

Characterization of Chickpea Genotypes (*Cicer arietinum* L.) Through Chemical Tests

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ABSTRACT: An experiment was carried out to characterize twenty-five chickpea genotypes based on rapid chemical tests and seed quality parameters. Seeds were subjected to NaOH, CuSO₄, Na₂CO₃, KOH, FeSO₄ reactions and GA₃ growth response test for differentiating the genotypes. Based on the NaOH test, the genotypes were grouped into dark yellow (7 genotypes), light yellow (8 genotypes) and no colour reaction (10 genotypes). CuSO₄ and Na₂CO₃ test, could not differentiated the genotypes. Based on the KOH test, the genotypes were grouped into black (16 genotypes), dark brown (8 genotypes) and no change (1 genotype). Based on the FeSO₄ test, the genotypes were grouped into black (24 genotypes) and no change (1 genotype). Among 25 genotypes, growth response test with GA₃ was high in all.

Key words: Chickpea, characterization, chemical tests

INTRODUCTION

Chickpea is the common name for *Cicer arietinum* L., of the *Fabaceae* family that is widely cultivated for its typically yellow-brown, pea-like seeds. It is a self-pollinated true diploid ($2n = 2x = 16$) crop, being cultivated by man in the Middle Eastern sites as early as 7500–6800 BC [1]. Its cultivation is mainly concentrated in semi-arid environments [2]. Vavilov (3) reported the Southwest Asia and the Mediterranean region being the primary centers of origin, with Ethiopia as the secondary center. Chickpea is popularly cultivated in sub-tropical and semi-arid to warm temperate regions under dry season.

India is the largest producer of chickpea contributing to more than 75 per cent of the world production. In India, during 2017-18, chickpea was grown in an area of 10.56 million hectare with a production 11.37 million tons and productivity of 1077 kg/ha. Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Uttar Pradesh, Gujarat, Chhattisgarh and Jharkhand are the major chickpea producing states in the country. It was grown in area of 0.293 million hectare with a production 0.38 million tons and productivity 1285 kg/ha in Gujarat (4).

As morphological diversity among chickpea genotypes is very limited, laboratory tests are attempted to furnish additional variability useful for genotype identification. These chemical tests being rapid and easy to perform can be undertaken throughout the year under controlled conditions, if these exhibit genotypic variability.

MATERIALS AND METHODS

An experiment was conducted at the Seed Testing Laboratory, Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh, during 2018-19 to characterize the 25 genotypes of chickpea (*Cicer arietinum* L.) viz., DCP 35, GNG 2064, GL 28147, ICCV 05529, GJG 0612, GCP 9602, GJG 0619, GNG 469, SAKI 9516, GCP 960, ICCV 4, JG 14, BG 39, GCP 9603, GJG 0611, GCP 9629, GCP 9808, JAKI 9218, VIJAY, GCP 2009, GG 1, GG 2, GJG 3, GG 5 and GJG 6. The experiment was conducted with four replications as per Completely Randomized Block Design. The observations on chemical tests viz., NaOH test, CuSO₄ test, Na₂CO₃ test, KOH test, FeSO₄ test, and GA₃ growth response were conducted as laboratory experiments conducted in CRD was standard method suggested by [5].

For NaOH test, ten seeds of each genotype in four replications were soaked in 2% NaOH solution and the change in the colour of the solution was observed over a period of 60 minutes. The varieties are grouped as; Dark yellow, Light yellow and No color reaction. In CuSO₄ test ten seeds of each genotype in four replications were soaked overnight in 0.4% copper sulphate solution at 20° ± 1°C and then placed in a Petri dish lined with filter paper pre-soaked with 1% phenol solution and kept at 30° ± 1°C. The change in colour of seed on the basis of their reaction with phenol is noted after 4 hours. The varieties are grouped as; Dark brown and No change. In, modified phenol test B (Na₂CO₃) ten seeds of each genotype in

four replications were soaked in 0.6% sodium carbonate solution overnight at $20^{\circ} \pm 1^{\circ}\text{C}$ and then placed in a Petri dish lined with filter paper pre-soaked with 1% phenol solution and kept at $30^{\circ} \pm 1^{\circ}\text{C}$. The change in colour of seed on the basis of their reaction with phenol is noted after 4 hours. The varieties are grouped as; Black, Dark brown and No change. For Potassium hydroxide test ten seeds of each genotype in four replications were soaked in 5% KOH solution for 6 hours at room temperature and observations were taken after colour development. The varieties are grouped as; Black, Dark brown and No change. In ferrous sulphate test, ten seeds of each genotype in four replications were soaked in distilled water for 5-6 hrs at $20^{\circ} \pm 1^{\circ}\text{C}$ and then placed in Petri dish lined with filter paper pre-soaked with 1% ferrous sulphate solution. The change in colour of seeds is noted after 6 hrs. The varieties are grouped as; Black and No change. GA_3 growth response test was also conducted, for this test, seed was surface sterilized with 0.1% sodium hypochlorite solution and washed with distilled water. The sterilized seeds are germinated using standard BP (between paper towel) method as per ISTA rules. The paper towels pre soaked with freshly prepared 100 ppm GA_3 was used to study the growth response of seedlings. The water treated paper towels are as a control. The seedling length and the dry weight were recorded at the final count *i.e.* 8th days. The varieties with 30-35% increase

in growth over water treated control are grouped as high responsive and others are grouped as low responsive varieties [6].

RESULTS AND DISCUSSION

Chemical tests are useful in development of varietal identification keys and also in genetic purity testing. A number of chemical tests have been developed for varietal identification such as NaOH, CuSO_4 , Na_2CO_3 , KOH, FeSO_4 and GA_3 growth response test, these chemical tests are very quick, easy and reproducible [6].

The genotypes GNG 2064, SAKI 9516, GCP 9603, GJG 0611, GCP 9808 having similar no colour reaction with NaOH test, dark brown colour in modified phenol test 1, black colour in modified phenol test 2, black colour in KOH test, black colour in FeSO_4 , high responsive to GA_3 growth response test (Table 1 and 2, Figure 1).

The genotypes ICCV 05529, GJG 0619, BG 39, GCP 9629 and JAKI 9218 having similar no colour reaction with NaOH test, dark brown colour in modified phenol test 1, black modified colour in phenol test 2, dark brown colour in KOH test, black colour in FeSO_4 , high responsive to GA_3 growth response test.

The genotypes GJG 0612, GCP 9602, GNG 469, GG 1, GG 2 and GJG 6 having similar dark yellow colour in NaOH test, dark brown in modified phenol test 1, black

Table 1. Identification and grouping of chickpea genotypes based on NaOH test, modified phenol test A and modified phenol test B

Genotypes	Sodium hydroxide test (NaOH)	Modified phenol test A	Modified phenol test B
DGP 35	Light yellow	Dark brown	Black
GNG 2064	No colour	Dark brown	Black
GL28147	Light yellow	Dark brown	Black
ICCV 05529	No colour	Dark brown	Black
GJG 0612	Dark yellow	Dark brown	Black
GCP 9602	Dark yellow	Dark brown	Black
GJG 0619	No colour	Dark brown	Black
GNG 469	Dark yellow	Dark brown	Black
SAKI 9516	No colour	Dark brown	Black
GCP 960	Light yellow	Dark brown	Black
ICCV 4	Light yellow	Dark brown	Black
JG 14	Light yellow	Dark brown	Black
BG 39	No colour	Dark brown	Black
GCP 9603	No colour	Dark brown	Black
GJG 0611	No colour	Dark brown	Black
GCP 9629	No colour	Dark brown	Black
GCP 9808	No colour	Dark brown	Black
JAKI 9218	No colour	Dark brown	Black
VIJAY	Light yellow	Dark brown	Black
GCP 2009	Light yellow	Dark brown	Black
GG 1	Dark yellow	Dark brown	Black
GG 2	Dark yellow	Dark brown	Black
GJG 3	Light yellow	Dark brown	Black
GG 5	Dark yellow	Dark brown	Black
GJG 6	Dark yellow	Dark brown	Black

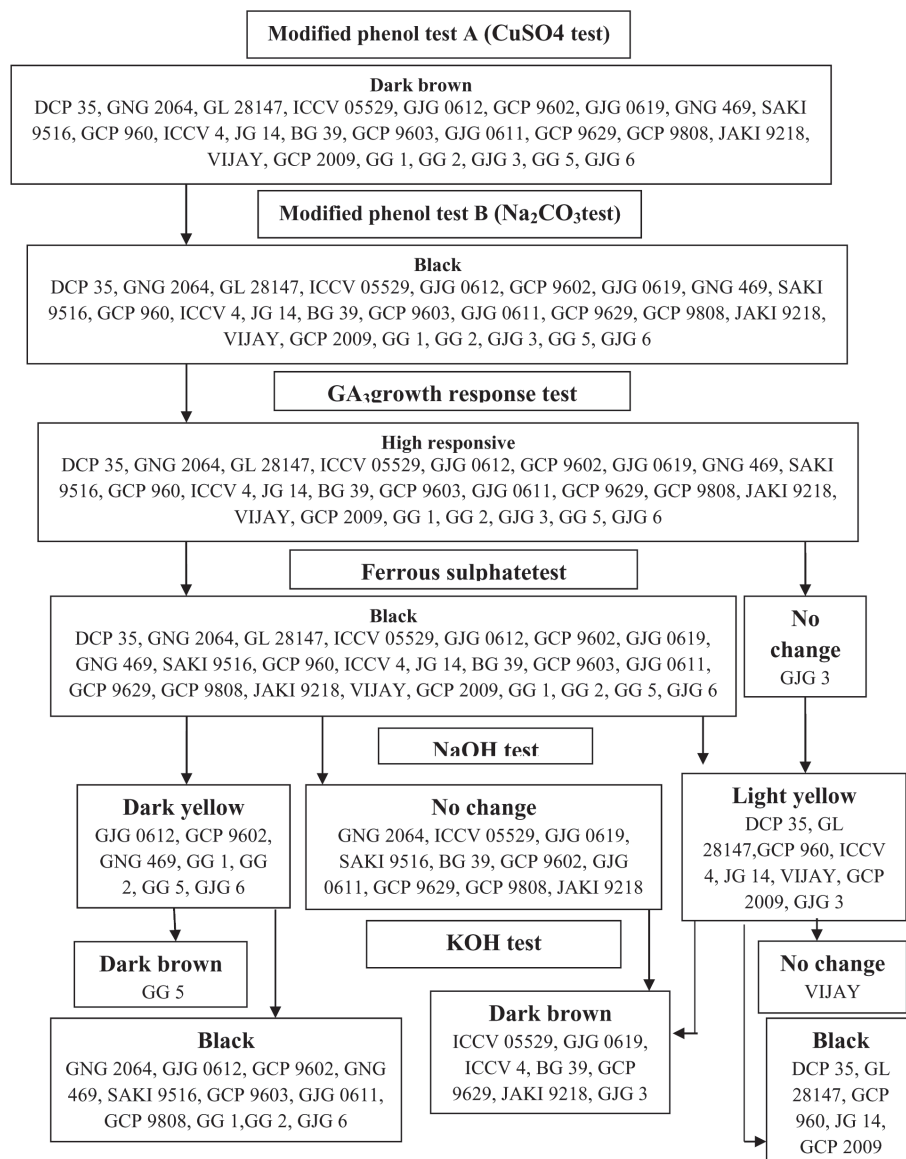


Figure 1. Chickpea genotypes identification keys on the basis of chemical tests

colour in modified phenol test 2, black colour in KOH test, black colour in FeSO_4 , high responsive to GA_3 growth response test. The genotype GG 5 differed from above genotypes with respect to dark brown colour in KOH test.

The genotypes DCP 35, GL 28147, GCP 960, JG 14 and GCP 2009 having similar light yellow colour in NaOH test, dark brown colour in modified phenol test 1, black colour in modified phenol test 2, black colour in KOH test, black colour in FeSO_4 , high responsive to GA_3 growth response test. The genotype ICCV 4 differing from above genotypes with respect to dark brown colour in KOH test.

The genotype VIJAY having light yellow colour in NaOH

test, dark brown colour in modified phenol test 1, black colour in modified phenol test 2, no colour reaction with KOH test, black colour in FeSO_4 , high responsive to GA_3 growth response test. The genotype GJG 3 having light yellow colour in NaOH test, dark brown colour in modified phenol test 1, black colour in modified phenol test 2, dark brown colour in KOH test, no colour reaction with FeSO_4 , high responsive to GA_3 growth response test. Similar grouping of genotypes using chemical tests were reported in groundnut [6, 7] and black gram [8]. Hence, simple and reliable chemical tests were found useful in grouping and identifying chickpea genotypes.

Table 2. Identification and grouping of chickpea genotypes based on potassium hydroxide test, ferrous sulphate test and GA₃ growth response test

Genotypes	Potassium hydroxide test	Ferrous sulphate test	GA ₃ growth response test (Seedling length (cm))	Group Responsiveness
DCP 35	Black	Black	43.44	High
GNG 2064	Black	Black	32.50	High
GL28147	Black	Black	32.11	High
ICCV 05529	Dark brown	Black	29.28	High
GJG 0612	Black	Black	33.55	High
GCP 9602	Black	Black	42.81	High
GJG 0619	Dark brown	Black	27.50	High
GNG 469	Black	Black	40.94	High
SAKI 9516	Black	Black	43.39	High
GCP 960	Black	Black	34.06	High
ICCV 4	Dark brown	Black	43.98	High
JG 14	Black	Black	40.45	High
BG 39	Dark brown	Black	43.01	High
GCP 9603	Black	Black	40.16	High
GJG 0611	Black	Black	41.88	High
GCP 9629	Dark brown	Black	38.85	High
GCP 9808	Black	Black	38.13	High
JAKI 9218	Dark brown	Black	50.00	High
VIJAY	No colour	Black	38.05	High
GCP 2009	Black	Black	34.78	High
GG 1	Black	Black	38.13	High
GG 2	Black	Black	42.17	High
GJG 3	Dark brown	No change	41.56	High
GG 5	Dark brown	Black	43.44	High
GJG 6	Black	Black	40.00	High
Mean			38.97	
S.Em ±			0.89	
C.D. at 5 %			2.52	
CV %			4.59	



No Colour -GJG 3



Light Yellow- GJG 3



Dark yellow -BG 39

NaOH test

Dark brown: GG 2
Modified phenol test A
(CuSO₄)Black: ICCV 05529
Modified phenol test B
(Na₂CO₃)

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