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Research Note

Drought tolerance efficiency and its correlation with yield and yield related traits in chickpea (*Cicer arietinum* L.)

C.K. Mehra[1], G. Katna[2*] and Sharma Kamal Dev[3]
[1]Department of Crop Improvement, CSK Himachal Pradesh Agriculture University, Palampur, India
[2]HAREC, CSKHPKV, Bajaura, Kullu (HP)
[3]Department of Agricultural Biotechnology, CSK Himachal Pradesh Agriculture University, Palampur, India
E-mail: gkatna@gmail.com

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Abstract
A set of 180 chickpea (*Cicer arietinum* L.) genotypes was evaluated under rainfed drought prone situation in north India. Same set was also evaluated under irrigated situation created artificially by supplementing the crop grown under rainfed conditions with two irrigations one at the time of flower initiation and another at pod set. Data on yield and its related traits, drought tolerance efficiency and incidence of wilt caused by *Fusarium oxysporum* f.sp. *ciceris* were recorded. Drought tolerance efficiency had significant and positive association with seed yield per plant, leaf area, plant height, secondary branches per plant, pods per plant, seeds per pod, biological yield per plant, harvest index and 100-seed weight under both drought and normal water conditions. On the other hand, days to 50 per cent flowering and days to maturity were negatively correlated with seed yield per plant under drought conditions indicating that early maturity was a desirable trait in chickpea breeding for drought stress. Drought enhanced wilt incidence in chickpea indicating a positive interaction between these two stresses and suggesting that drought in wilt pathogen infested areas would be more devastating. Based on yield performance and wilt resistance, nine genotypes, three *desi* (ICC-8521, ICC-1915 and L-328) and six *kabuli* (ICC- 14203, ICC- 14199, ICC-10755, ICC-10885, ICC-11819 and ICC-11284) were found promising for cultivation under drought conditions where as four *kabuli* types (ICC- 14203, ICC- 14199, ICC-11819 and ICC-11284) were suitable for cultivation under well watered conditions.

Key words
Cicer arietinum, correlation, *Fusarium* wilt, root rot complex, grain yield

Chickpea (*Cicer arietinum* L.) is the third most important grain legume in the world and is a predominant source of protein for vegetarian population in countries like India. Chickpea seed contains two to three times more of energy rich proteins (primarily the lysine) and oil in their seeds compared to the cereals. Being rich in protein, it plays a significant role in balanced human diet, especially when mixed with the cereal grains. Chickpea accounts for 13.54 million hectares area with a corresponding production of 13.90 million tonnes worldwide (FAOSTAT, 2015). Drought is an important yield-limiting factor in chickpea and is also a major threat to food security, sustainability of production systems and the well being of people living in drought prone areas. Drought as well as other biotic and abiotic stresses are the cause of low productivity of chickpea in India (Singh, 1993). Losses due to drought vary from 30% to 100%, depending on the genotypes, time and severity of drought (Singh, 1993, Leport *et al*., 1999). Annual yield losses due to drought and heat stress are estimated to the tune of 3.3 million tonnes globally (Ryan, 1997). Chickpea, being a rainfed crop in India, is usually subjected to terminal drought owing to less rainfall or lack of rainfall thereby resulting in poor flowering, pod formation, seed set per pod and finally the low productivity. One of the strategy to minimize losses due to drought is to identify or develop genotypes possessing tolerance to drought as well as capability to yield more under drought conditions.

A disease of chickpea called wilt which is caused by a fungal pathogen *Fusarium oxysporum* f. sp. *ciceri*, is also a serious problem in almost all chickpea growing areas of the world (Haware and Nene, 1980a). The disease leads to death of infected plants and causes significant annual yield losses in chickpea (Haware and Nene, 1980b). The disease under severe epiphytotics can cause 100% plant mortality (Halila and Strange, 1996) and hence, complete crop loss. The wilt pathogen survives in the soil even in the absence of host for more than six years (Haware *et al*., 1986) and the disease can occur under drought conditions.

Determination of correlation coefficients between yield and yield components are important to select favorable plant types for effective chickpea breeding. Character association has already been used to identify suitable genotypes in chickpea. Drought-related yield parameters for chickpea have already been reviewed (Turner *et al.*, 2001, Stoddard *et al.*, 2006, Toker *et al.*, 2007). Drought susceptibility index originally developed for cereals by Fischer and Maurer (1978) are used in the present study. Toker and Cagirgan (1998) found significant correlations in chickpea between drought susceptibility index and seed yield, biological yield, harvest index and mean productivity in drought-stressed environments. Other characteristics such as seed size (Singh *et al.*, 1994), rapid ground coverage (Siddique *et al.*, 2001), early vigour (Sabaghpour *et al.*, 2003), earliness and early maturity (Toker and Canci,

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2005) have been related to yield under drought conditions. Although direct selection for the seed yield could be misleading, indirect selection *via* yield related characters with high heritability might be more effective than the direct selection for yield (Tokerand Cagirgan, 2004). Correlation among the traits may be the consequence of pleiotropy or linkage/linkage disequilibrium (different loci affect traits, but these loci are linked together) among the characters (Ali *et al.*, 2009). Overall, the information on correlation of different characters will be very helpful for an efficient selection criterion in selecting the most desirable, high yielding genotypes of chickpea suitable for drought prone areas.

In the present study, we report correlation of different traits in chickpea under rainfed and irrigated conditions and genotypes which are tolerant to drought. The introduction of chickpea genotypes performing better under both drought and irrigated conditions will enhance chickpea productivity.

The experiments were conducted at the Research Sub Station Berthin, CSK Himachal Pradesh Krishi Vishvavidyalaya (31°12'30" to 31°35'30" N latitude, 76°23'45" to 76°55'40" E longitude, 625 meters above mean sea level), during *rabi* season 2010-11 under drought (E_1) and irrigated (E_2) conditions. One hundred eighty chickpea genotypes (119 *desi* and 61 *kabuli*) comprising of local germplasm or accessions procured from ICRISAT were evaluated in an Augmented Block Design. The genotypes were sown during *rabi* season (2nd November, 2010) in 9 blocks, each having 20 entries and 2 checks. Each genotype was sown in a single row of 3m length with inter-row and inter-plant spacing of 30 and 10 cm, respectively. Recommended agronomic practices were followed during the period of crop growth in both the environments. The drought condition prevailed at the time of flowering and pod set of the crop due to lack of rain. In irrigated experiment two irrigations, one at flowering stage and second at pod formation stage were provided.

The data were recorded on line basis for days to 50 per cent flowering, days to maturity and seed yield. Five randomly selected plants were used to calculate leaf area, plant height, primary branches per plant, secondary branches per plant, pods per plant, seeds per plant, biological yield per plant, harvest index, 100-seed weight and seed yield per plant. The data of the five plants were pooled to calculate the average.

To assess drought tolerance, drought susceptibility index (DSI) and drought tolerance efficiency (DTE) were calculated. The drought susceptibility index (DSI) measures drought tolerance in terms of minimization of the reduction in yield caused by drought compared to favorable conditions. The DSI was estimated for seed yield using the formula suggested by Fisher and Maurer (1978).

$$DSI = \frac{1 - Y_D/Y_P}{D}$$

Where, Y_D= Grain yield of the genotype under moisture stress condition; Y_P = Grain yield of the genotype under non- stress condition

$$Dn = 1 - \frac{\text{Mean grain yield of all strains under moisture stress condition}}{\text{Mean grain yield of all strains under non- stress condition}}$$

Drought tolerance efficiency (DTE) was estimated by using formula given by Fischer and Wood (1981).

$$DTE\ (\%) = \frac{\text{Yield under stress}}{\text{Yield under non-stress}} \times 100$$

For computing correlation coefficient**,** analysis of variance was performed in all possible paired combination of various characters studied under both the conditions.

$$r = \frac{Cov.\ (x.y)}{(V_x V_y)^{1/2}}$$

where, $Cov.x.y = [\sum x.y. - \{(\sum x). (\sum y)/N\}]/N\text{-}1$

$V_x = S^2x = [\sum x.y\text{-}\{(\sum x)/N\}]/N\text{-}1$

$V_y = S^2y = [\sum x.y\text{-}\{(\sum y)/N\}]/N\text{-}1$

The significance of coefficients of correlation was tested against 'r' values as given by Fisher and Yates (1963) at n-2 degree of freedom.

The incidence (%) of *Fusarium* wilt was also recorded. Based on the incidence, the genotypes were classified for their disease reaction on a 0-9 scale given by Mayee and Datar (1986).

Seed yield per plant varied from 3.00-26.00 g with an average of 12.69 g for *desi* and from 3.00-22.00 g with an average of 12.52 g for *kabuli* under drought condition. In irrigated condition, the seed yield varied from 3.60-32.2 g with an average of 17.12 g for *desi* and for *kabuli* from 8.00-32.00 g with an average of 18.72 g. Eight *kabuli* genotypes *viz*., ICC-14203, ICC-14199, ICC-13816, ICC-10755, ICC-11819, ICC-11284, ICC-8151 and ICC-10885 were found to be significantly superior to the grand mean of *kabuli* genotypes and three *desi* genotypes *viz*.,ICC-8521, ICC-1915 and L-328 were found to be significantly superior to the best check HPG-17 under drought condition whereas four *kabuli* genotypes, *viz*., ICC-14199, ICC-11819, ICC-11284 and ICC-14203 were found to be superior under irrigated condition to the grand mean of *kabuli* genotypes.

Both under drought and irrigated conditions, the seed yield per plant had a strong positive association with leaf area, plant height, secondary branches per plant, pods per plant, seeds per pod, biological yield per plant, harvest index and 100-

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seed weight indicating that selection criteria would be the same under both drought and irrigated conditions. Similar to the present findings, high and positive correlation of yield per plant with pods per plant, number of primary branches per plant, number of secondary branches per plant, plant height, biological yield per plant, harvest index and days to maturity was observed by several workers (Islam *et al.,* 1984, Muhammad *et al.,* 2008, Sanjay and Anil, 2009 and Geetika *et al.,* 2015). The positive significant correlations with seed yield per plant with days to maturity, plant height and primary branches per plant, however changed in the rainfed areas (Geetika *et al.,* 2015). In contrast to irrigated conditions, seed yield per plant under drought showed significant negative correlation to days to 50 per cent flowering and days to maturity indicated that early maturing genotypes might be best suited for cultivation in rainfed conditions of northern India. Negative association of seed yield per plant with days to 50 per cent flowering and days to maturity indicated that there is possibility of improvement of yield without any adverse effect on the expression of these traits. Whereas, Saleem *et al.* (2002) reported that the seed yield per plant was positively and significantly correlated with days to flowering, total weight of plant, number of pods per plant and 100-seed weight. This finding has been contrary to our findings.

Seeds per pod showed significant positive correlations with biological yield per plant and seed yield per plant under both the conditions, whereas with plant height, primary branches per plant, pods per plant and drought tolerance efficiency under drought condition. While this trait showed significant negative association with days to 50 per cent flowering, days to maturity, 100-seed weight, drought susceptibility index and reduction in yield (%) under drought condition. Pods per plant exhibited significantly positive correlation with leaf area, plant height, primary branches per plant, secondary branches per plant, seeds per pod, biological yield per plant, seed yield per plant and drought tolerance efficiency under drought condition; and with leaf area, plant height, secondary branches per plant, biological yield per plant and seed yield per plant under irrigated condition. Harvest index showed significant positive correlation with seed yield per plant and drought tolerance efficiency under drought condition and with seed yield per plant and 100-seed weight under irrigated condition. Whereas, significant negative associations were observed under drought condition with leaf area, plant height, biological yield per plant, drought susceptibility index and reduction in yield (%) and under irrigated condition with biological yield per plant only. These results are in conformity with earlier studies by Meena *et al.,* 2010 and Zali *et al.,* 2011.

Under drought conditions, DTE showed significant positive association with plant height, primary branches per plant, secondary branches per plant, pods per plant, seeds per plant, biological yield per plant, seed yield per plant and harvest index. Whereas association between DTE and days to maturity was negative. Both drought susceptibility index (DSI) and reduction in yield (%) showed significant negative associations with plant height, primary branches per plant, secondary branches per plant, pods per plant, seeds per pod, biological yield per plant, seed yield per plant and harvest index under drought conditions. Thus, seed yield per plant showed positive association with drought tolerance efficiency (DTE) whereas negative association with drought susceptibility index (DSI) and reduction in yield (%) under drought conditions. This indicated that potential genotypes to be grown under drought conditions should be selected on the basis of low DSI and high DTE values with due consideration on higher seed yield under drought . Toker (2004) found that biological yield was the most important character of all the traits studied due to its close relationship with seed yield. Million *et al*. (2005) while studying the response of chickpea genotypes to soil moisture stress at different growth stages reported that seed yield positively and significantly correlated with number of pods per plant and seeds per plant under stress and non-stress conditions. Similar to our study, the morphological traits such as biomass, pod number, branch number, leaf area etc. have also been reported to be strongly correlated with grain yield under water stress conditions (Singh, 2006).

Overall incidence of disease was low among the genotypes studied (Table 3). The incidence, however, led to comparison of incidence among the genotypes between drought and normal conditions. Between water sufficient and water scarce conditions, the wilt incidence was more under water scarce conditions. Under drought, 101 genotypes (68 *desi* and 39 *kabuli* genotypes) had wilt incidence less than 1 per cent whereas under irrigated condition 139 genotypes (101 *desi* and 38 *kabuli* genotypes) had wilt incidence less than 1 per cent. Forty seven genotypes (29 *desi* and 18 *kabuli* genotypes) growing under water scarce condition and 27 (23 *desi* and 4 *kabuli* genotypes) under irrigated condition had disease incidence between 1-10% (Table 3). Seventeen genotypes (16 *desi* and 1 *kabuli*) under drought condition and that of six (4 *desi* and 2 *kabuli*) under irrigated condition were moderately susceptible whereas nine genotypes (6 *desi* and 3 *kabuli*) under drought and eight genotypes (5 *desi* and 3 *kabuli*) growing under adequate water condition were susceptible. It clearlyindicates that drought enhanced incidence of wilt lead to more damage to crop. The best genotypes on the basis of *per se* performance and resistance to disease were ICC-8521, ICC-1915

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and L-328 for *desi* and ICC- 14203, ICC- 14199, ICC-10755, ICC-10885, ICC-11819 and ICC-11284 for *kabuli* under drought conditions; and ICC- 14203, ICC- 14199, ICC-11819 and ICC-11284 for *kabuli* under irrigated condition.

On the basis of yield performance and resistance to disease, the promising genotypes under drought conditions were three *desi* types (ICC-8521, ICC-1915 and L-328) and six *kabuli* types (ICC- 14203, ICC- 14199, ICC-10755, ICC-10885, ICC-11819 and ICC-11284). Under adequate water conditions i.e. irrigated four *kabuli* genotypes *viz*., ICC-14203, ICC-14199, ICC-11819 and ICC-11284 were high yielding as well as resistant to wilt. The resistant genotypes found in the present study need further evaluation before their direct use as a source of resistance to wilt/root rot complex in breeding programme as the study is of one year under natural epiphytic conditions and overall wilt incidence was low.

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Table 1. Scale used to evaluate chickpea genotypes for disease reaction to wilt

S. No.	Grade	Score	Reaction
1	<1%	1	Resistant
2	1-10%	3	Moderately resistant
3	11-20%	5	Moderately susceptible
4	21-50%	7	Susceptible
5	>51%	9	Highly susceptible

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Table 2. Estimates of correlation coefficients among different traits of chickpea under drought (E_1) and irrigated (E_1) conditions

Characters	C	Days to 50% flowering	Days to maturity	Leaf area (cm^2)	Plant height (g)	Primary branches per plant	Secondary branches per plant	Pods per plant	Seeds per pod	Biological yield per plant (g)	Seed yield per plant (g)	Harvest index (%)	100-seed weight (g)	DTE	DSI	Reduction in yield (%)
Days to flowering 50%	E_1	1.000														
	E_2	1.000														
Days to maturity	E_1	0.924*	1.000													
	E_2	0.513*	1.000													
Leaf area (cm^2)	E_1	-0.194*	-0.169*	1.000												
	E_2	0.001	0.057	1.000												
Plant height (cm)	E_1	-0.240*	-0.216*	0.509*	1.000											
	E_2	-0.088	0.070	0.251*	1.000											
Primary branches per plant	E_1	-0.195*	-0.225*	0.151*	0.089	1.000										
	E_2	0.075	-0.007	0.085	-0.004	1.000										
Secondary branches per plant	E_1	-0.043	-0.014	0.345*	0.272*	0.257*	1.000									
	E_2	-0.002	0.067	0.259*	0.269*	0.029	1.000									
Pods per plant	E_1	-0.035	-0.027	0.351*	0.238*	0.169*	0.613*	1.000								
	E_2	0.056	0.101	0.296*	0.185*	0.088	0.528*	1.000								
Seeds per pod	E_1	-0.272*	-0.273*	0.039	0.185*	0.166*	0.119	0.174*	1.000							
	E_2	-0.035	-0.076	-0.013	0.062	0.034	0.013	0.022	1.000							
Biological yield per plant (g)	E_1	-0.248*	-0.250*	0.481*	0.508*	0.131	0.430*	0.647*	0.256*	1.000						
	E_2	-0.076	-0.103	0.380*	0.449*	0.097	0.472*	0.592*	0.172*	1.000						
Seed yield per plant (g)	E_1	-0.187*	-0.189*	0.364*	0.407*	0.136	0.447*	0.638*	0.239*	0.791*	1.000					
	E_2	-0.078	-0.063	0.320*	0.438*	0.010	0.423*	0.576*	0.189*	0.846*	1.000					
Harvest index (%)	E_1	0.056	0.048	-0.246*	-0.233*	0.039	-0.025	-0.042	-0.015	-0.384*	0.205*	1.000				
	E_2	0.006	0.067	-0.055	0.007	-0.112	-0.019	0.083	0.046	-0.179*	0.344*	1.000				
100-seed weight (g)	E_1	-0.031	-0.030	0.248*	0.284*	-0.058	-0.014	-0.206*	-0.271*	0.190*	0.335*	0.128	1.000			
	E_2	-0.081	-0.064	0.181*	0.331*	-0.030	0.067	-0.254*	-0.130	0.264*	0.389*	0.201*	1.000			
DTE	E_1	-0.087	-0.126*	0.128	0.263*	0.148*	0.293*	0.395*	0.287*	0.398*	0.565*	0.239*	0.010	1.000		
DSI	E_1	0.087	0.126*	-0.128	-0.263*	-0.148*	-0.293*	-0.395*	-0.287*	-0.398*	-0.565*	-0.239*	-0.010	-1.000	1.000	
Reduction in yield (%)	E_1	0.079	0.120	-0.119	-0.258*	-0.153*	-0.292*	-0.390*	-0.275*	-0.394*	-0.560*	-0.239*	-0.015	-0.996*	0.996*	1.000

* Significant at 5 per cent level of significance

Table 3. Incidence of wilt in chickpea genotypes in drought (E_1) and irrigated (E_2) conditions

	Disease incidence				
	<1%	**1-10%**	**11-20%**	**21-50%**	**>51%**
E_1	(***Desi***) ICC-1230, PBG-1, L-328, ICC-2720, 1CCV-95509, ICC-2065, BGD-112, ICC-2210, ICC-1052, 1CCV-96911, ICC-1392, ICC-2884, ICCV- 95503, ICC-440, ICCV-96904, ICC-1923, ICC-4445, ICC-762, L-294, ICC-16349, L-221, ICC-3761, L-810800, ICC-3325, ICC-5434, ICC-67, L-306, ICC-1882, ICC-1083, ICC-283, ICC-6306, ICC-5504, L-81, ICC-3631, ICC-4538, ICC-10673, ICC-10685, C-622, ICC-8515, ICC-8521, ICC-8718, ICC-6279, ICC-8384, ICC-4567, ICC-11903, ICC-7305, ICC-8522, ICC-8195, ICC-7184, ICC-5383, ICC-12654, ICC-8607, ICC-12307, ICC-12379, ICC-12866, ICC-12851, ICC-12537, ICC-12726, ICC-13863, ICC-13892, ICC-14799, ICC-15888, ICC-16374, ICC-16269, ICC-15868, ICC-15618. **(55.46%)** (***Kabuli***) ICC-1164, ICC-3218, ICC-2990, ICC-6263, ICC-3239, CSU-927, ICC-4841, ICC - 12492, ICC-10885, ICC-7255, ICC-8156, ICCV-95413, ICC-8261, ICC-7223, ICCV-95428, ICC-7345, ICC-11819, ICC-11284, ICC-7668, ICC-11303, ICC-12028, ICCV-6, ICC-10755, ICC-7308, ICC-15435, ICC-15406, ICC-14203, ICC-14199, ICC-15518, ICC-15785, ICC-16654, ICC-15762, ICC-1444. **(54.09%)**	(***Desi***) ICC-708, ICC-1180, ICC-16348, ICC-2737, ICC-1710, ICC-898, ICC-2969, ICC-637, ICC-867, ICC-95, ICC-1205, ICC-791, ICC-2072, ICC-3776, ICC-6571, ICC-6293, ICC-3582, ICC-8318, ICC-6579, ICC-8621, ICC-12284, ICC-15612, ICC-14778, ICC-16487, ICC-16207, ICC-16261, ICC-6537, ICC-8200, ICC-11944. **(24.36%)** (***Kabuli***) ICC-6294, ICC-8855, ICCV-96903, ICC-9712, ICC-7571, ICCV-95414, ICCV-16, ICC-8740, ICC-12328, ICC-11879, ICC- 13816, ICC-11764, C-603, ICC-9755, ICC-9636, ICC-9643, ICC-10341, ICC-15697. **(29.50%)**	(***Desi***) ICC-1397, ICC-456, ICC-506, GPF-2, L-333, ICC-1715, L-113, ICC-1098, ICC-4918, ICC-4593, ICC-4639, ICCV-96910, ICC-9702, ICC-9590, ICC-15614, ICC-7150. **(13.44%)** (***Kabuli***) ICC-8151. **(1.63%)**	(***Desi***) ICC-2919, ICC-3421, ICC-11279, ICC-16574, ICC-8350, ICC-15802. **(5.04%)** (***Kabuli***) ICC-1161, ICC-7272, ICCV-95417. **(4.91%)**	-
E_2	(***Desi***) ICC-708, ICC-1230, ICC-2720, PBG-1, L-328, ICC-16348, ICC-2737, ICC-1915, ICC-1052, BGD-112, ICC-1392, ICCV-96911, ICC-1710, ICC-898, ICC-2884, ICC-456, ICCV-96904, ICC-1923, ICC-4495, ICC-637, ICC-95, ICC-762, L-294, ICC-16349, ICC-3230, ICC-1715, L-333, ICC-791, ICC-1098, L-113, ICC-3421, ICC-L-810800, ICC-3325, ICC-5434, ICC-3512, ICC-1882, L-306, ICC-1083, ICC-283, ICC-4918, ICC-4593, ICC-3776, ICC-6306, ICC-6571, ICCV-96910, ICC-6294, ICC-5504, ICC-3631, L-81, ICC-4533, ICC-10673, ICC-10685, ICC-12492, ICC-8515, ICC-8521, ICCV-95503, ICC-8318, ICC-9702, ICC-6579, ICC-7345, ICC-8718, ICC-9590, ICC-11279, ICC-11819, ICC-7571, ICCV-16, ICC-8740, ICC-8752, ICC-6537, ICC-8384, ICC-8350, ICC-8200, ICC-11903, ICC-7305, ICC-8522, ICC-7184, ICC-5383, ICC-12654, ICC-8607, ICC-12307, ICC-12379, ICC-12537, ICC-12866, ICC-12851, ICC-12824, ICC-12726, ICC-13863, ICC-15612, ICC-13892, ICC- 14799, ICC-14402, ICC-14403, ICC-15888, ICC-14778, ICC-16487, ICC-16524, ICC-15735, ICC-16207, ICC-16379, ICC-16261, ICC-15618. **(84.87%)** (***Kabuli***) ICC-1161, ICC-3218, ICC-2990, ICC-3239, ICCV-95417, CSU-927, ICC-10885, ICC-7255, C-622, ICC-7272, ICCV-96903, ICC-9712, ICC-8261, ICCV-95428, ICC-8151, ICC-8156, ICC-8855, ICCV-95414, ICC-11764, C-603, ICC-9755, ICC-9636, ICC-10341 ICC-12028, ICCV-6, ICC-10755, ICC-7308, ICC-12328, ICC-11879, ICC-13816, ICC-15435, ICC-15406, ICC-14199, ICC-14195, ICC-15518, ICC-15762, ICC-14446, ICC-15697, **(63.93%)**	(***Desi***) ICC-1180, ICC-1164, ICCV-95509, ICC-2210, ICCV-95503, ICC-867, L-221, GPF-2, ICC-506, ICC-2919, ICC-3761, ICC-67, ICC-2072, ICC-4639, ICC-6293, ICC-3582, ICC-8621, ICC-6279, ICC-8195, ICC-11944, ICC-16269, ICC-15868, ICC-15802. **(37.70%)** (***Kabuli***) ICC-6263, ICCV-95413, ICC-11284, ICC-9643. **(6.55%)**	(***Desi***) ICC-1205, ICC-2679, ICC-7150, ICC-15614. **(3.36%)** (***Kabuli***) ICC-7323, ICC-11303. **(3.27%)**	(***Desi***) ICC-2065, ICC-1397, ICC-2969, ICC-440, ICC-4567. **(4.20%)** (***Kabuli***) ICC-4841, ICC-7668, ICC-16654. **(4.91%)**	-