

Table S1. Different QTLs reported in chickpea under drought stress

SN	Mapping population	Population size	Trait	Marker /marker interval	Marker type	LOD	Genes/ QTLs	Interval/ position (cM)	Linkage group	Ref.
1	ICC4958 × Annigeri	257	Root Traits	TAA 170	SSR		Major QTL	54.56	LG4	Gaur et al. 2008
2	JG 62 × Vijay	197	Plant height	TS72-GA24R, TA144-TR2s	SSR		QPh.t.ncl-1.3, QPh.t.ncl-6.1	12.0 5.0	LG1 LG6	Gowda et al. 2011
			Plant spread	NCPGR81-TA116y	SSR		QPsp.ncl-2.2	2.0	LG2	
			Number of branches per plant	NCPGR79-GA26	SSR, RAPD		QBrp.ncl-2.4	3.0	LG2	
				UBC17-TA194s			QBrp.ncl-5.1	6.0	LG5	
				TS45-NCPGR50			QBrp.ncl-6.1	2.0	LG6	
			Number of pods per plant	UBC760-TA64	RAPD, SSR		QPdp.ncl-2.4	3.0	LG2	
				TA186-SSR5			QPdp.ncl-1.1	5.0	LG1a	
			Yield per plant	UBC696-TS83	RAPD, SSR		QYld.ncl-8.1	3.0	LG8	
			100-seed weight	STMS10-TR56	STMS, SSR		QSwt.ncl-2.1	5.0	LG2	
3	Vijay × ICC4958	108	Plant height	TS35-TR29s, UBC859x-TA127	SSR, ISSR		QPh.t.ncl-1.7, QPh.t.ncl-5.1	5.0 8.0	LG1a LG5	Gowda et al. 2011

				Plant spread	UBC721-TA146, TA34s- NCPGR69, TA117-C4D02, UBC743y-TA117	RAPD, SSR		QPsp.ncl-1.6,	3.0	LG1a	Rehman et al. 2011
								QPsp.ncl-2.6,	8.0	LG2	
								QPsp.ncl-3.2,			
								QPsp.ncl-3.3	4.0	LG3	
								7.0	LG3		
				Number of branches per plant	TAA170-NCPGR98	SSR		QBrp.ncl-1.6	3.0	LG1a	
				Number of pods per plant	UBC721-TA146, TA43- TA116x, H1A10x- H3GO3/2, UBC190y-UBC249z	RAPD, SSR,		QPdp.ncl-1.4, QPdp.ncl-2.3, QPdp.ncl-3.3, QPdp.ncl-7.3	51.6	LG1a	
									46.8	LG2	
									58.5	LG3	
									95.3	LG7	
				Yield per plant	SSR6x-GA24, TA5- NCPGR56	SSR		QYld.ncl-1.6, QYld.ncl-2.2	60.4	LG1a	
									33.9	LG2	
				100-seed weight	UBC335y-UBC173, TA110- HIB09	RAPD, SSR		QSwt.ncl-1.12, QSwt.ncl-5.1	34.6	LG1a	
									38.4	LG5	
Days to maturity	UBC149z-UBC149x, H3A05/2-NCPGR57	RAPD, SSR		QDmt.ncl-1.4, QDmt.ncl-4.2	67.0	LG1a					
					35.6	LG4					

4	ILC 588 × ILC 3279	155	Grain Yield	H5A08-TA8	SSR	3.1	Q1-1	0.4	LG1	Rehman et al. 2011
				H1B17-TA72		2.5	Q4-1	3.0	LG4	
			Days to flowering	H5A08-TA8	SSR	7.5	Q1-1	0.4	LG1	
				TA6-NCPGR12		10.9	Q3-1	13.1	LG3	

	TA132-GA137		2.9	Q4-2	13.8	LG4
	TA159-GA6		3.7	Q8-2	2.4	LG8
Days to maturity	H5A08-TA8	SSR	8.2	Q1-1	0.4	LG1
	TA6-NCPGR12		17.1	Q3-1	13.1	LG3
	TA28-CaSTMS25		3.2	Q7-1	8.5	LG7
Reproductive period	H5A08-TA8	SSR	3.4	Q1-1	0.4	LG1
	TA6-NCPGR12		12.8	Q3-1	13.1	LG3
	TA28-CaSTMS25		3.0	Q7-1	8.5	LG7
Plant height	H5A08-TA8	SSR	9.6	Q1-1	0.4	LG1
	H1B17-TA2		2.4	Q4-3	3.0	LG4
Harvest index	H5A08-TA8	SSR	6.0	Q1-1	0.4	LG1
	TA6-NCPGR12		10.5	Q3-1	13.1	LG3
Drought tolerance score	H5A08-TA8	SSR	6.2	Q1-1	0.4	LG1
	TA6-NCPGR12		13.4	Q3-1	13.1	LG3
	TA28-CaSTMS25		2.9	Q7-1	8.5	LG7
	TS12-TA118		2.7	Q8-1	11.0	LG8
Stomatal conductance	TA28-CaSTMS25	SSR	2.4	Q7-1	8.5	LG7
	TA180-H1A10		2.6	Q7-2	0.9	LG7
	TA125-NCPGR10		2.6	Q3-3	5.6	LG3

			Canopy temperature differential [Canopy temperature minus air temperature (Tc-Ta)]	H5A08-TA8	SSR	5.0	Q1-1	0.4	LG1	
				TA6-TS58		2.4	Q3-2	7.5	LG3	
				GA137-TA46		3.0	Q4-4	15.5	LG4	
				TR7-TA14		2.9	Q6-1	3.1	LG6	
				TA80-GA21		2.9	Q6-2	1.0	LG6	
				GA21-CaSTMS2		3.0	Q6-3	9.8	LG6	
5	JG 11 × ICC4958	-	Root traits and other drought tolerance traits	ICCM0249	SSR	-	QTL	54.52	CaLG04	Varshney et al. 2013
				TAA170				54.56	CaLG04	
				STMS11				82.25	CaLG04	
6	ILC588 × ILC 3279	181	Drought resistance score	H6C-07	SSR	5.19	DRS	-	LG3	Hamwiah et al. 2013
				H5G-01		2.03			LG4	
			Percentage of empty pods	TA-1	SSR	2.05	Epod	-	LG1	
				H1O-06		2.28			LG2	
			Grain yield	H6C-07	SSR	2.18	GY	-	LG3	
				H5G-01		2.28			LG4	
			100-seed weight	NCPGR-50	SSR	3.12	100sw	-	LG3	
				SCEA19		2.29			LG7	
				TAA-58		2.24			LG5	
				H1H-15		3.88			LG4	
			Pod number	H6C-07	SSR	5.09	Pod	-	LG3	

				TAA-55		2.02			LG7	
				H5G-01		2.32			LG4	
			Days to flowering	H6C-07	SSR	6.07	DFLR	-	LG3	
				H1B-17		2.53			LG4	
			Days to maturity	TA-203	SSR	2.02	MAT	-	LG1	
				H6C-07		4.26			LG3	
				H2B-061		2.22			LG2	
				H1B-17		2.56			LG4	
7	ICC 4958 × ICC1882 (ICCRIL03)	264	Root length density	NCPGR127 -	SSR	4.78	QR3rld01	10.7	CaLG04	Varshney et al. 2014
				NCPGR21		-				
						-				
			Plant height	TA106-GA26	SSR	-	QR3pht01	15.5	CaLG06	
				TA34-NCPGR49		-	QR3pht02	1.0	CaLG03	
				NCPGR127 -		16.55	QR3pht03	10.7	CaLG04	
				NCPGR21						
			Pods/plant	NCPGR127 -	SSR	13.14	QR3pod01	10.7	CaLG04	
				NCPGR21						
			100-Seed weight	NCPGR127 -	SSR	32.38	QR3100sdw03	10.7	CaLG04	
				NCPGR21						

Root dry weight/Total plant dry weight (RTR, %)	TAA170 -	SSR	7.59	QR3rtr01	3.0	CaLG04
	NCPGR21					
Stem dry weight	TAA170 -	SSR	7.97	QR3sdw01	3.0	CaLG04
	NCPGR21					
Primary branches	TAA170 -	SSR	-	QR3bm03	3.0	CaLG04
	NCPGR21		3.01	QR3bm05		CaLG08
	TA118 -					
	HIII6					
Days to 50% flowering	NCPGR164 -	SSR	9.63	QR3df01	8.5	CaLG08
	CaM1918		-	QR3df04	3.0	CaLG04
	TAA170-NCPGR 21					
Harvest index	cpPb-679915	SSR	4.96	QR3hi06	12.0	CaLG01
	- CaM0393		-	QR3hi03	18.0	CaLG01
	TAA170 -					
	NCPGR21					
Days to maturity	NCPGR127 - TAA170	SSR	8.75	QR3dm01	8.5	CaLG08
	TAA170 -		-	QR3dm04	3.0	CaLG04
	NCPGR21		-	QR3dm03	14.0	CaLG06
	GA26-CaM0399					

			Yield	NCPGR90- TA8	SSR	-	<i>QR3yld03</i>	10.0	CaLG01	
				TAA170 -		-	<i>QR3yld04</i>	18.0	CaLG04	
				cpPb-680552				2.0		
			Drought tolerance indices	NCPGR90- TA8	SSR	-	<i>QR3dti03</i>	10.0	CaLG01	
			Root surface area	TA106-GA26	SSR	-	<i>QR3rsa02</i>	15.5	CaLG06	
8	ICC 283 × ICC 8261(ICCRL04)	288	Plant height	CaM0772-TS45	SSR	-	<i>QR4pht02</i>		CaLG08	Varshney et al. 2014
				CaM2029-TA11			<i>QR4pht04</i>		CaLG05	
		Days to 50% flowering		CaM1753- cpPb-677529,	SSR	-	<i>QR4df01</i>		CaLG03	
				TA103II-TA122		-	<i>QR4df06</i>		CaLG01	
				ICCeM0015-NCPGR200		-	<i>QR4df02</i>		CaLG06	
				CaM0772-TA118		-	<i>QR4df03</i>		CaLG08	
		Days to maturity		TA103II-TA122'	SSR	-	' <i>QR4dm05</i>		CaLG01	
				CaM2029-TA11		-	' <i>QR4dm07</i>		CaLG05	
				ICCeM0015-NCPGR200		-	' <i>QR4dm03</i>		CaLG06	
		100SW		CaM2093-ICCM0249	SSR	-	<i>QR4100sdw02</i>		CaLG04	
			POD	CaM0772- TS45'	SSR	-	<i>QR4pod02</i>		CaLG08	

			Drought tolerance indices	NCPGR136- TA203 TA103II-TA122'	SSR	-	QR4dti02 QR4dti03		CaLG01 CaLG01	
			Yield	TA 59-TA200 NCPGR273-CaM0051	SSR	-	QR4yld02 QR4yld03		CaLG02 CaLG03	
			Harvest index	CaM0317-CaM1257	SSR		QR4hi02		CaLG06	
9	ICC 4958 × ICC 1882	232	Root length density	bin_4_13239546 - bin_4_13378761	SNP	5.23	QTL	0.23	CaLG04	Kale et al. 2015
			Plant height	bin_4_13239546 - bin_4_13378761	SNP	24.34	QTL	0.23	CaLG04	
			pods/plant	bin_4_13239546 - bin_4_13378761	SNP	9.82	QTL	0.23	CaLG04	
			100-seed weight	bin_4_13239546 - bin_4_13378761	SNP	43.56	QTL	0.23	CaLG04	
			physiological trait: delta carbon ratio	bin_4_13239546 - bin_4_13378761	SNP	6.11	QTL	0.23	CaLG04	
			root dry weight/total plant dry weight ratio (%)	bin_4_13393647 - bin_4_13547009	SNP	10.57	QTL	0.22	CaLG04	
			morphological traits: shoot dry weight (g)	bin_4_13393647 - bin_4_13547009	SNP	13.78	QTL	0.22	CaLG04	
			primary branches	bin_8_6034209 - bin_8_5984553	SNP	5.70	QTL	9.47	CaLG08	

			Days to 50% flowering	bin_8_6034209 - bin_8_5984553	SNP	28.19	QTL	9.47	CaLG08	
			Harvest index	bin_8_6034209 - bin_8_5984553	SNP	8.01	QTL	9.47	CaLG08	
			days to maturity	bin_7_12870961 - bin_7_12856579	SNP	19.53	QTL	0.23	CaLG07	
10	ICC 4958 × ICC 1882	264	Root length density	ICCM0065 -Ca4_11276225;	SSR	4.59	QR3rld01.1; QR3rld01.2; QR3rld01.3	3.23	CaLG04	Jaganathan et al. 2015
				Ca4_13687456 - NCPGR21;		7.09		5.14		
				Ca4_13840227 - NCPGR21		6.20		5.37		
			Plant height	STMS11 - CaM0615,	SSR	9.02	QR3pht11, QR3pht11, QR3pht12	3.80	CaLG04	
				Ca8_4106644 - CISR80		8.06		3.80	CaLG08	
				Ca8_4106644 - CISR80		18.75		13.44	CaLG08	
			Pods/plant	Ca4_13687456- TAA170	SSR	5.34-18.79	10 QTL	0.86-5.37	CaLG04	
			100-seed weight	Ca4_13687456- TAA170	SSR	50.13	41 QTL	1.81-15.41	CaLG04	
			Root dry weight/total plant dry weight ratio (%)	Ca4_12558541 - Ca4_11276225,	SSR	-	QR3rtr01.1,	1.81	CaLG04	
				Ca4_13840227 - TAA170,		-	QR3rtr01.2,	4.39		
				ICCM0065 - Ca4_13588956,		-	QR3rtr01.3,	2.39		
				Ca4_13840227 - NCPGR21		8.96	QR3rtr01.4	5.37		
			morphologic al traits:	Ca4_12558541 - Ca4_11276225,	SSR	-	QR3sdw01.1	1.81	CaLG04	
				Ca4_12982420 - NCPGR21,		-	QR3sdw01.2	5.91		

			shoot dry weight (g)	Ca4_12558541 - Ca4_11276225,	-		QR3sdw01.1	1.81		
				Ca4_15651804 - TR8, Ca4_16149998 - ICCM0249	-		QR3sdw01.3	4.39		
					-		QR3sdw3	0.73		
							QR3sdw4	3.15		
			Root surface area	NCPGR4 - Ca6_4994876	SSR		QR3rsa02	7.57	CaLG06	
			Primary branches	CaM0812 -NCPGR164	SSR	5.27	QR3pbs02	8.81	CaLG08	
			Days to 50% flowering	NCPGR164 -Ca8_3050452	SSR	46.03	26 QTL	1.81-15.13	CaLG08	
			Harvest index	NCPGR164 -Ca8_3050452	SSR	14.52	6 QTLs	5.68-15.13	CaLG08	
			Days to maturity	NCPGR164 -Ca8_3050452	SSR	30.01	19 QTL	5.14-15.13	CaLG08	
			Drought susceptibility index (DSI)	ICCM0199c - CaM1417	SSR	-	QR3dsi02	6.28	CaLG07	
			Drought tolerance index (DTI)	Ca4_12558541 - Ca4_11276225,	SSR	-	QR3dti02	1.81	CaLG04	
				H2A08 - Ca1_6540035,		-	QR3dti05	16.29	CaLG01	
				NCPGR164 - CISR80		-	QR3dti06	15.13	CaLG08	
11	ICC 4958 × ICC 17163	190	Yield per plant and	SNP102 (86.7) to SNP104 (90.2)	SNP	8.0-8.5	CaqYP2.1 CaqHI2.1	3.5	CaLG(Chr)02	Srivastava et al. 2016

			harvest index							
				SNP171 (102.8) to SNP173 (106.4)	SNP	7.1-7.5	<i>CaqYP3.1</i> <i>CaqHI3.1</i>	4.4	aLG(Chr)03	
				SNP229 (96.6) to SNP231 (101.6)	SNP	6.5-6.7	<i>CaqYP4.1</i> <i>CaqHI4.1</i>	5.0	CaLG(Chr)04	
				SNP265 (75.8) to SNP268 (77.3)	SNP	8.0-8.2	<i>CaqYP5.1</i> <i>CaqHI5.1</i>	1.5	CaLG(Chr)05	
				SNP364 (86.4) to SNP367 (89.5)	SNP	9.5-10.0	<i>CaqYP6.1</i> <i>CaqHI6.1</i>	3.1	CaLG(Chr)06	
				SNP420 (95.1) to SNP422 (98.0)	SNP	10.8-11.5	<i>CaqYP7.1</i> <i>CaqHI7.1</i>	2.9	CaLG(Chr)07	
12	ICC 4958 × ICC 1882	232	Plant vigour score	Low density- SSR	SSR, SNP	7.0-32	5QTL	2.00	LG-4	Sivasakthi et al. 2018
				High density- SSR + SNPs		36-39		0.4-2.7	LG-4	
				Ultra-high density-SNPs		36.7		0.14	LG-4	
			3D-leaf area	Low density- SSR	SSR, SNP	5.0-12	14QTL	1.0-6.0	LG-4	
				High density- SSR + SNPs		6.0-13		0.4-3.6	LG-4	
				Ultra-high density-SNPs		2.3-9.8		0.15-13.0	LG-4,6	
			Projected leaf area	Low density- SSR	SSR, SNP	60.-6.0	7QTL	5.0-7.0	LG-4	
				High density- SSR + SNPs		6.0-9.0		1.3-5.6	LG-4	
				Ultra-high density-SNPs		5.6		0.05	LG-4	

Shoot dry weight	Low density- SSR	SSR, SNP	4.0-10.0	12QTL	3.0-7.0	LG-4
	High density- SSR + SNPs		5.0-11		0.9-2.8	LG-4
	Ultra-high density-SNPs		9.3		0.15	LG-4
Leaf area index	Low density- SSR	SSR, SNP	5.0-7.0	4QTL	4.0-7.0	LG-4
	High density- SSR + SNPs		6.0		0.8	LG-4
	Ultra-high density-SNPs		5.7		0.15	LG-4
Plant height	Low density- SSR	SSR,SNP	6.0-23	19QTL	2.0-8.0	LG-4
	High density- SSR + SNPs		8.0-29		0.8-2.9	LG-4
	Ultra-high density-SNPs		4.9-21.7		3.4-.14	LG-4
Plant height growth rate	Low density- SSR	SSR,SNP	5.0-13	QTL	3.0-4.0	LG-4
	High density- SSR + SNPs		7.0-17		1.1-4.6	LG-4
	Ultra-high density-SNPs		4.8-13.6		0.14-0.07	LG-4,7
Evapotranspiration	Low density- SSR	SSR, SNP	5.0	2QTL	8.0	LG-4
	High density- SSR + SNPs		4.0		0.21	LG-4
	Ultra-high density-SNPs		-		-	-
Evapotranspiration rate	Low density- SSR	SSR,SNP	6.0-8.0	7QTL	7.0-10	LG-4
	High density- SSR + SNPs		3.0-6.0		2.0-5.0	LG-3,4

				Ultra-high density-SNPs		5.7		0.48	LG-4	
			Transpiration	Low density- SSR	SSR,SNP	5.0	4QTL	6.0-8.0	LG-4,8	
				High density- SSR + SNPs		3.0-6.0		2.9-3.5	LG-5,8	
				Ultra-high density-SNPs		-		-	-	
			Transpiration rate	Low density- SSR	SSR,SNP	3.0-5.0	4QTL	5.0-13	LG-7	
				High density- SSR + SNPs		-		-	-	
				Ultra-high density-SNPs		5.1		0.08	LG-3	
			Residuals between 3D and projected leaf area (R-3D/PLA)	Low density- SSR	SSR, SNP	6.0-13	QTL	1.0-15.0	LG-4,6,7	
				High density- SSR + SNPs		7.0-14		0.3-4.2	LG-1,4,6,7	
				Ultra-high density-SNPs		-		-	-	
13	GPF 2 x ILWC 292	187	Days to germination	CNC_021165.1.18056125-CNC_021165.1.513801,	SNP	4.77	qdg-01	7.63	CaLG(Chr)06	Kushwah et al. 2022
						4.53	qdg-02	11.07	CaLG(Chr)07	
				CNC_021166.1.34922231-CNC_021166.1.15786786						
			Days to flowering initiation	CNC_021163.1.11351447-CNC_021163.1.12812015	SNP	6.85	qdfi-01	13.12	CaLG(Chr)04	
				CNC_021165.1.18056125-CNC_021165.1.513801		3.29	qdfi-02	7.63	CaLG(Chr)06	
			Days to 50% flowering	CNC_021163.1.11351447-CNC_021163.1.12812015,	SNP	5.27	qdff-02	13.12	CaLG(Chr)04	
						3.22	qdff-03	7.63	CaLG(Chr)06	

Days to 100% flowering;	CNC_021163.1.11351447- CNC_021163.1.12812015,	SNP	3.40	qdhf-02	13.12	CaLG(Chr)0 4
HI	CNC_021163.1.30731371- CNC_021163.1.30731330		4.65	qhi-02	4.23	CaLG(Chr)0 4
Membrane permeability index;	CNC_021165.1.1002514- CNC_021165.1.8008006	SNP	3.89	qmpi-02	16.75	CaLG(Chr)0 6
Relative leaf water content (%);	CNC_021163.1.30731371- CNC_021163.1.30731330	SNP	3.78	qrlwc-01	4.23	CaLG(Chr)0 4
