A	RAL19	0.0	7.0	18.7	4.15	9.32	-0.13
QFdk.nc-7A	RAL19	37.6	46.0	159.8	3.97	8.91	-0.13
QFdk.nc-1A	WAR19	56.3	85.6	99.6	4.52	9.88	-6.47
QFdk.nc-2B	WAR19	76.5	100.7	113.5	4.42	9.65	-6.44

QTL	Environment	Left Position (cM)	Peak Position (cM)	Right Position (cM)	LOD	PV	Effect
QFdk.nc-3A	WAR19	128.2	140.0	164.2	3.78	8.18	-5.96
QFdk.nc-1A	WAR20	85.6	98.0	99.6	3.89	7.85	-0.16
QFdk.nc-4A	WAR20	115.5	132.0	141.7	6.09	12.66	-0.20
QFdk.nc-5A	WAR20	34.6	54.0	71.4	5.80	12.02	-0.20
QFvr.nc-2A	ME	0.0	2.0	9.8	3.04	4.14	-0.06
QFvr.nc-2B	ME	38.4	66.0	86.5	4.65	6.47	-0.08
QFvr.nc-2D	ME	0.0	32.0	89.2	3.50	4.79	-0.07
QFvr.nc-3B	ME	46.4	58.7	88.6	4.42	6.13	-0.08
QFvr.nc-4A	ME	105.8	114.9	148.6	2.98	4.05	-0.06
QFvr.nc-5A	ME	50.9	60.4	78.7	7.48	10.85	-0.10
QFvr.nc-7D	ME	83.3	118.0	118.0	5.21	7.32	0.09
QFvr.nc-3B	KIN20	43.7	76.4	111.2	3.54	8.32	-0.11
QFvr.nc-6B	KIN20	68.3	75.1	79.2	2.33	5.39	0.09
QFvr.nc-7D	KIN20	83.3	118.0	118.0	2.94	6.85	0.10
QFvr.nc-2A	RAL19	0.0	7.0	23.3	3.89	7.47	-0.08
QFvr.nc-2B	RAL19	38.4	66.0	104.4	4.85	9.43	-0.10
QFvr.nc-4A	RAL19	105.8	114.4	127.2	2.69	5.07	-0.07
QFvr.nc-5A	RAL19	50.9	62.0	115.0	5.12	9.99	-0.10
QFvr.nc-2B	RAL20	35.0	42.0	86.1	4.09	8.43	-0.12
QFvr.nc-3B	RAL20	43.7	74.9	88.6	3.32	6.76	-0.10
QFvr.nc-5A	RAL20	42.1	57.9	78.7	7.03	15.12	-0.15
QFvr.nc-3B.1	WAR20	65.3	68.0	68.7	3.17	6.63	2.59
QFvr.nc-3B.2	WAR20	49.8	68.7	77.0	4.13	8.77	-3.00
QFvr.nc-4A	WAR20	115.5	134.7	148.6	5.13	11.05	-0.48