**Table S1.** Chickpea genotypes used along with their source and pedigree

|  |  |  |  |
| --- | --- | --- | --- |
| Sr. No. | Name of genotype | Source | Pedigree |
| 1 | JSC 55 | Sehore, MP | (JAKI 9226 x DCP 20) x JG 412 |
| 2 | JSC 56 | Sehore, MP | (ICCV 91962 x ICCV 10) x ICCV 892330 |
| 3 | JSC 40 | Sehore, MP | - |
| 4 | RV SSG 29 | Sehore, MP | FG 712 x CSG 9505 |
| 5 | RV SSG 28 | Sehore, MP | BGD 112 x BG72 |
| 6 | JG 6 | Jabalpur, MP | (ICCV10 x K850) x (H208 x RS11) |
| 7 | JG 315 | Jabalpur, MP | Selection from Kanpur Germplasm |
| 8 | JG 12 | Jabalpur, MP | (N. Bold x PG5) x PG 5 |
| 9 | JG 14 | Jabalpur, MP | (GW 5/7 x P327) x ICCV 83149 |
| 10 | JG 63 | Jabalpur, MP | Single plant selection from JG 62 |
| 11 | JG 322 | Jabalpur, MP | Chaffa x BG1 |
| 12 | JG 16 | Jabalpur, MP | ICCC 42 x ICCV 10 |
| 13 | JG 11 | Jabalpur, MP | (Phule G 5 x Narsingpur bold) x (ICCC37 x ICCC 860265-BPB 29P- BP) |
| 14 | JG 42 | Jabalpur, MP | [CJM 1 x IPC 9239) JG 7] 14-11-2011-42 |
| 15 | ICCV 10 | ICRISAT, Hyderabad | PI 231 x PI 265 |
| 16 | ICC 4958 | ICRISAT, Hyderabad | Germplasm collection |
| 17 | NBeG 780 | ANGRAU, AP | ICCC 37 x K 1189 |
| 18 | NBeG 03108 | ANGRAU, AP | ICCV 92065 x ICCV 88202) x KW 118 |
| 19 | NBeG 47 | ANGRAU, AP | ICCV 2 x PDG 84-16 |
| 20 | CSJ 513 | Durgapura, RJ | FG712 x CSJ 146 |
| 21 | BG 256 | IARI, New Delhi | (JG 62 x 850-3/27) x (L550 x H208) |
| 22 | BG 372 | IARI, New Delhi | P 1231 x P 1265 |
| 23 | BG 391 | IARI, New Delhi | ICC3935 x BG 256 |
| 24 | BGD 72 | IARI, New Delhi | (BG 256 x E 100 Ym) |
| 25 | BG 3062 | IARI, New Delhi | ICCV 10 X ICCL 87 |
| 26 | BG 3061 | IARI, New Delhi | ICCCV 03112 x JAKI 9218 |
| 27 | BG 3056 | IARI, New Delhi | ILC 3279 x RSG 143-1 |
| 28 | BGM 547 | IARI, New Delhi | Mutant of BG 256 |
| 29 | PhuleVikram | MPKV, Rahuri, MS | ICC 4958 x Annegiri |
| 30 | Phule G 0405 | MPKV, Rahuri, MS | Digvijay x WGC 2000-2 |
| 31 | Phule G 12107 | MPKV, Rahuri, MS | ICCV 04112 x ICCV 88202 |
| 32 | Phule G 12110 | MPKV, Rahuri, MS | ICCV 03112 x JAKI 9218 |
| 33 | Phule G 0302 | MPKV, Rahuri, MS | PGC x Phule G 96006 |
| 34 | GCP 101 | Junagadh, GJ | GCRZ x ICCV 2 |
| 35 | GJG 1205 | Junagadh, GJ | ICCV 04112 x JG 130 |
| 36 | GJG 1207 | Junagadh, GJ | ICCV 04112 x JG 130 |
| 37 | IPC 2010-09 | IIPR, Kanpur, UP | RSG 143-1 x IPC 2000-33 |
| 38 | IPC 2009-91 | IIPR, Kanpur, UP | JGK 1 x JG 315 |
| 39 | IPC 2011-28 | IIPR, Kanpur, UP | HC 5 x GL 23138 |
| 40 | IPC 2011-112 | IIPR, Kanpur, UP | IPC 94 x IPC 2002-120 |
| 41 | PBC 506 | Ludhiana, PB | ICCV 5107 x ICCC 37 |
| 42 | DBGV 101 | Dharwad, KA | - |
| 43 | H-11-22 | Hisar, HR | HC 1 x WR 315 |
| 44 | BDNG 797 | Badnapur, MS | - |
| 45 | JAKI 9218 | Akola, MS | (ICCC 37 x GW 517) x ICCV 10 |
| 46 | SAKI 9516 | Akola, MS | ICCC 4 x ICCV 10 |
| 47 | Digvijay | MPKV,Rahuri, MS | Phule G 9108 x Bheema |
| 48 | Vishal | MPKV,Rahuri, MS | K 850 x ICCL 80074 |
| 49 | Vijay | MPKV,Rahuri, MS | P127 x Annegiri |

- not known

**Table S2.** Molecular markers used for analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No.** | **Marker** | **Forward primer** | **Reverse primer** | **Linkage group** |
| 1 | TA122 | AATGCTACAAATTATTAAAAACAGTC | AACTTTTAGTGTGCTGACGAGT | LG01 |
| 2 | TA103 | TGAAATATCTAATGTTGCAATTAGGAC | TATGGATCACATCAAAGAAATAAAAT | LG01 |
| 3 | CaM2093 | AAAAGCCCCCAAAATACACC | TTCTTCCTCTTCTCTCCCACA | LG03 |
| 4 | H1E06 | GCAAATGTAACATCCTAAAATTAAAA | TCTTATAATAAAATTAAAAACACGTCAA | LG03 |
| 5 | H3G09 | AATTGTGCTTTGCCATTTCTAA | AAAATTTCTCTATAAGGGGAGAGGA | LG03 |
| 6 | H4G07 | ATTAGAGGCAAACAAGAACTTGAAAC | TGACACCTAATTTTATTCGGTTTTTAT | LG03 |
| 7 | H6C07 | CAAAAGTGCAATTAAGCCTACATAATA | CCATTTTGTTTTAACACATATTTAACG | LG03 |
| 8 | NCPGR21 | TCTACCTCGTTTTTCGTGCC | TTGCTCCTTCAACAAAACCC | LG04 |
| 9 | NCPGR127 | CATAATGCAAGGGCAATTAG | CTCTTATCTTCATGTTGCCG | LG04 |
| 10 | NCPGR142 | TAACTCCATTTGGCTTGAGA | TAACCTTATATGGTAGGCGG | LG04 |
| 11 | TA130 | TCTTTCTTTGCTTCCAATGT | GTAAATCCCACGAGAAATCAA | LG04 |
| 12 | TAA170 | TATAGAGTGAGAAGAAGCAAAGAGGAG | TATTTGCATCAATGTTCTGTAGTGTTT | LG04 |
| 13 | TR11 | AGGGAACCGGGATTACAGC | AAACACAGAGTGACTGCCC | LG04 |
| 14 | GA24 | TTGCCAAAACCAATAACTCTG | TCCCTTTTACACAAGGCCAG | LG04 |
| 15 | CaM1760 | AAATGTCAAAATTACCTTCTTTAATTG | TTTTTAAATTTGACGTGTTAAGTGG | LG04 |
| 16 | CaM0399 | ATAGCTTCGCAGTCCACACC | AATATGACAGCATGAGTGAGACA | LG04 |
| 17 | TR72 | ATCCTGCGTCCATTGTTAGG | TCTCTCTTTCATTTCTCTCATCATTC | LG04 |
| 18 | CaM1214 | ATTCACGGTGAGGAGACACC | CAACAAGTGCAGTGTATCAAATCA | LG04 |
| 19 | ICCM0257 | TCGCTTCCAACATTCAAAAA | CAATTGCACTTATAGCACAAACA | LG04 |
| 20 | ICCM0249 | TTTCTTCGCATGGGCTTAAC | GGAGATTTGTTGGGTAGGCTC | LG04 |
| 21 | STMS11 | GTATCTACTTGTAATATTCTCTTCTCT | ATATCATAAACCCCCCAC | LG04 |
| 22 | H1B04 | AGTTGAAACACACGGGTTA | AAAGTGAAATATGTCATCCTTATTA | LG04 |
| 23 | H1B17 | ATTCGAGGTGGTACCTCTAGTGA | GAGGAACCGACGATGTATCTATT | LG04 |
| 24 | H1G20 | TCAACACTTGTTTGAGATTGTT | GGTTCTCTAATGGCTTTATTCA | LG04 |
| 25 | SCY17 | GACGTGGTGACTATCTAGC | GACGTGGTGAAATAGATACC | LG04 |
| 26 | TA200 | TTTCTCCTCTACTATTATGATCACCAG | TTGAGAGGGTTAGAACTCATTATGTTT | LG05 |
| 27 | NCPGR203 | GAAGAGTTCTGTTGCGGTAG | ATTGGTAATGGCTCAACATC | LG06 |
| 28 | TA76 | TCCTCTTCTTCGATATCATCA | CCATTCTATCTTTGGTGCTT | LG07 |
| 29 | NCPGR138 | ATTCCAAATTGCTGTTGTTG | TGTGGATTTTAGTTGCAATG | LG08 |
| 30 | NCPGR164 | CCATAACCATAACCCTTTCA | TCTTCTCCTAAGTTGATGGG | LG08 |
| 31 | TA127 | AAATTGTAAGACTCTCATTTTTCTTTATT | TCAAATTAACTACATCATGTCACACAC | LG08 |
| 32 | TS45 | TGACACAAAATTGTCTCTTGT | TGTTCTTAACGTAACTAACCTAA | LG08 |
| 33 | GA6 | ATTTTTCTCCGGTGTTGCAC | AAACGACAGAGAGTGGCG AT | LG08 |
| 34 | CaM1918 | CCAAAAAGAAAATTGCAATCCA | TTCGTGCTCTCCTCTTCGAT | LG08 |
| 35 | CaM1753 | ATGGGAATTTTGAGCATCCA | TTTGCTGTAAACTCACGACCA | LG08 |

Markers were identified from the following studies

Hamwieh A, Imtiaz M and Malhotra RS (2013) Multi-environment QTL analyses for drought-related traits in a recombinant inbred population of chickpea (*Cicer arientinum* L.). *Theoretical and Applied Genetics* 126:1025–1038.

Thudi M, Upadhyaya HD, Rathore A, Gaur PM, Krishnamurthy L, Roorkiwal MN, Nayak S, Chaturvedi SK, Basu PS, Gangarao NVPR, Fikre A, Kimurto P, Sharma PC, Sheshashayee MS, Tobita S, Kashiwagi J, Ito O, Killian A and Varshney RK (2014) Genetic dissection of drought and heat tolerance in chickpea through genome-wide and candidate gene based association mapping approaches. *PLoS One* 9(5):0096758.

Varshney RK, Thudi M, Nayak SN, Gaur PM, Kashiwagi J *et al.*(2014) Genetic dissection of drought tolerance in chickpea (*Cicer arietinum* L.). *Theoretical and Applied Genetics* 127:445-462.

**Supplementary Table S3.** Mean growth rate (plant height in cm) at different growth periods and range of average temperatures in timely and late sown trials

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Trial | Sowing time | Days after sowing\* | | | | Mean height and range |
| 30 days | 60 days | 90 days | Maturity |
| 2015-16 | November | 19.66  43.16%  16.89-31.81ºC | 16.64  36.53% 12.42-31.01ºC | 4.63  10.16%  11.38-30.55ºC | 4.62  10.14%  15.88-33.97ºC | 45.55 |
| 31.30 - 57.20 |
| December | 20.81  49.89%  12.23-30.97ºC | 16.8  40.28%  11.33-30.54ºC | 3.81  9.13%  16.08-33.82ºC | 0.29  0.70%  17.05-35.02ºC | 41.71 |
| 32.70 - 58.60 |
| January | 12.8  42.38%  11.33-30.74ºC | 14.91  49.37%  16.16-33.82ºC | 2.34  7.75%  18.44-36.96ºC | 0.15  0.50%  21.28-38.88ºC | 30.2 |
| 24.00 - 42.60 |
| 2016-17 | November | 16.08  33.10%  11.24-29.73ºC | 24.66  50.76%  9.83-29.06ºC | 6.96  14.33%  11.99-29.46ºC | 0.88  1.81%  13.86-33.34ºC | 48.58 |
| 36.00 - 59.80 |
| December | 16.54  33.03%  9.82-28.99ºC | 23.39  46.71%  11.99-29.46ºC | 8.18  16.34%  13.86-33.39ºC | 1.96  3.91%  16.93-36.06ºC | 50.07 |
| 35.20 - 60.60 |
| January | 13.82  30.37%  12.04-29.24ºC | 22.55  49.56%  13.86-33.34ºC | 8.50  18.68%  17.05-36.48ºC | 0.63  1.38%  17.40-39.38ºC | 45.5 |
| 38.00 - 58.30 |
| Pooled data | November | 17.87  37.97%  14.07-30.77ºC | 20.65  43.88%  11.09-29.97ºC | 5.80  12.32%  11.69-30.01ºC | 0.63  5.82%  14.82-33.66ºC | 47.06 |
| 34.40 - 57.25` |
| December | 18.67  40.68%  11.02-30.01ºC | 20.10  43.80%  11.69-30.01ºC | 5.99  13.05%  15.00-33.58ºC | 1.13  2.46%  17.06-35.76ºC | 45.89 |
| 37.15 - 56.80 |
| January | 13.31  35.17%  11.69-30.14ºC | 18.73  49.48%  15.01-33.58ºC | 5.42  14.32%  17.69-36.48ºC | 0.39  1.03%  19.25-39.18ºC | 37.85 |
| 32.25 - 48.85 |

\* In each case, values in the first row indicate the average plant height (cm), in the second row indicate the percent growth compared to mean total plant height at maturity, while those in the third row indicate the average temperature range during the respective crop growth period