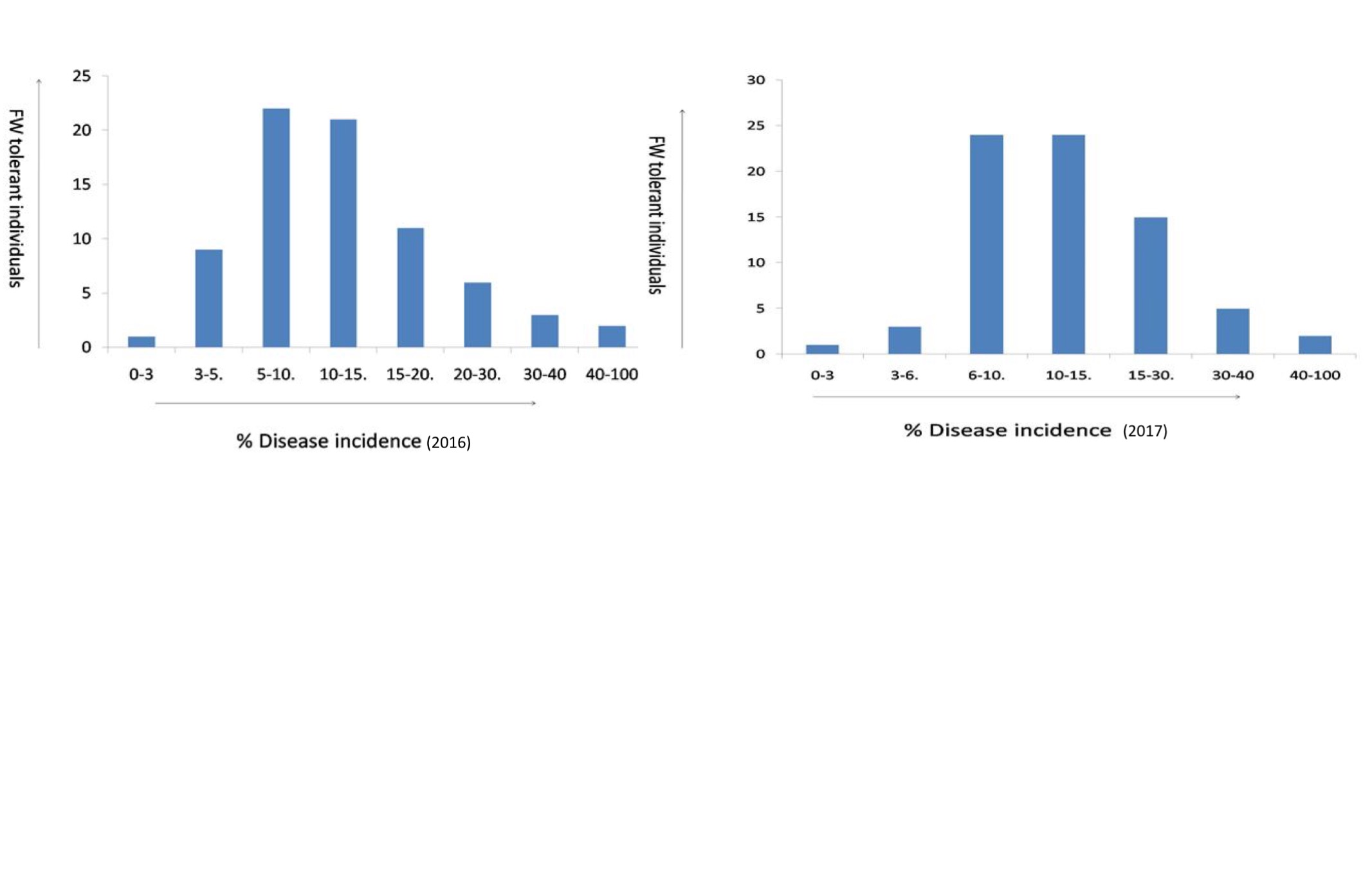
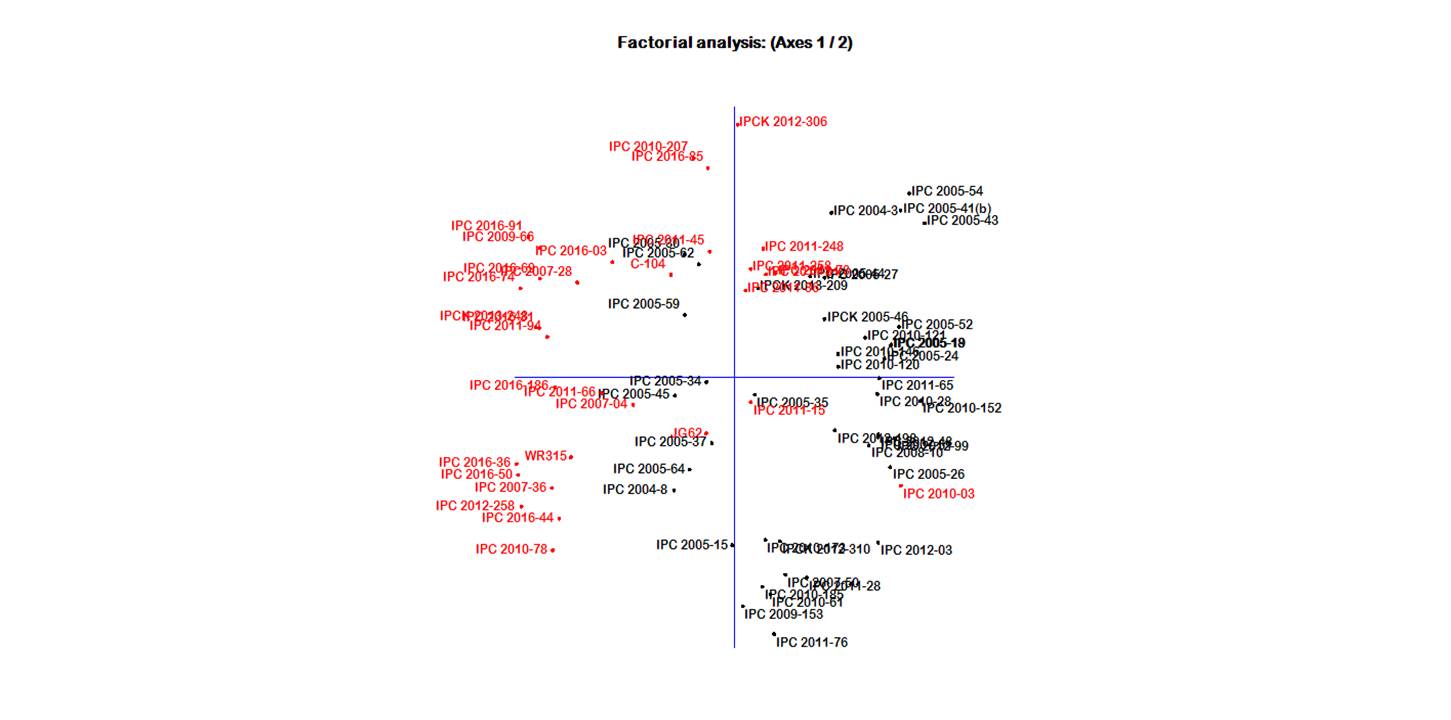
|  |  |  |  |
| --- | --- | --- | --- |
| **Table S1. List of 75 chickpea genotypes studied for association mapping** | | |  |
| **Genotype** | **Pedigree** | **FW disease reaction** | **Status** |
| JG62\*\* sensitive check | Local bulk selection | S | Released variety |
| IPC 2005-45 | DCP92-3 × IPC 71 | R | Advanced breeding line |
| IPC 2005-37 | L-149 × H-82-2 | MR | Advanced breeding line |
| IPC 2005-35 | KATILA × BG362 | MR | Advanced breeding line |
| IPC 2004-8 | IPC94-37 × ICCV96029 | MR | Advanced breeding line |
| IPC 2005-64 | DCP92-3 × IPC71 | MR | Advanced breeding line |
| IPC 2005-15 | H-82-2 × X ICCV10 | MR | Advanced breeding line |
| IPC 2005-34\* | ICC4953 × H82-2 | S | Advanced breeding line |
| IPC 2005-59 | DCP92-3 × IPC71 | MR | Advanced breeding line |
| IPC 2005-30 | GNG469 × KWR108 | S | Advanced breeding line |
| IPC 2005-62 | DCP92-3 × T-39-1 | MR | Advanced breeding line |
| IPC 2005-44 | KPG143-1 × T-39-1 | MR | Advanced breeding line |
| IPC 2005-54\* | PG5 × GNG469 | S | Advanced breeding line |
| IPC 2005-43\*\* | ICCV10 × PDG84-16 | S | Advanced breeding line |
| IPC 2005-41(b) | KPG 143-2 × T39-1 | MR | Advanced breeding line |
| IPC 2005-18 | DCP92-3 × IPC71 × ICC4958 | MR | Advanced breeding line |
| IPC 2005-27\*\* | GNG469 × KWR108 | S | Advanced breeding line |
| IPC 2004-3 | Selection from PA079 -9301 | MR | Advanced breeding line |
| IPCK 2005-46 | H82-94 × H95-67 × HK89131 | MR | Advanced breeding line |
| IPC 2005-52 | BG362 × BG256 | MR | Advanced breeding line |
| IPC 2005-24 | DCP92-3 × KTP1 | MR | Advanced breeding line |
| IPC 2005-19 | DCP92-3 × IPC92-1 | R | Advanced breeding line |
| IPC 2010-03 | IPCK96-3 × IPCK2004-1 | R | Advanced breeding line |
| IPC 2007-50 | GNG469 × KWR108 | MR | Advanced breeding line |
| IPC 2011-76 | CSG892 × FG711 | R | Advanced breeding line |
| IPC 2011-28 | HC5 × GL23138 | R | Advanced breeding line |
| IPC 2010-173 | IPC94-132 × BGD 112 | R | Advanced breeding line |
| IPC 2012-03 | IPC98-12 × BIO25 | MR | Advanced breeding line |
| IPC 2005-26 | KPG143-2 × T39-1 | MR | Advanced breeding line |
| IPC 2012-48 | DCP92-3 × BPM | MR | Advanced breeding line |
| IPC 2008-10 | PDG84-16 × ICC87322 | MR | Advanced breeding line |
| IPCK 2012-310 | JGK1 × ICC16144 | MR | Advanced breeding line |
| IPC 2010-185 | Selection from CP-116-15-22 | MR | Advanced breeding line |
| IPC 2009-153 | DOLLOR × IPCK96-3 | MR | Advanced breeding line |
| IPC 2010-61 | KWR108 × *C. reticulatum* | MR | Advanced breeding line |
| IPC 2012-198 | C214 × K850 | R | Advanced breeding line |
| IPC 2012-99 | GC98 × ICC14203 | MR | Advanced breeding line |
| IPC 2007-51 | PDG84-16 × H86-18 | MR | Advanced breeding line |
| IPC 2010-152 | BG256 × JG16 | MR | Advanced breeding line |
| IPC 2011-65 | IPC94-94 × IPC2000-4 | MR | Advanced breeding line |
| IPC 2010-28 | JG315 × ICCV92944 | R | Advanced breeding line |
| IPC 2010-120 | KWR108 × JG62 | MR | Advanced breeding line |
| IPC 2010-146 | IPC94-132 × ICCV96029 | MR | Advanced breeding line |
| IPC 2010-121 | IPC97-7 × IPC95-1 | R | Advanced breeding line |
| IPCK 2013-209 | Selection from ICARDA28143 line | R | Advanced breeding line |
| IPC 2007-04 | DCP92-3 × IPC94-19 | R | Advanced breeding line |
| WR315 tolerant check | Local bulk selection | R | Released variety |
| IPC 2012-258 | HC5 × PG5 | R | Advanced breeding line |
| IPC 2007-36 | DCP92-3 × IPC92-1 | R | Advanced breeding line |
| IPC 2010-78 | CSG8962 × K850 | R | Advanced breeding line |
| IPC 2011-94 | JG16 × IPC99-18 | R | Advanced breeding line |
| IPCK 2013-248 | Selection from ICARDA 16116 | R | Advanced breeding line |
| IPC 2009-66 | Selection from ICARDA LINE | R | Advanced breeding line |
| IPC 2007-28 | DCP92-3 × SAKI9516 | R | Advanced breeding line |
| C-104\*\* | Derivative of PB7 × rabat | S | Released variety |
| IPC 2010-207 | Selection from CP-211-2-3 | MR | Advanced breeding line |
| IPCK 2012-306 | Selection from ICARDA17/22 line | R | Advanced breeding line |
| IPC 2011-31 | BG256 × PG5 | R | Advanced breeding line |
| IPC 2011-45\* | Selection from ICARDA 24112 | S | Advanced breeding line |
| IPC 2011-258\* | Selection from ICARDA line | S | Advanced breeding line |
| IPC 2011-36 | KWR108 × RSG865 | R | Advanced breeding line |
| IPC 2011-78 | IPC98-12 × FG712 | MR | Advanced breeding line |
| IPC 2011-248\* | Selection from ICARDA line | S | Advanced breeding line |
| IPC 2011-15\*\* | IPC98-12 × ICC395466 | S | Advanced breeding line |
| IPC 2011-66 | IPC2002-120× IPC2000-4 | MR | Advanced breeding line |
| IPC 2016-186 | IPC06-88 × ILWC179 | R | Advanced breeding line |
| IPC 2016-36 | IPC06-127 × ILWC245 | R | Advanced breeding line |
| IPC 2016-50 | WR315 × IPCK02 | R | Advanced breeding line |
| IPC 2016-44 | IPC2008-57 × WR315 | R | Advanced breeding line |
| IPC 2016-31 | IPC09-50 × BPM | MR | Advanced breeding line |
| IPC 2016-74 | IPC09-50 × IPC2007-88 | MR | Advanced breeding line |
| IPC 2016-91 | HC5 × DCP92-3 | R | Advanced breeding line |
| IPC 2016-69 | KWR108 × JG14 | R | Advanced breeding line |
| IPC 2016-03 | WR315 × IPCK02 | R | Advanced breeding line |
| IPC 2016-85 | IPCK02 × ILWC21 | R | Advanced breeding line |
| R=resistant, MR=moderately resistant, S=susceptible | |  |  |

\*\*=early wilting, \*=late wilting

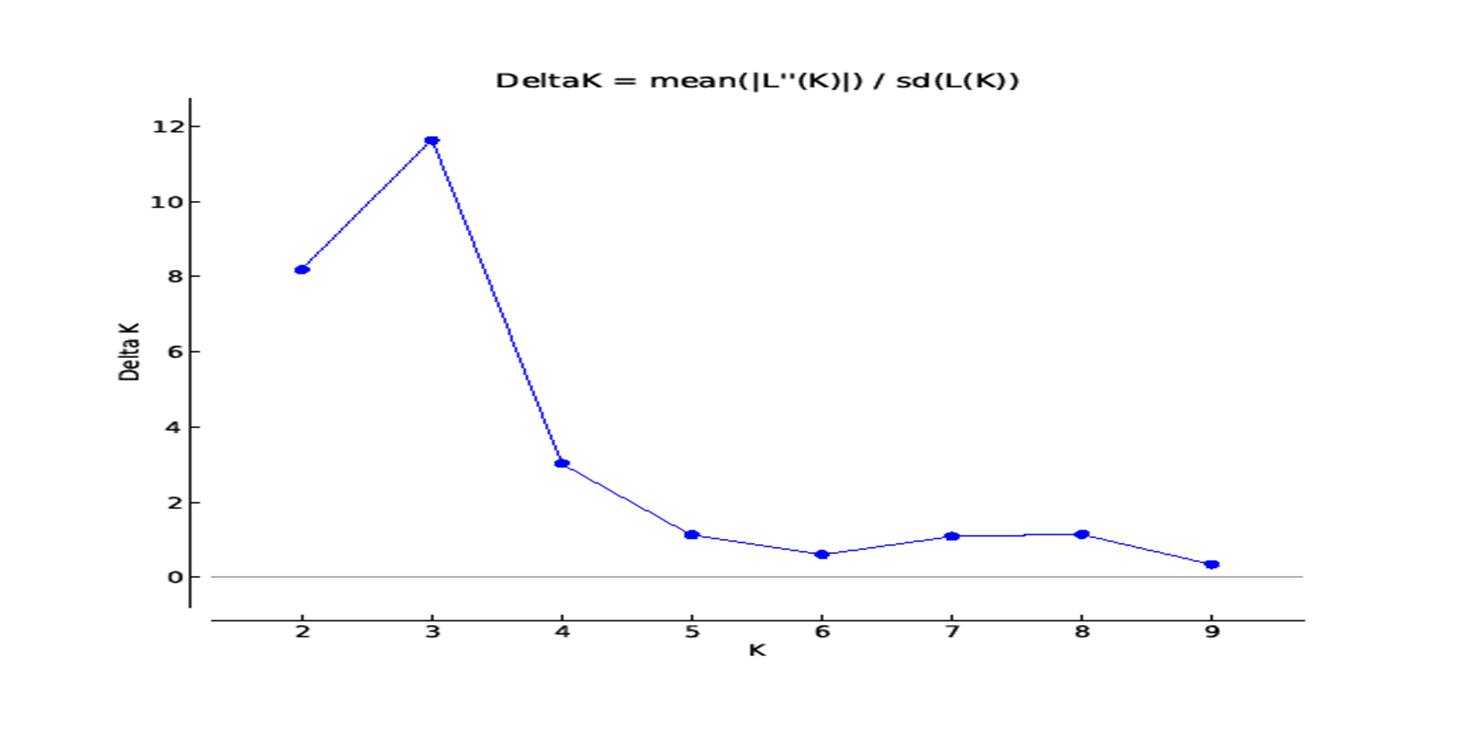


**Fig. S1. Frequency distribution of disease incidence in the 75 studied chickpea genotypes in the year 2016 & 2017**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table S2. Number of alleles, gene diversity and polymorphism recorded in 75 chickpea genotypes** | | | | | |
| **Marker** | | **Allele No. (Na)** | **Gene Diversity (He)** | **Heterozygosity** | **PIC** | **LG** | | **Reference** |
| TA106 | | 8 | 0.77 | 0.05 | 0.74 | LG6 | | Winter *et al.*(2000) |
| TS35 | | 3 | 0.55 | 0.07 | 0.46 | LG5 | | Winter *et al.*(1999) |
| NCPGR40 | | 3 | 0.55 | 0 | 0.48 | LG2 | | Sethy et al.(2006) |
| NCPGR129 | | 4 | 0.44 | 0.15 | 0.38 | LG4 | | Choudhary *et al.*(2012) |
| TA2 | | 4 | 0.73 | 0.08 | 0.68 | LG4 | | Winter *et al.* (1999) |
| CESSR172 | | 3 | 0.46 | 0.01 | 0.39 | LG2 | | Choudhary *et al.*(2012) |
| ICCM0124 | | 4 | 0.56 | 0.24 | 0.5 | LG3 | | Nayak *et al.*(2010) |
| NCPGR274 | | 3 | 0.64 | 0.07 | 0.57 | LG3 | | Choudhary *et al.*(2012) |
| NCPGR255 | | 6 | 0.8 | 0.95 | 0.77 | LG7 | | Choudhary *et al.*(2012) |
| NCPGR278 | | 3 | 0.54 | 0.11 | 0.48 | LG7 | | Choudhary *et al.*(2012) |
| GAA44 | | 2 | 0.48 | 0.09 | 0.37 | LG7 | | Winter *et al.*(2000) |
| NCPGR249 | | 2 | 0.19 | 0 | 0.17 | LG1 | | Choudhary *et al.*(2012) |
| H2L102 | | 5 | 0.74 | 0.03 | 0.7 | LG5 | | Choudhary *et al.*(2012) |
| STMS12 | | 2 | 0.49 | 0 | 0.37 | LG1 | | Lichtenzveig *et al.* (2005) |
| NCPGR217 | | 2 | 0.49 | 0 | 0.37 | LG5 | | Gaur *et al.*(2011) |
| NCPGR232 | | 4 | 0.67 | 0.01 | 0.61 | LG5 | | Choudhary *et al.*(2012) |
| NCPGR238 | | 4 | 0.65 | 0.01 | 0.58 | LG6 | | Gaur *et al.*(2011) |
| NCPGR46 | | 2 | 0.49 | 0 | 0.37 | LG6 | | Sethy *et al.*(2006) |
| CESSR88 | | 2 | 0.41 | 0 | 0.33 | LG3 | | Choudhary *et al.*(2012) |
| ICCeM036 | | 5 | 0.76 | 0.19 | 0.72 | LG6 | | Gujaria et al.(2011) |
| Cak TpSSR2543 | | 3 | 0.57 | 0.11 | 0.51 | - | | - |
| NCPGR149 | | 6 | 0.77 | 0.39 | 0.73 | - | | - |
| NCPGR231 | | 4 | 0.71 | 0.09 | 0.66 | LG4 | | Gaur *et al.*(2011) |
| NCPGR234 | | 5 | 0.71 | 0.03 | 0.66 | - | | Gaur *et al.*(2011) |
| NCPGR136 | | 5 | 0.76 | 0.2 | 0.73 | LG1 | | Gaur *et al.*(2011) |
| STMS10 | | 4 | 0.65 | 0.01 | 0.59 | LG3 | | Winter *et al.* (1999) |
| GA105 | | 2 | 0.44 | 0.03 | 0.35 | LG3 | | Winter *et al.*(2000) |
| ICCeM018 | | 2 | 0.49 | 0.07 | 0.37 | LG3 | | Winter *et al.* (2000) |
| TR19 | | 6 | 0.72 | 0.16 | 0.67 | LG2 | | Winter *et al.* (2000) |
| TS54 | | 6 | 0.78 | 0.23 | 0.74 | LG4 | | Winter *et al.* (2000) |
| NCPGR76 | | 2 | 0.5 | 0 | 0.37 | LG4 | | Sethy *et al.* (2006) |
| CESSR164 | | 3 | 0.6 | 0.01 | 0.52 | LG4 | | Choudhary *et al.*(2012) |
| CESSR114 | | 2 | 0.47 | 0 | 0.36 | LG4 | | Choudhary *et al.*(2012) |
| TAAS | | 7 | 0.77 | 0.21 | 0.74 | LG5 | | Winter *et al.*(2000) |
| NCPGR139 | | 6 | 0.73 | 0.15 | 0.68 | LG6 | | Choudhary *et al.*(2012) |
| TA176 | | 7 | 0.72 | 0.24 | 0.69 | LG6 | | Winter *et al.* (1999) |
| NCPGR199 | | 3 | 0.48 | 0.21 | 0.38 | LG4 | | Gaur *et al.*(2011) |
| NCPGR200 | | 3 | 0.6 | 0.09 | 0.54 | LG6 | | Choudhary *et al.*(2012) |
| TA80 | | 6 | 0.76 | 0.37 | 0.73 | LG6 | | Winter *et al.*(2000) |
| GA102 | | 3 | 0.57 | 0 | 0.49 | LG7 | | - |
| H4F07 | | 4 | 0.69 | 0.25 | 0.63 | LG5 | | Gujaria *et al.*(2011) |
| CESSR432 | | 2 | 0.39 | 0 | 0.31 | LG5 | | Choudhary *et al.*(2012) |
| NCPGR56 | | 3 | 0.63 | 0 | 0.56 | LG5 | | Sethy *et al.* (2006) |
| GA9 | | 4 | 0.58 | 0.04 | 0.51 | LG6 | | Winter *et al.*(2000) |
| H5A04 | | 3 | 0.63 | 0.05 | 0.56 | LG6 | | Lichtenzveig *et al.* (2005) |
| NCPGR177 | | 2 | 0.47 | 0.05 | 0.36 | LG6 | | Choudhary *et al.*(2012) |
| STMS2 | | 4 | 0.56 | 0.05 | 0.47 | LG4 | | Winter *et al.*(1999) |
| GA21 | | 4 | 0.67 | 0.01 | 0.61 | - | | Winter *et al.* (1999) |
| CESSR142 | | 3 | 0.49 | 0.01 | 0.38 | LG3 | | Choudhary *et al.*(2012) |
| GAA47 | | 2 | 0.49 | 0.01 | 0.37 | LG4 | | Winter *et al.* (1999) |
| TAASH | | 5 | 0.72 | 0.03 | 0.68 | LG5 | | Winter *et al.* (1999) |
| STMS22 | | 3 | 0.55 | 0.11 | 0.49 | LG5 | | Lichtenzveig *et al.* (2005) |
| NCPGR91 | | 4 | 0.73 | 0.09 | 0.68 | LG4 | | Sethy *et al.* (2006) |
| ICCM0196 | | 4 | 0.73 | 0.07 | 0.68 | LG7 | | Lichtenzveig *et al.* (2005) |
| NCPGR171 | | 2 | 0.37 | 0.01 | 0.3 | LG3 | | Choudhary *et al.*(2012) |
| CESSR53 | | 3 | 0.42 | 0.07 | 0.35 | LG3 | | Choudhary *et al.*(2012) |
| NCPGR123 | | 3 | 0.5 | 0.13 | 0.44 | LG6 | | Choudhary *et al.*(2012) |
| ICCM0065b | | 3 | 0.56 | 0.07 | 0.47 | LG4 | | Lichtenzveig *et al.* (2005) |
| TS72 | | 2 | 0.46 | 0.01 | 0.35 | LG4 | | Winter *et al.* (1999) |
| NCPGR187 | | 2 | 0.49 | 0 | 0.37 | LG6 | | Choudhary *et al.*(2012) |
| NCPGR180 | | 3 | 0.56 | 0 | 0.48 | LG3 | | Choudhary *et al.*(2012) |
| ICCeM028 | | 3 | 0.55 | 0.07 | 0.46 | LG3 | | Gujaria et al.(2011) |
| NCPGR43 | | 3 | 0.65 | 0.05 | 0.58 | LG3 | | Sethy *et al.* (2006) |
| STMS4 | | 4 | 0.74 | 0.19 | 0.69 | LG3 | | Winter *et al.* (1999) |
| ICCM034 | | 2 | 0.3 | 0 | 0.26 | LG7 | | Lichtenzveig *et al.* (2005) |
| NCPGR145 | | 2 | 0.48 | 0.08 | 0.36 | LG5 | | Choudhary *et al.*(2012) |
| TA34 | | 3 | 0.59 | 0.01 | 0.51 | LG1 | | Winter *et al.*(1999) |
| TR26 | | 4 | 0.6 | 0.08 | 0.54 | LG1 | | Winter *et al.*(1999) |
| NCPGR33 | | 3 | 0.57 | 0 | 0.5 | LG1 | | Sethy *et al.*(2006) |
| CESSR433 | | 4 | 0.67 | 0.05 | 0.61 | LG1 | | Choudhary *et al.*(2012) |
| TA14 | | 3 | 0.57 | 0.11 | 0.5 | LG4 | | Winter *et al.*(1999) |
| NCPGR254 | | 3 | 0.65 | 0 | 0.57 | LG5 | | Choudhary *et al.*(2012) |
| H2B19 | | 5 | 0.72 | 0.21 | 0.67 | LG7 | | Choudhary *et al.*(2012) |
| ICCM0284 | | 4 | 0.65 | 0.08 | 0.58 | LG6 | | Nayak *et al.* (2010) |
| NCPGR220 | | 3 | 0.66 | 0.01 | 0.59 | LG3 | | Choudhary *et al.*(2012) |
| **Mean** | | **3.56** | **0.59** | 0.09 | **0.52** |  | |  |



**Fig. S3. Factorial analysis of the 75 chickpea genotypes for FW resistance**



**Fig.S4. Relationship between *K* and Δ*Κ* based on STRUCTURE analysis of 75 chickpea genotypes based on SSR marker**