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Grouping of Desi Chickpea (*Cicer arietinum* L.) Genotypes Based on Seed Quality Parameters and Chemical Test

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Abstract

An experiment was carried out at the Seed Testing Laboratory, Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh, to characterize twenty-five chickpea genotypes based on seed quality parameters and chemical tests. Among 25 genotypes, seed germination percent was observed higher (>90%) except GJG 0504 (84.75 %) in all twenty five genotypes, whileseedling vigour index I was high in all twenty-five genotypes. The seeds were subjected to NaOH test, Modified phenol test A, Modified phenol test B, KOH test, $FeSO_4$ test and GA_3 growth response test for differentiating the genotypes. The genotypes were grouped based on Potassium Hydroxide test, the genotypes were grouped into dark yellow (2 genotypes), light yellow (2 genotypes) and no colour reaction (21 genotypes). Based on the $CuSO_4$ test, the genotypes were grouped into dark brown (23 genotypes) and no change (2 genotypes). Based on Na_2CO_3 test, the genotypes did not differentiated, all the 25 genotypes, seed colour was black. Based on the KOH test, the genotypes were grouped into black (13 genotypes), dark brown (7 genotypes) and no change (5 genotypes). Based on the $FeSO_4$ test, the genotypes were grouped into black (17 genotypes) and no change (8 genotypes). Based on GA_3 growth response test varied significantly among the genotypes and the GA_3 growth response test ranged from 26.80 cm (GCP 9709) to 42.15 cm (JCP 63) with a mean of 34.22 cm.

***Key words** : Chickpea, characterization, quality parameters, chemical tests*

Introduction

Chickpea popularly known as Gram, Bengal gram, Homes, Chhola, Garbanzo bean is one of the first seed legumes to be domesticated by humans in old world. Chickpea (*Cicer arietinum* L.) a diploid (2n=16) member of the family Fabaceae and sub family Faboideae. Among pulses chickpea is the third most important food legume crop in the world after dry beans (*Phaseolus vulgaris* L.) and dry peas *(Pisum sativum* L.) (1). In india, the area under chickpea was 10.56 million hectares with a production of 11.37 million tonnes and productivity of 1077 kg/ha during *rabi* 2017-18. In Gujrat, area under chickpea was 0.293 million hectares with a total production of 0.376 million tonnes and productivity of 1285 kg/ha during 2017-18. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka are major growing states. However, India being largest producer of chickpea is unable to meet the demands of its own. Chickpea originated in the temperate regions of Southeastern Turkey and adjoining Syria. The chickpea has been divided in to two groups. (2) Macrospora referred as *kabuli* and (3) Microspora referred as *desi* type by Indian breeders. *Desi*and*kabuli* chickpea production ratio throughout the world is 3:1.

Maintenance of genetic purity of varieties is of primary importance for preventing varietal deterioration during successive regeneration cycles and for ensuring varietal performance at an expected level. The aspects of Distinctness, Uniformity and Stability (DUS) are fundamental for characterization of varieties. In countries having Plant Breeder's Right (PBR) in operation, a new variety is registered only, if it is distinct from other varieties (4) uniform in its characteristics and genetically stable. In the light of the above facts, the present study on the documentation of characters for chickpea genotypes was planned with the objective to identify stable diagnostic characteristics of plant morphology of chickpea genotypes.

Materials and Methods

The experiment was conducted in the Seed Testing Laboratory of the Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh, during *rabi* 2018-19 to study the genotype characterization in 25 chickpea genotypes *viz.,* ICC 5147, GCP 9813, GJG 0504, GJG 0906, JCP 54, JCP 63, JCP 125, GJG 0419, GJG 0825, GCP 9709, JCP 184, GCP 2017, DGM 810, HIMCHANA 1, JCP 13, JCP 140, GJG 1204, JCP 126, JCP 17, GCP 2012, ICCV 10113, GJG 0814, ICC 9239, JCP 145 and GG 4based on quality parameters and chemical tests. The experiment was conducted as per Completely Block Design with four repetitions. The observations viz., seed germination,

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Table-1 : Identification and grouping of chickpea genotypes based on seed germination (%), shoot length (cm), root length (cm) and seedling fresh weight (g).

Genotypes	Seed germination (%)	Shoot length (cm)	Root length(cm)	Seedling fresh weight (g)
ICC 5147	93.50	6.28	7.25	0.31
GCP 9813	90.25	7.18	8.10	0.51
GJG 0504	84.75	10.55	9.20	0.46
GJG 0906	94.00	8.95	10.23	0.37
JCP 54	91.50	11.93	10.13	0.44
JCP 63	98.50	10.28	10.10	0.67
JCP 125	100.00	14.08	12.60	0.52
GJG 0419	100.00	13.13	11.35	0.43
GJG 0825	94.25	10.05	9.13	0.46
GCP 9709	100.00	12.25	11.13	0.64
JCP 184	91.75	9.78	6.30	0.48
GJG 2017	93.50	10.18	9.10	0.64
DGM 810	93.25	10.08	9.35	0.44
Himchana 1	90.25	4.60	6.48	0.32
JCP 13	99.75	9.43	9.33	0.44
JCP 140	95.25	11.25	10.15	0.64
GJG 1204	93.25	8.35	8.18	0.53
JCP 126	100.00	12.10	11.05	0.74
JCP 17	97.25	7.13	6.30	0.63
GJG 2012	99.75	10.30	10.50	0.63
ICCV 10113	99.50	9.50	9.58	0.59
GJG 0814	99.00	7.15	9.23	0.62
ICC 9239	96.00	7.18	4.25	0.47
JCP 145	98.75	8.15	5.30	0.54
GG 4	96.75	7.10	6.10	0.37
Mean	95.63	9.47	8.81	0.51
S.Em ±	0.71	0.12	0.15	0.01
C.D. at 5 %	2.02	0.36	0.43	0.03
CV %	1.50	2.71	3.51	4.40

shoot length, root length, seedling fresh weight, seedling dry weight,seedling vigour index I, seedling vigour index II, NaOH test, Modified phenol test A, Modified phenol test B, KOH test, $FeSO_4$ test and GA_3 growth response test. The data obtained from laboratory experiment conducted in CRD were analyzed as per standard method.

Results and Discussion

Based on seed germination and seedling characters, chickpea genotypes were categorized into different groups (Table-1 and 2). The seed germination percentage varied among the genotypes due to the quality parameters and could be attributed to better development of seeds. The seed germination percentage ranged fromGJG 0504 (84.75%)to JCP 125, GJG 0419, GCP 9709 and JCP 126 (100%)with a mean seed germination percentage of 95.63%. Shoot length ranged from 4.6 cm (Himchana 1) to 14.08 cm (JCP 125) with a mean of 9.47 cm. Root length varied significantly among the twenty five genotypes and the root length ranged from 4.25 cm (ICC 9239) to 12.60 cm (JCP 125) with a mean of 8.81 cm. Seedling fresh weight ranged from 0.31 g (ICC 5147) to 0.74 g (JCP 126) with a mean of 0.51 g. Seedling dry weight varied significantly among the twenty five genotypes and the seedling dry weight ranged from 0.024 g (GJG 0825) to 0.050 g (GCP 9709) with a mean of 0.034 g. Seedling vigor indexI ranged from 999.50 (Himchana 1) to 2667.50 (JCP 125) with a mean of 1754.26. Among the 25 genotypes seedling vigour index I was high vigorous in all thirty genotypes. Seedling vigor index II ranged from 2.29 (GJG 0825) to 4.96 (GJG 9709) with a mean of 3.26.

The chemical tests such as NaOH test, Modified phenol test A, Modified phenol test B, KOH test, $FeSO_4$ test and GA_3 growth response test, which help for classifying the genotypes into different groups (Table-3 and 4). On the basis of chemical tests, genotype identification keys were prepared (Figure-1). The genotypes ICC 5147, GJG 0504, JCP 125, GJG 0825, GCP 9709, GJG 1204, JCP 17, ICCV 10113 and GG 4 were having similar black colour in sodium carbonate test, dark brown colour in copper sulphate test, no colour reaction with NaOH test, black colour in KOH test and $FeSO_4$ test and high GA_3 growth response test,while the genotype GJG 0906 and JCP 126 was differed from

Table-2 : Identification and grouping of chickpea genotypes based on seedling dry weight (g), seedling vigour index I and seedling vigour index II.

Genotypes	Seedling dry weight (g)	Seedling vigour index I	Group	Seedling vigour index II
ICC 5147	0.025	1264.70	High vigorous	2.34
GCP 9813	0.034	1378.60	High vigorous	3.03
GJG 0504	0.029	1673.80	High vigorous	2.42
GJG 0906	0.032	1802.53	High vigorous	3.02
JCP 54	0.026	2017.53	High vigorous	2.36
JCP 63	0.025	2007.20	High vigorous	2.46
JCP 125	0.043	2667.50	High vigorous	4.30
GJG 0419	0.042	2447.50	High vigorous	4.18
GJG 0825	0.024	1807.25	High vigorous	2.29
GCP 9709	0.050	2337.50	High vigorous	4.96
JCP 184	0.030	1474.83	High vigorous	2.79
GCP 2017	0.040	1802.10	High vigorous	3.76
DGM 810	0.030	1811.25	High vigorous	2.78
Himchana 1	0.032	999.50	High vigorous	2.84
JCP 13	0.029	1870.20	High vigorous	2.92
JCP 140	0.037	2038.43	High vigorous	3.48
GJG 1204	0.039	1540.68	High vigorous	3.59
JCP 126	0.041	2315.00	High vigorous	4.05
JCP 17	0.035	1305.38	High vigorous	3.40
GCP 2012	0.042	2074.85	High vigorous	4.18
ICCV 10113	0.041	1897.90	High vigorous	4.04
GJG 0814	0.027	1621.05	High vigorous	2.63
ICC 9239	0.034	1096.60	High vigorous	3.26
JCP 145	0.036	1327.75	High vigorous	3.51
GG 4	0.032	1277.03	High vigorous	3.05
Mean	0.034	1754.26	High vigorous	3.26
S.Em ±	0.0005	23.3		0.05
C.D. at 5 %	0.001	65.9		0.16
CV %	3.22	2.66		3.54

Note : Seedling vigour index 1, Less vigorous : <500, High vigorour : >500

above genotypes with respect to light yellow colour (GJG 0906) and dark yellow colour (JCP 126) of NaOH test.

The genotypes GCP 2017, DGM 810 and JCP 140 were having similar black colour in sodium carbonate test, dark brown colour in copper sulphate test, no colour reaction in NaOH test, no colour change in KOH and $FeSO_4$ test and low GA_3 growth response test, while the genotype JCP 54 was differed from above genotypes with respect to no colour change in copper sulphate test. The genotypes JCP 13, GCP 2012, GJG 0814 and JCP 145 were having similar black colour in sodium carbonate test, dark brown colour in copper sulphate test, no colour reaction in NaOH test, dark brown colour with KOH test and black colour in $FeSO_4$ test and high GA_3 growth response test, while the genotype JCP 13 was differed from above genotypes with respect to light yellow colour in NaOH test, black colour in KOH test and no change in $FeSO_4$ test and the genotype GJG 0814 was differed from above genotypes with respect to dark yellow colour in NaOH test.

The genotypes JCP 63, JCP 184 and ICC 9239 were having black colour in sodium carbonate test, dark brown colour in copper sulphate test, no colour reaction with NaOH test and dark brown colour in KOH test, but differed with respect to black colour in $FeSO_4$ test and high GA_3 growth response (JCP 63), no colour change in $FeSO_4$ test and low GA_3 growth response test (JCP 184) and no colour change in $FeSO_4$ test and high GA_3 growth response test (ICC 9239).

The genotype GCP 9813 was having similar black colour in sodium carbonate test, dark brown colour in copper sulphate test, no colour reaction in NaOH test, black colour in KOH and $FeSO_4$ test and low GA_3 growth response test. The genotype GJG 0419 was having similar black colour in sodium carbonate test, dark brown colour in copper sulphate test, no colour reaction in NaOH test, no colour change in KOH test and black colour in $FeSO_4$ test and low GA_3 growth response test. The genotype Himchana 1 was having similar black colour in

Table-3 : Identification and grouping of chickpea genotypes based on Sodium hydroxide test (NaOH), modified phenol test A ($CuSO_4$) and modified phenol test B (Na_2CO_3)

Genotypes	Sodium hydroxide test (NaOH)	Modified phenol test A ($CuSO_4$)	Modified phenol test B (Na_2CO_3)
ICC 5147	No colour reaction	Dark brown	Black
GCP 9813	No colour reaction	Dark brown	Black
GJG 0504	No colour reaction	Dark brown	Black
GJG 0906	Light yellow	Dark brown	Black
JCP 54	No colour reaction	No change	Black
JCP 63	No colour reaction	Dark brown	Black
JCP 125	No colour reaction	Dark brown	Black
GJG 0419	No colour reaction	Dark brown	Black
GJG 0825	No colour reaction	Dark brown	Black
GCP 9709	No colour reaction	Dark brown	Black
JCP 184	No colour reaction	Dark brown	Black
GCP 2017	No colour reaction	Dark brown	Black
DGM 810	No colour reaction	Dark brown	Black
Himchana 1	No colour reaction	No change	Black
JCP 13	Light yellow	Dark brown	Black
JCP 140	No colour reaction	Dark brown	Black
GJG 1204	No colour reaction	Dark brown	Black
JCP 126	Dark yellow	Dark brown	Black
JCP 17	No colour reaction	Dark brown	Black
GCP 2012	No colour reaction	Dark brown	Black
ICCV 10113	No colour reaction	Dark brown	Black
GJG 0814	Dark yellow	Dark brown	Black
ICC 9239	No colour reaction	Dark brown	Black
JCP 145	No colour reaction	Dark brown	Black
GG 4	No colour reaction	Dark brown	Black

Table-4 : Identification and grouping of chickpea genotypes based on Potassium hydroxide (KOH), Ferrous sulphate test ($FeSO_4$) and GA_3 growth response test.

Genotypes	Potassium hydroxide test (KOH)	Ferrous sulphate test ($FeSO_4$)	GA_3 growth response test (Seedling length (cm)	Group
ICC 5147	Black	Black	41.85	High response
GCP 9813	Black	Black	30.90	Low response
GJG 0504	Black	Black	32.45	High response
GJG 0906	Black	Black	27.75	High response
JCP 54	No change	No change	34.85	Low response
JCP 63	Dark brown	Black	42.15	High response
JCP 125	Black	Black	40.48	High response
GJG 0419	No change	Black	27.93	Low response
GJG 0825	Black	Black	32.10	High response
GCP 9709	Black	Black	26.80	High response
JCP 184	Dark brown	No change	34.35	Low response
GCP 2017	No change	No change	32.85	Low response
DGM 810	No change	No change	36.50	Low response
Himchana 1	Dark brown	No change	32.35	Low response
JCP 13	Black	No change	40.83	High response
JCP 140	No change	No change	40.33	Low response
GJG 1204	Black	Black	32.43	High response
JCP 126	Black	Black	33.60	High response
JCP 17	Black	Black	41.50	High response
GCP 2012	Dark brown	Black	31.38	High response
ICCV 10113	Black	Black	27.53	High response
GJG 0814	Dark brown	Black	30.90	High response
ICC 9239	Dark brown	No change	30.48	High response
JCP 145	Dark brown	Black	41.75	High response
GG 4	Black	Black	31.55	High response
Mean			34.22	
S.Em ±			0.64	
C.D. at 5 %			1.81	
CV %			3.76	

Characterization of chickpea genotypes through chemical tests

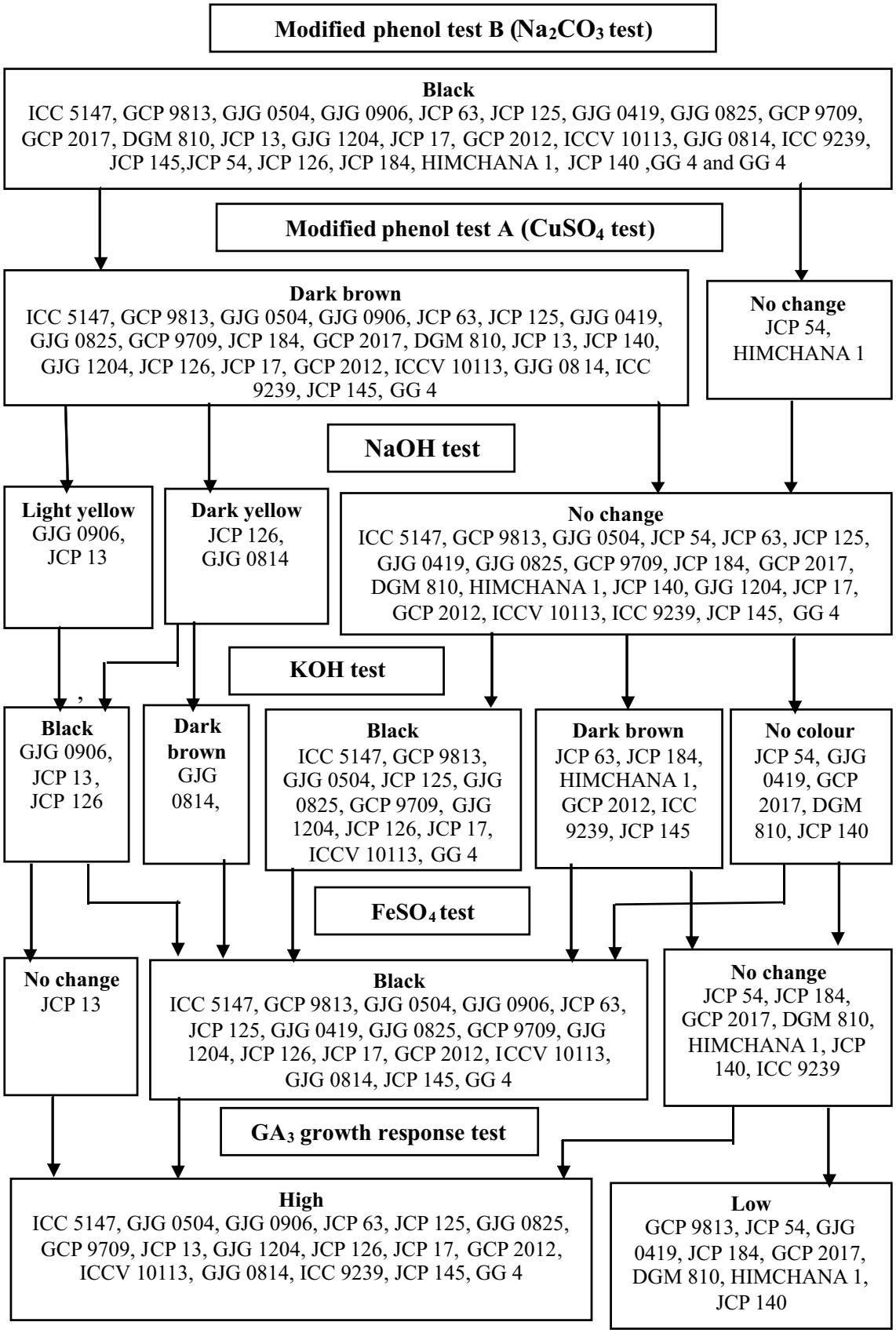

Fig.-1 : Chickpea genotypes identification keys on the basis of chemical test.

sodium carbonate test, no colourchange in copper sulphate test, no colour reaction in NaOH test, dark brown colour in KOH test, no colour change in $FeSO_4$ test and low GA_3 growth response test.

Similar observations and grouping was made based on the seed germination and seedling characters by (2) in chickpea; (3) in urdbean; (5) in groundnut; (6) in french bean; (7) in finger millet; (8) in pearl millet; (9) in wheat; (10) in green gram.

Conclusions

Assessment of genetic purity is an important criterion in seed production programme. Therefore, simple and reliable techniques need to be developed for genetic purity assessment and genotype characterization. The study suggested that seed quality parameters and chemical test,were found to be useful in broad classification of chickpea genotypes.

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