

Genomic regions associated with herbicide tolerance in a worldwide faba bean (*Vicia faba* L.) collection

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Supplementary Table S1. SNP-trait associations revealed by the ST-GWAS analysis. Underscored SNPs represents the highly significant associations, while SNPs in italic represents the SNPs associated with multiple traits

Trait	SNP	allele1	allele0	MAF	Effect	P	-Log10
TR16_DFLRI_RI	<u>SNODE_5725_31</u>	C	T	0.41	5.66	4.3E-11	10.4
TR16_DFLRI_RI	<u>SCONTIG127798_41</u>	C	T	0.07	-2.60	5.0E-11	10.3
TR16_DFLRM_RI	<u>SNODE_23759_68</u>	A	G	0.10	6.67	2.1E-07	6.7
MR15_PLTHTI	<u>SNODE_106460_36</u>	T	C	0.05	18.29	4.3E-07	6.4
TRS18_HDS1M	<u>SNODE_13467_45</u>	A	G	0.19	0.70	1.1E-06	6.0
MR15_GYPLTI	<u>SNODE_4555_43</u>	T	A	0.10	12.18	1.5E-06	5.8
TR16_DFLRI	<u>SNODE_7114_58</u>	C	T	0.11	6.71	2.5E-06	5.6
TR19_NBrPLTM_RI	<u>SNODE_173108_18</u>	A	G	0.06	65.35	3.0E-06	5.5
TRS18_GCCC	<u>SNODE_12390_16</u>	C	T	0.21	1.27	3.0E-06	5.5
TR16_DFLRM_RI	<u>SNODE_4187_38</u>	G	A	0.05	7.81	3.3E-06	5.5
TR16_NSPLTM	<u>SCONTIG38056_40</u>	C	T	0.07	9.44	5.9E-06	5.2
TR19_NPPLTI	<u>SCONTIG16487_99</u>	T	C	0.07	5.53	6.1E-06	5.2
TR16_DMATI	<u>SNODE_76542_45</u>	T	G	0.05	-3.24	7.0E-06	5.2
MR15_PLTHTM_RI	<u>SNODE_14298_44</u>	A	G	0.06	63.37	7.1E-06	5.1
TR16_GYPLTI	<u>SNODE_77186_51</u>	T	A	0.10	7.97	7.2E-06	5.1
MR15_PLTHTI_RI	<u>SCONTIG65312_44</u>	T	C	0.05	89.46	9.1E-06	5.0
MR15_PLTHTI_RI	<u>SNODE_783_18</u>	G	A	0.06	83.04	1.0E-05	5.0
TR19_NBrPLTM_RI	<u>SNODE_2942_50</u>	C	T	0.06	61.37	1.0E-05	5.0
TR19_NBrPLTI_RI	<u>SNODE_103_72</u>	T	C	0.25	27.28	1.1E-05	5.0
TR16_DFLRI_RI	<u>SCONTIG5600_39</u>	C	T	0.06	7.01	1.2E-05	4.9
TR16_DFLRM	<u>SNODE_7114_58</u>	C	T	0.11	6.69	1.2E-05	4.9
TR19_GCCC	<u>SNODE_46550_53</u>	C	A	0.41	5.17	1.5E-05	4.8
TRS18_HDS2M	<u>SNODE_132611_47</u>	T	G	0.06	1.48	1.5E-05	4.8
TR16_NPPLTTI_RI	<u>SNODE_522694_66</u>	T	C	0.07	53.48	1.6E-05	4.8
TR19_GCCM_RI	<u>SNODE_18326_71</u>	G	A	0.37	14.61	1.6E-05	4.8
MR15_GYPLTM	<u>SNODE_32018_65</u>	A	G	0.20	6.33	1.6E-05	4.8
TR19_GYPLTI	<u>SNODE_4363_81</u>	C	T	0.34	4.00	1.7E-05	4.8
TRS18_HDS1M	<u>SCONTIG65425_78</u>	T	C	0.22	0.52	1.7E-05	4.8

TR16_DMATI	SNODE_5210_41	G	A	0.24	-1.31	1.8E-05	4.7
TR16_DMATI	SNODE_5352_33	C	T	0.43	-1.23	1.9E-05	4.7
MR15_PLTHTI_RI	SNODE_303749_26	G	C	0.09	55.58	1.9E-05	4.7
TR16_PLHTI_RI	SNODE_168698_34	G	A	0.31	-7.68	2.0E-05	4.7
TR19_DMATM	SNODE_1938_61	T	G	0.10	0.91	2.1E-05	4.7
TR16_DMATC	SNODE_7114_58	C	T	0.11	1.67	2.2E-05	4.7
TR19_DMATC	SNODE_176062_39	G	T	0.39	0.66	2.2E-05	4.7
TR16_PLHTM	SNODE_1327_40	G	A	0.26	-4.92	2.2E-05	4.7
MR15_PLTHTI_RI	SCONTIG16540_74	G	A	0.06	78.04	2.3E-05	4.6
MR15_GYPLTI	SNODE_49416_94	A	G	0.07	12.46	2.4E-05	4.6
TR19_DMATI	SCONTIG93219_127	A	C	0.05	2.09	2.5E-05	4.6
TR19_NPPLTC	SNODE_159494_68	G	A	0.07	6.96	2.7E-05	4.6
MR15_PLTHTI	SNODE_4025_42	T	G	0.06	16.12	2.7E-05	4.6
MR15_PLTHTI_RI	SNODE_11304_26	G	A	0.13	44.41	2.8E-05	4.6
MR15_PLTHTI_RI	SNODE_14298_44	A	G	0.06	58.04	2.8E-05	4.6
TR19_NSPI	SNODE_99859_41	C	A	0.05	11.79	2.8E-05	4.5
MR15_GYPLTM	SCONTIG8042_30	T	G	0.14	9.13	2.9E-05	4.5
TR16_DFLRI	SNODE_27970_52	C	G	0.17	4.79	3.0E-05	4.5
TRS18_PLHT2C	SNODE_8117_82	T	C	0.41	-3.63	3.0E-05	4.5
TR16_DMATI	SNODE_5497_184	C	T	0.07	-2.62	3.1E-05	4.5
TR16_NPPLTTM_RI	SNODE_13896_44	T	G	0.21	33.37	3.1E-05	4.5
MR15_GYPLTM	SCONTIG124093_52	T	A	0.06	14.06	3.1E-05	4.5
MR15_PLTHTM_RI	SNODE_154943_14	T	C	0.08	52.28	3.4E-05	4.5
MR15_GYPLTI	SNODE_113699_29	T	C	0.17	8.18	3.5E-05	4.5
TR19_ScoreI	SNODE_6947_50	A	G	0.22	0.15	3.6E-05	4.4
TR16_GYPLTM_RI	SNODE_22383_32	T	C	0.14	23.39	3.6E-05	4.4
TR16_DFLRI_RI	SNODE_12919_43	A	T	0.11	3.97	3.6E-05	4.4
TR16_DMATM	SCONTIG38602_68	G	A	0.06	-2.68	3.7E-05	4.4
TR19_DFLRM	SNODE_73156_58	C	T	0.19	4.17	3.7E-05	4.4
TR19_NPPLTI	SNODE_13244_37	C	T	0.08	4.84	3.7E-05	4.4
TR16_GYPLTM	SNODE_3696_16	G	A	0.10	62.71	3.9E-05	4.4
TRS18_GCCC	SNODE_11304_24	A	T	0.31	-0.89	4.1E-05	4.4
TR19_ScoreI	SCONTIG57859_65	G	A	0.07	-0.31	4.2E-05	4.4
TR19_DMATI	SNODE_239220_75	G	C	0.41	1.03	4.3E-05	4.4
MR15_PLTHTM_RI	SNODE_303749_26	G	C	0.09	54.27	4.3E-05	4.4
TR19_NBrPLTM_RI	SNODE_144193_69	C	A	0.46	-66.48	4.4E-05	4.4
MR15_GYPLTI	SCONTIG90061_39	A	C	0.06	13.39	4.4E-05	4.4
TR16_GYPLTM	SNODE_3696_16	G	A	0.10	5.23	4.5E-05	4.3
TRS18_PLHT2M	SNODE_50475_21	A	G	0.23	3.85	4.5E-05	4.3
TR16_DFLRM	SNODE_27970_52	C	G	0.16	5.02	4.6E-05	4.3
TR16_DFLRM_RI	SNODE_1051_18	C	T	0.08	5.93	4.8E-05	4.3
TR16_PLHTC	SCONTIG124142_38	A	G	0.11	-7.42	5.0E-05	4.3
TR16_HDS1I	SCONTIG124448_24	G	A	0.47	0.91	5.0E-05	4.3
MR15_PLTHTI_RI	SCONTIG86606_73	G	A	0.07	75.29	5.1E-05	4.3
TR19_NBrPLTC	SCONTIG97891_72	A	G	0.40	0.64	5.3E-05	4.3
TR19_GCCI_RI	SNODE_8714_56	G	A	0.12	26.15	5.4E-05	4.3

MR15_GYPLTC	SCONTIG107603_117	G	A	0.33	8.52	5.5E-05	4.3
TR16_DFLRM	SNODE_23759_68	A	G	0.10	8.39	5.6E-05	4.3
TR16_DFLRC	SNODE_7114_58	C	T	0.11	3.49	5.6E-05	4.3
TR16_NSPLTI	SNODE_27984_41	T	C	0.09	-6.51	5.6E-05	4.2
TRS18_GCCM_RI	SNODE_6438_25	T	A	0.28	23.95	5.7E-05	4.2
TR19_NBrPLTC	SNODE_1799_57	A	T	0.16	0.52	5.7E-05	4.2
TR16_GYPLTM_RI	SNODE_22383_32	T	C	0.14	21.58	5.9E-05	4.2
MR15_PLTHTI_RI	SNODE_6940_56	C	T	0.13	42.12	5.9E-05	4.2
TR19_NSPM	SNODE_784518_64	C	T	0.43	-4.05	6.0E-05	4.2
TR16_DFLRM_RI	SCONTIG20800_23	G	A	0.06	6.56	6.0E-05	4.2
MR15_PLTHTI_RI	SNODE_2199_68	G	A	0.07	68.70	6.2E-05	4.2
TR16_PLHTI	SNODE_168698_34	G	A	0.31	-5.44	6.2E-05	4.2
TR16_NPPLTTM_RI	SNODE_55885_28	C	T	0.09	47.66	6.3E-05	4.2
TR19_DMATI_RI	SNODE_13235_37	C	A	0.25	-0.43	6.3E-05	4.2
TR16_PLHTM_RI	SCONTIG99169_68	C	T	0.05	-12.13	6.6E-05	4.2
MR15_GYPLTI	SCONTIG46666_46	A	T	0.07	12.22	6.7E-05	4.2
TR16_DFLRI_RI	SNODE_4187_38	G	A	0.05	6.82	6.8E-05	4.2
MR15_PLTHTI_RI	SNODE_34274_45	A	G	0.11	46.06	7.0E-05	4.2
TR16_NPPLTTI_RI	SNODE_503024_18	T	A	0.40	23.17	7.3E-05	4.1
TR16_NSPLTC	SNODE_125479_23	A	T	0.28	5.86	7.3E-05	4.1
TR16_DFLRC	SNODE_9493_68	T	C	0.06	4.19	7.3E-05	4.1
TR16_DFLRM_RI	SNODE_8481_51	T	C	0.17	3.50	7.4E-05	4.1
TR19_NPPLTI_RI	SCONTIG63866_41	T	C	0.34	-14.64	7.5E-05	4.1
TR19_DFLRI_RI	SNODE_84004_43	T	G	0.23	1.14	7.7E-05	4.1
TRS18_HDS2M	SNODE_7070_46	T	G	0.09	0.91	7.9E-05	4.1
TR19_GYPLTC	SNODE_35312_45	A	T	0.38	5.77	7.9E-05	4.1
TR19_NPPLTI	SCONTIG106679_64	C	T	0.07	4.70	8.1E-05	4.1
TR19_NPPLTM	SNODE_134625_31	C	T	0.44	-2.15	8.1E-05	4.1
TR19_NSPI_RI	SNODE_2075_83	C	T	0.18	15.10	8.3E-05	4.1
TR19_DMATI	SNODE_3763_57	C	T	0.21	-0.81	8.4E-05	4.1
MR15_PLTHTM	SNODE_53396_78	G	T	0.23	7.29	8.4E-05	4.1
MR15_GYPLTC	SNODE_139623_44	A	T	0.36	12.78	8.5E-05	4.1
TR19_GCCM_RI	SCONTIG50118_65	G	A	0.08	-29.38	8.5E-05	4.1
TR16_DMATM_RI	SNODE_6679_53	T	A	0.48	0.71	8.9E-05	4.1
TR16_NPPLTTI_RI	SNODE_239220_75	G	C	0.41	30.20	8.9E-05	4.1
TR19_GYPLTM	SNODE_12261_51	C	T	0.06	-9.39	8.9E-05	4.0
TR19_GCCI_RI	SNODE_10934_67	A	G	0.35	-18.74	9.0E-05	4.0
MR15_PLTHTI_RI	SNODE_106637_40	C	T	0.07	73.72	9.1E-05	4.0
TR16_DFLRC	SNODE_27970_52	C	G	0.16	2.75	9.3E-05	4.0
TR19_GYPLTM_RI	SCONTIG7685_19	A	G	0.06	23.11	9.4E-05	4.0
TR16_DFLRI	SNODE_162178_22	A	G	0.07	8.88	9.5E-05	4.0
MR15_GYPLTM	SCONTIG61848_71	G	A	0.07	10.97	9.7E-05	4.0
TR19_DFLRM_RI	SNODE_7114_58	C	T	0.12	1.39	9.7E-05	4.0
TR16_DMATC	SNODE_12561_61	A	C	0.08	2.38	9.8E-05	4.0

MR15HDS2M	MR15HDS2I	TR19HDS2I	TR19HDS2M	NA	TR518HDS2M	NA
NA	NA	NA	NA	NA	TR518HDS1M	NA
NA	NA	TR19GCC_I_RI	TR19GCCM_I_RI	NA	TR518GCCM_I_RI	NA
NA	NA	TR19GCC_I	TR19GCCM	TR19GCCC	TR518GCCM	TR518GCCC
NA	NA	TR19NBpPLT_I_RI	TR19NBpPLTM_I_RI	NA	NA	NA
NA	NA	TR19NBpPLTI	TR19NBpPLTM	TR19NBpPLTC	NA	NA
NA	NA	NA	NA	NA	NA	NA
MR15GYPLTM	MR15GYPLTC	NA	NA	NA	NA	NA
NA	NA	TR19NSPLT_I_RI	TR19NSPLTM_I_RI	NA	NA	NA
NA	NA	TR19NSPLTI	TR19NSPLTM	TR19NSPLTC	NA	NA
RMR15PLHTM_I_RI	NA	TR19PLHTM_I_RI	TR19PLHTC_I_RI	NA	TR518pLHTTM_I_RI	NA
RMR15PLHTM	TR19PLHTI	TR19PLHTM	TR19PLHTC	NA	TR518pLHTTM	TR518pLHT1C
NA	NA	TR19NPPLT_I_RI	TR19NPPLTM_I_RI	NA	NA	NA
NA	NA	TR19NPPLTI	TR19NPPLTM	TR19NPPLTC	NA	NA
NA	NA	TR19DMAT_I_RI	TR19DMATM_I_RI	NA	NA	NA
NA	MR15DMATC	TR19DMATI	TR19DMATM	TR19DMATC	NA	NA
NA	NA	TR19DFLR_I_RI	TR19DFLRM_I_RI	NA	NA	NA
NA	MR15DFLRC	TR19DFLRI	TR19DFLRM	TR19DFLRC	NA	NA
Marchouch 2015 Methibuzin	Marchouch 2015 Control	Terbol 2019 Imzethapyr	Terbol 2019 Methibuzin	Terbol 2019 Control	Terbol Summer 2018 Methibuzin	Terbol Summer 2018 Control

DFLR days to flowering, DMAT days to maturity, NPPLT number of pods per plant, PLHT plant height, NSPLT number of seeds per plant, GYPLT grain yield per plant, NBrPLT number of branches per plant, GCC green canopy cover, HDS1 herbicide damage HDS2 recorded at the flowering stage, HDS2 herbicide damage HDS2 recorded at the pod development stage, RI Reduction index, NA not applicable.

Supplementary Table S4. Description of the damages observed in the treated plants for each herbicide damage score (HDS)

Herbicide damage score (HDS)	Description
1	No damage observed
	Normal phytosanitary status
	Normal and very good vegetative growth
2	Very light damage observed
	Very few leaf burnings
	Very good phytosanitary status
3	A clear moderate damage observed
	Stunting in growth with high yellowing
	Necrosis on leaves
4	A high damage was observed and death of <50% of plants
	Severe yellowing, leaf and stem burning with high deformations
	Very weak vegetative growth and stunted plants
5	Severe damage and death of >50% of plants
	High deformations and burnings
	High reduction of plant's biomass
	Overall yellowing was detected