

Additional Table 1. Temperature and rainfall data for the Aberdeen field studies in 2020 and 2021																
		April			May			June			July			August		
Temp. (°F)	Year	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min
	2020	61.58	46.39	28.39	74.32	56.03	40.49	77.75	62.66	44.74	81.90	71.38	63.11	82.38	73.33	54.58
	2021	68.04	45.53	34.37	65.21	55.39	44.38	80.56	71.98	55.43	82.32	76.43	55.17	81.25	67.44	45.97
Rainfall (inches)		Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min
	2020	0.63	0.05	1.40	0.62	0.04	1.39	0.47	0.06	1.72	0.11	0.01	0.21	0.10	0.00	0.11
	2021	0.38	0.04	1.16	0.32	0.02	0.57	0.01	0.00	0.01	0.01	0.00	0.01	1.03	0.05	1.47

Additional Table 2. Candidate gene list within 1Mbp upstream and downstream of stable QTL on chromosome 2H and 5H.

ID of candidate genes on chrom 2H	Uniprot name
HORVU.MOREX.r3.2HG0107220	Growth arrest and DNA damage-inducible protein
eiHORVU.MOREX.r3.2HG0107250	Glycine-rich cell wall structural protein 2-like
HORVU.MOREX.r3.2HG0107260	Str_synth domain-containing protein
HORVU.MOREX.r3.2HG0107280	DUF295 domain-containing protein
HORVU.MOREX.r3.2HG0107300	Acetyltransferase
HORVU.MOREX.r3.2HG0107310	NAM-associated domain-containing protein
HORVU.MOREX.r3.2HG0107320	DUF295 domain-containing protein
HORVU.MOREX.r3.2HG0107330	Coiled-coil domain-containing protein 167
HORVU.MOREX.r3.2HG0107340	PMR5N domain-containing protein
HORVU.MOREX.r3.2HG0107350	DUF295 domain-containing protein
HORVU.MOREX.r3.2HG0107380	Dof-type domain-containing protein
HORVU.MOREX.r3.2HG0107400	Protein kinase domain-containing protein
HORVU.MOREX.r3.2HG0107410	MATH domain-containing protein
HORVU.MOREX.r3.2HG0107420	Oxoglutarate dehydrogenase (succinyl-transferring)
HORVU.MOREX.r3.2HG0107430	HTH myb-type domain-containing protein
HORVU.MOREX.r3.2HG0107440	p53 and DNA damage-regulated protein 1
HORVU.MOREX.r3.2HG0107450	DUF4378 domain-containing protein
HORVU.MOREX.r3.2HG0107470	Pectate lyase
HORVU.MOREX.r3.2HG0107480	LITAF domain-containing protein
HORVU.MOREX.r3.2HG0107490	DUF569 domain-containing protein
HORVU.MOREX.r3.2HG0107500	DUF3444 domain-containing protein
HORVU.MOREX.r3.2HG0107550	DUF569 domain-containing protein
HORVU.MOREX.r3.2HG0107570	Bidirectional sugar transporter SWEET
HORVU.MOREX.r3.2HG0107590	NAB domain-containing protein
HORVU.MOREX.r3.2HG0107600	Expansin-B2
HORVU.MOREX.r3.2HG0107610	Expansin-B2
HORVU.MOREX.r3.2HG0107620	Glutamic acid-rich protein-like

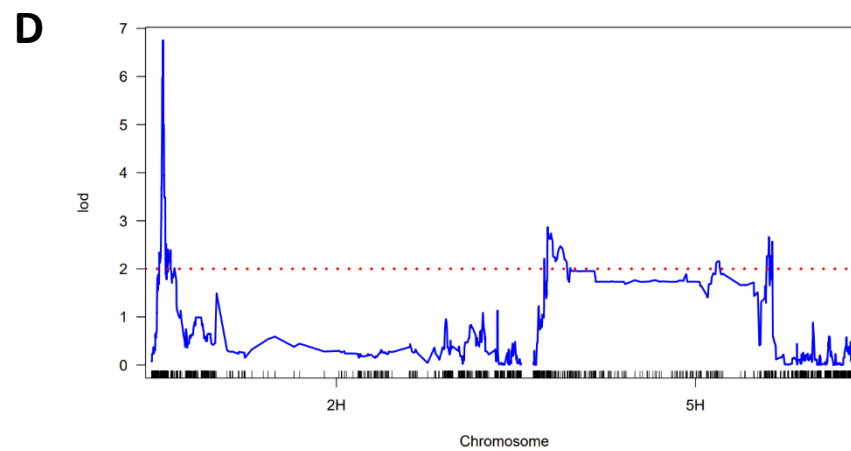
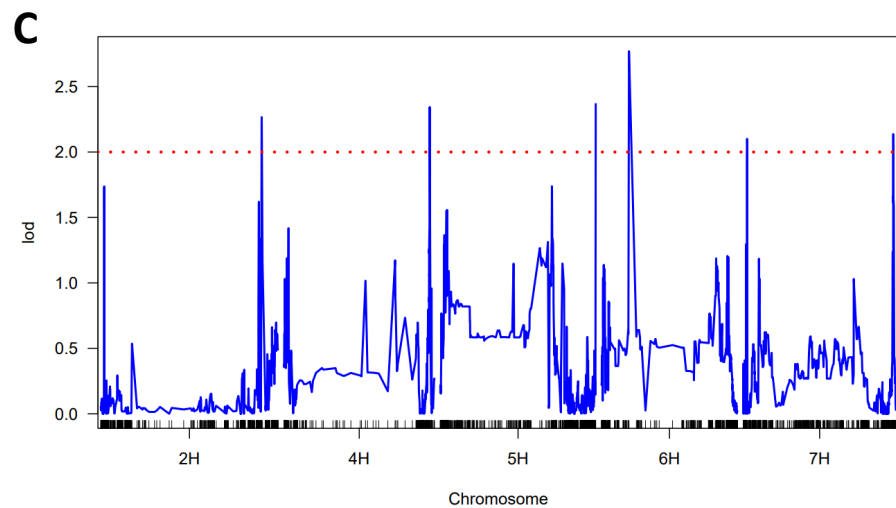
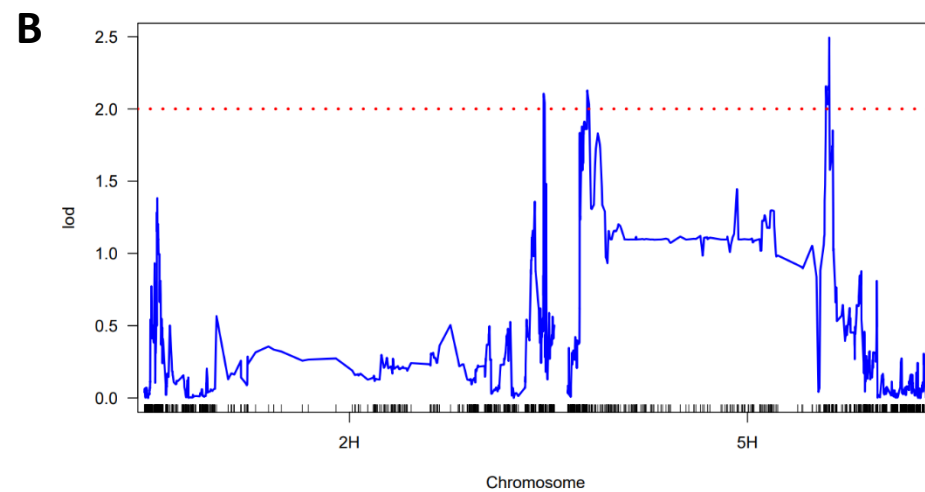
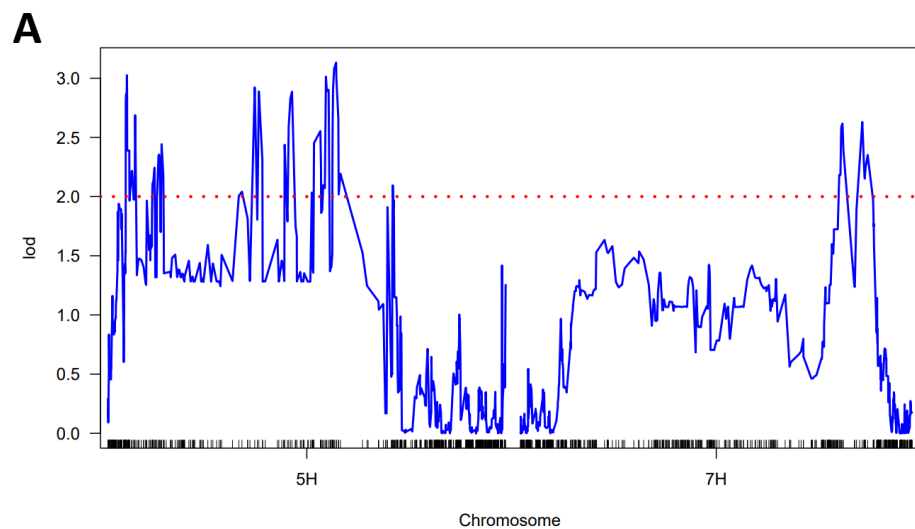
HORVU.MOREX.r3.2HG0107640	Expansin-B11
HORVU.MOREX.r3.2HG0107650	Glycosyltransferase
HORVU.MOREX.r3.2HG0107660	Transposase
HORVU.MOREX.r3.2HG0107680	BHLH domain-containing protein
HORVU.MOREX.r3.2HG0107690	Serine/threonine kinase
HORVU.MOREX.r3.2HG0107700	Uncharacterized protein
HORVU.MOREX.r3.2HG0107710	PPD-H1
HORVU.MOREX.r3.2HG0107720	Str_synth domain-containing protein
HORVU.MOREX.r3.2HG0107730	DUF155 domain-containing protein
HORVU.MOREX.r3.2HG0107740	L-ascorbate peroxidase
HORVU.MOREX.r3.2HG0107750	Arogenate dehydratase
HORVU.MOREX.r3.2HG0107760	Reverse transcriptase Ty1/copia-type domain-containing protein
HORVU.MOREX.r3.2HG0107770	Myb_DNA-bind_3 domain-containing protein
HORVU.MOREX.r3.2HG0107780	TPD1 protein-like 1
HORVU.MOREX.r3.2HG0107790	HHH_2 domain-containing protein
HORVU.MOREX.r3.2HG0107800	PWWP domain-containing protein
HORVU.MOREX.r3.2HG0107820	Glycosyltransferases
HORVU.MOREX.r3.2HG0107830	Glycosyltransferases
HORVU.MOREX.r3.2HG0107850	Elongation factor 1-alpha
HORVU.MOREX.r3.2HG0107900	Elongation factor 1-alpha
HORVU.MOREX.r3.2HG0107910	Metal-nicotianamine transporter YSL6
HORVU.MOREX.r3.2HG0107940	MLO-like protein
HORVU.MOREX.r3.2HG0107950	zf-GRF domain-containing protein
HORVU.MOREX.r3.2HG0107960	Phosphoinositide phospholipase C
HORVU.MOREX.r3.2HG0107970	Peroxidase
HORVU.MOREX.r3.2HG0107980	DUF3453 domain-containing protein
HORVU.MOREX.r3.2HG0107990	Protein FAR1-RELATED SEQUENCE
HORVU.MOREX.r3.2HG0108000	Protein FAR1-RELATED SEQUENCE
HORVU.MOREX.r3.2HG0108010	Uncharacterized protein

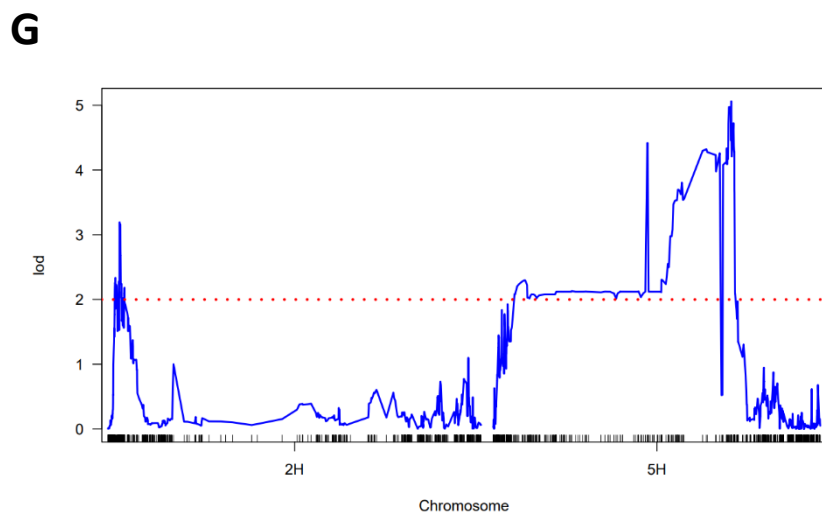
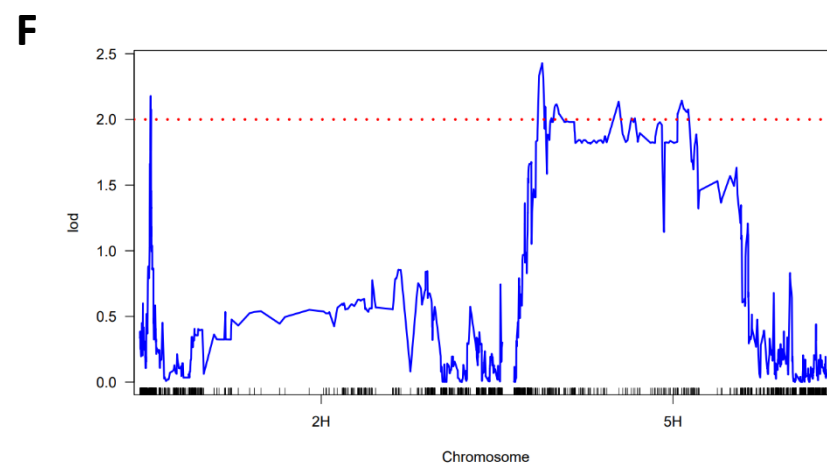
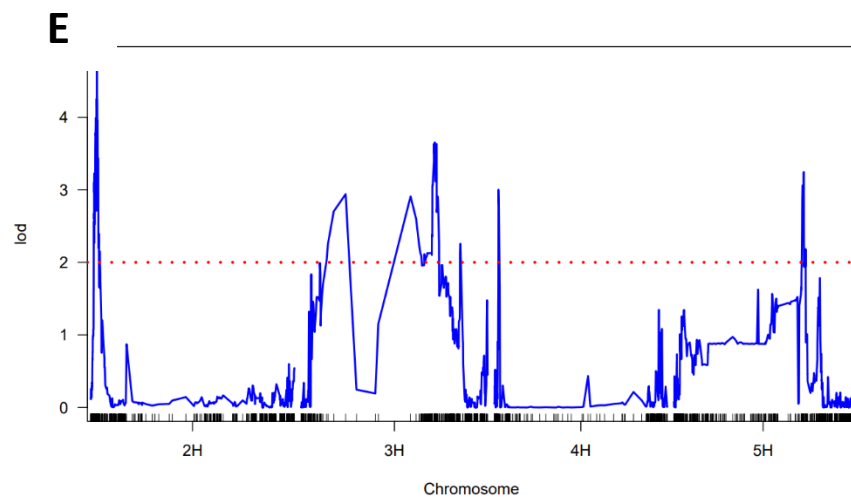
HORVU.MOREX.r3.2HG0108020	Predicted protein
HORVU.MOREX.r3.2HG0108040	V-SNARE coiled-coil homology domain-containing protein
HORVU.MOREX.r3.2HG0108050	PHD-type domain-containing protein
HORVU.MOREX.r3.2HG0108060	Uncharacterized protein
HORVU.MOREX.r3.2HG0108080	FAD-binding PCMH-type domain-containing protein
HORVU.MOREX.r3.2HG0108090	Dirigent protein

Gene ID for candidate genes on chrom5H

HORVU.MOREX.r3.5HG0480850,	Auxin-responsive protein SAUR50-like
HORVU.MOREX.r3.5HG0480870,	AAA domain-containing protein
HORVU.MOREX.r3.5HG0480890,	Dirigent protein
HORVU.MOREX.r3.5HG0480940,	Dirigent protein
HORVU.MOREX.r3.5HG0480960,	TMV resistance protein N-like
HORVU.MOREX.r3.5HG0481010,	Predicted protein
HORVU.MOREX.r3.5HG0481030,	Embryogenesis-associated protein EMB8
HORVU.MOREX.r3.5HG0481070,	PDZ_6 domain-containing protein
HORVU.MOREX.r3.5HG0481080,	PDZ_6 domain-containing protein
HORVU.MOREX.r3.5HG0481090,	PDZ domain-containing protein
HORVU.MOREX.r3.5HG0481100,	LEA_2 domain-containing protein
HORVU.MOREX.r3.5HG0481110,	RBR-type E3 ubiquitin transferase
HORVU.MOREX.r3.5HG0481120,	RING-type domain-containing protein
HORVU.MOREX.r3.5HG0481130,	Secreted protein
HORVU.MOREX.r3.5HG0481140,	F-box/kelch-repeat protein SKIP11
HORVU.MOREX.r3.5HG0481160,	Glycine--tRNA ligase
HORVU.MOREX.r3.5HG0481240,	AP2/ERF domain-containing protein
HORVU.MOREX.r3.5HG0481290,	Predicted protein
HORVU.MOREX.r3.5HG0481310,	ARID domain-containing protein
HORVU.MOREX.r3.5HG0481320,	Alanine transaminase
HORVU.MOREX.r3.5HG0481330,	GRF-type domain-containing protein

N.B Those indicated in bold are implicated in abiotic stress based on published literatures. Ascorbate peroxidase, PPD-H1 on 2H, and Dirigent and PDZ_6 domain-containing protein genes on 5H are nearest to the stable QTL and indicated in red.





Additional figure 1. QTL plot of RIL population for (A) seed weight data for biotron 2018, (B) seed weight data for biotron 2019, (C) seed weight data for Idaho 2020, (D) Shoot dry weight for biotron 2018, (E) Shoot dry weight for biotron 2019, (F) Protein content for combined 2018 and 2019 seed samples, (G) Protein content for Seed samples from Idaho 2020.