

Grouping of *desi* Chickpea (*Cicer arietinum* L.) Genotypes Based on Plant Morphological Characters

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ABSTRACT An experiment was carried out at the Pulses Research Station, Junagadh Agricultural University, Junagadh, to characterize twenty five genotypes of chickpea (*Cicer arietinum* L.) based on plant morphological characters. Genotypes were grouped into early (9 genotypes) and medium (16 genotypes), based on time of flowering; into three classes i.e., erect (11 genotypes), semi erect (7 genotypes) and spreading (7 genotypes), based on growth habit. Based on leaflet size, genotypes were grouped into three classes of small (1 genotype), medium (12 genotypes) and large (12 genotypes), whereas, genotypes were grouped into the classes of medium (7 genotypes) and long (18 genotypes), based on peduncle length. Based on plant height, genotypes were grouped into short (22 genotypes) and medium (3 genotypes), and based on pod size, genotypes were grouped into small (12 genotypes), medium (10 genotypes) and large (3 genotypes). Based on days to maturity, genotypes were grouped into early (17 genotypes) and medium (8 genotypes), whereas, based on the number of branches per plant, these were grouped into high (1 genotype), medium (21 genotypes) and low (3 genotypes). Number of pod per plant varied significantly among the genotypes. Number of pod per plant ranged from 78.67 (HIMCHANA 1) to 114.33 (JCP 125) with a mean of 96.24. Similarly the first pod bearing node varied significantly among the genotypes ranging from 14.67 cm (JCP 125) to 25.50 cm (HIMCHANA 1) with a mean 20.67 cm.

Keywords: Chickpea genotypes, growth habit, characterization

INTRODUCTION

Chickpea commonly known as gram, Bengal gram, chhola, garbanzo bean, etc. is one of the first seed legumes to be domesticated by humans in the old world. Chickpea (*Cicer arietinum* L.) is 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.). In India, the area under chickpea was reported to be 10.56 million hectares with a production of 11.37 million tonnes and productivity of 1077 kg/ha during *rabi* 2017-18. In Gujarat, 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 the major chickpea growing states [1]. However, India in spite of being the largest producer of chickpea, is unable to meet the demands of domestic consumption. Chickpea originated in the temperate regions of Southeastern Turkey and adjoining Syria. It is divided into two groups, (1) Macrospora referred locally as *kabuli* and (2) Microspora referred as

desi type by Indian breeders. The ratio of *Desi* and *kabuli* chickpea production is nearly 3:1 throughout the world.

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. Distinctness, is also fundamental for DUS 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, 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 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 4 released for general cultivation in Gujarat at state level as well as at the National level in central India based on the plant morphological characters. Plant morphological characters were measured as per the guidelines of DUS testing (PPV & FR Authority, GOI, New Delhi). Of all the plant morphological characters, quantitative characters were analyzed following analysis of variance for Randomized Block Design as per the method of Cochran and Cox [2].

RESULTS AND DISCUSSION

On the basis of the plant morphological characteristics such as time of 50 % flowering, growth habit, leaf let size, peduncle length, plant height, pod size, days to maturity, number of branches per plant, number of pods per plant and first pod bearing node genotypes were grouped into different categories (Table 1, 2 and 3). Based on the variation in time of 50 % flowering, 25 genotypes under study were grouped into early (<60 days) in nine genotypes and medium (60-80 days) in sixteen genotypes.

Table 1. Grouping and identification of chickpea genotypes based on time of 50% flowering, growth habit and leaf let size (mm)

Genotypes	Time of 50% flowering	Group	Growth habit	Leaf let size (mm)	Group
ICC 5147	62.00	Medium	Semi erect	13.33	Medium
GCP 9813	61.67	Medium	Erect	17.03	Large
GJG 0504	50.00	Early	Spreading	19.40	Large
GJG 0906	51.00	Early	Erect	18.10	Large
JCP 54	64.33	Medium	Semi erect	20.37	Large
JCP 63	63.00	Medium	Spreading	9.57	Small
JCP 125	54.00	Early	Spreading	22.33	Large
GJG 0419	63.33	Medium	Erect	17.73	Large
GJG 0825	64.33	Medium	Semi erect	18.80	Large
GCP 9709	51.00	Early	Erect	13.07	Medium
JCP 184	63.67	Medium	Spreading	23.37	Large
GCP 2017	52.33	Early	Erect	14.03	Medium
DGM 810	63.00	Medium	Erect	17.10	Large
HIMCHANA 1	64.00	Medium	Erect	12.37	Medium
JCP 13	62.67	Medium	Spreading	13.37	Medium
JCP 140	62.67	Medium	Semi erect	17.97	Large
GJG 1204	51.67	Early	Spreading	12.20	Medium
JCP 126	63.33	Medium	Erect	20.77	Large
JCP 17	60.67	Medium	Erect	13.17	Medium
GCP 2012	65.00	Medium	Semi erect	13.40	Medium
ICCV 10113	54.33	Early	Semi erect	15.87	Large
GJG 0814	52.67	Early	Erect	13.60	Medium
ICC 9239	60.00	Medium	Spreading	14.13	Medium
JCP 145	52.33	Early	Erect	13.90	Medium
GG 4	60.67	Medium	Semi erect	14.70	Medium
Mean	58.95			16.19	
S.Em ±	2.44			0.80	
C.D. at 5 %	7.13			2.34	
CV %	7.18			8.58	

Note : Time of 50% flowering
 Early : <60 days
 Medium : 60-80 days
 Late : >80 days

Note : Leaf let size
 Small : <10 mm
 Medium : 10-15 mm
 Large : >15 mm

Table 2. Grouping and identification of chickpea genotypes based on peduncle length (mm), plant height (cm) and pod size (mm)

Genotypes	Peduncle length (mm)	Group	Plant height (cm)	Group	Pod size (mm)	Group
ICC 5147	17.10	Long	37.87	Short	13.33	Small
GCP 9813	16.77	Long	34.67	Short	17.03	Medium
GJG 0504	18.07	Long	27.70	Short	19.40	Medium
GJG 0906	15.17	Long	26.70	Short	18.10	Medium
JCP 54	12.97	Long	31.50	Short	19.37	Medium
JCP 63	9.17	Medium	36.40	Short	11.20	Small
JCP 125	19.43	Long	33.67	Short	22.33	Large
GJG 0419	11.97	Long	46.07	Medium	17.73	Medium
GJG 0825	15.03	Long	50.70	Medium	18.80	Medium
GCP 9709	9.20	Medium	47.37	Medium	13.07	Small
JCP 184	9.20	Medium	30.93	Short	23.37	Large
GJG 2017	10.40	Long	37.70	Short	14.03	Small
DGM 810	7.33	Medium	34.33	Short	17.10	Medium
Himchana 1	11.93	Long	31.03	Short	12.37	Small
JCP 13	11.03	Long	28.43	Short	13.37	Small
JCP 140	13.17	Long	32.57	Short	17.97	Medium
GJG 1204	10.37	Long	31.37	Short	12.20	Small
JCP 126	9.13	Medium	34.67	Short	21.77	Large
JCP 17	20.50	Long	31.33	Short	13.17	Small
GJG 2012	7.10	Medium	41.57	Short	13.40	Small
ICCV 10113	10.07	Long	37.73	Short	15.87	Medium
GJG 0814	18.27	Long	40.37	Short	13.60	Small
ICC 9239	17.40	Long	40.33	Short	14.13	Small
JCP 145	11.67	Long	38.43	Short	13.90	Small
GG 4	9.33	Medium	34.00	Short	19.70	Medium
Mean	13.15		35.90		16.25	
S.Em ±	0.56		1.47		0.67	
C.D. at 5 %	1.63		4.27		1.96	
CV %	7.35		7.07		7.18	

Note : Peduncle length (mm)

Short : (<5 mm)

Medium : (5-10 mm)

Long : (>10 mm)

Note : Plant height (cm)

Short : (<45 cm)

Medium: (45-60 cm)

Tall : (>60 cm)

Note : Pod size (mm)

Small : (<15 mm)

Medium : (15-20 mm)

Large : (>20 mm)

Based on the growth habit, genotypes were grouped as erect in eleven genotypes, semi erect in seven genotypes and spreading in seven genotypes. Based on leaf let size, the genotypes were grouped as small (<10 mm) in one genotype, medium (10-15 mm) in twelve genotypes and large (> 15 mm) in twelve genotypes. Based on the peduncle length, genotypes were grouped as medium (5-10 mm) in seven genotypes and long (>10 mm) in eighteen genotypes. Based on plant height, genotypes were grouped as short (<45 cm) in twenty two genotypes, medium (45-60 cm) in three genotypes.

Based on the pod size, genotypes were grouped as small (<15 mm) in twelve genotypes, medium (15-20 mm) in ten genotypes and large (>20 mm) in three genotypes. Based on days to maturity, the genotypes were grouped

as early (90-110 days) in seventeen genotypes, medium (110-130 days) in eight genotypes. Based on number of branches per plant, the genotypes were grouped low (1-2) in three genotypes, medium (3-4) in twenty one genotypes and high (4) in one genotype. Number of pod per plant varied significantly among the twenty five genotypes and number of pod per plant ranged from 78.67 (HIMCHANA 1) to 114.33 (JCP 125) with mean of 96.24. The first pod bearing node varied significantly among the twenty five genotypes and first pod bearing node ranged from 14.67 cm (JCP 125) to 25.50 cm (HIMCHANA 1) with mean 20.67 cm.

On the basis of plant morphological characteristics discussed above, genotypic identification keys were prepared (Figure 1). The genotypes viz; GJG 0814, JCP

Table 3. Grouping and identification of chickpea genotypes based on days to maturity, number of branches per plant and number of pod per plant

Genotypes	Days to maturity	Group	Number of branches per plant	Group	Number of pod per plant	First pod bearing node (cm)
ICC 5147	105.33	Early	2.92	Medium	104.67	23.17
GCP 9813	106.33	Early	2.00	Low	95.00	21.67
GJG 0504	104.33	Early	3.46	Medium	98.00	21.47
GJG 0906	101.00	Early	2.38	Medium	79.33	15.83
JCP 54	113.67	Medium	2.70	Medium	89.33	22.17
JCP 63	114.00	Medium	3.64	Medium	98.33	16.67
JCP 125	104.67	Early	3.83	Medium	114.33	14.67
GJG 0419	111.33	Medium	3.79	Medium	107.00	23.10
GJG 0825	107.00	Early	3.16	Medium	99.67	17.30
GCP 9709	101.00	Early	4.17	High	110.00	22.17
JCP 184	105.00	Early	1.90	Low	98.33	22.03
GCP 2017	100.00	Early	3.41	Medium	104.00	23.33
DGM 810	104.00	Early	2.63	Medium	98.00	23.43
HIMCHANA 1	113.67	Medium	1.74	Low	78.67	25.50
JCP 13	111.67	Medium	2.83	Medium	90.00	22.17
JCP 140	115.33	Medium	3.41	Medium	92.00	19.00
GJG 1204	105.00	Early	2.33	Medium	99.33	16.67
JCP 126	108.33	Early	3.42	Medium	104.00	19.93
JCP 17	114.00	Medium	2.71	Medium	88.33	24.17
GCP 2012	105.67	Early	3.66	Medium	106.00	20.33
ICCV 10113	104.00	Early	2.58	Medium	96.67	16.07
GJG 0814	97.00	Early	2.75	Medium	96.67	23.67
ICC 9239	112.33	Medium	3.50	Medium	79.00	18.37
JCP 145	99.33	Early	3.63	Medium	91.00	23.17
GG 4	103.67	Early	3.75	Medium	88.33	20.67
Mean	106.71		3.05		96.24	20.67
S.Em ±	3.75		0.20		6.25	1.01
C.D. at 5 %	10.94		0.59		18.24	2.95
CV %	6.09		11.57		11.25	8.49

Note	:	Days to maturity	Note	:	Number of branches per plant
Early	:	90-110 days	Low	:	1-2 branches
Medium	:	111-130 days	Medium	:	3-4 branches
Late	:	131-150 days	High	:	>4 branches

145 and GCP 2017 were having similar plant morphology viz., early time of flowering, short plant height, erect growth habit, medium leaf let size, long peduncle length, small pod size, early days to maturity and medium number of branches per plant. The genotype GJG 1204 differing from above genotypes with respect to spreading growth habit. The genotypes JCP 54 and JCP 140 were having similar plant morphology viz., medium time of flowering, short plant height, semi erect growth habit, large leaf let size, long peduncle length, medium pod size, medium days to maturity and medium number of branches per plant, while the genotype ICCV 10113 varied from above genotypes with respect to early flowering and early maturity.

Genotype JCP 17 was having medium time of flowering, short plant height, erect growth habit, medium leaf let size, long peduncle length, small pod size, and medium days to maturity and medium number of branches per plant, while genotype HIMCHAMNA 1 varied from above genotypes with respect to low number of branches per plant. The genotypes viz; JCP 13 and ICC 9239 were having similar plant morphology viz., medium time of flowering, short plant height, spreading growth habit, medium leaf let size, long peduncle length, small pod size, medium days to maturity and medium number of branches per plant.

Genotype GCP 9813 was having medium time of flowering, short plant height, erect growth habit, large

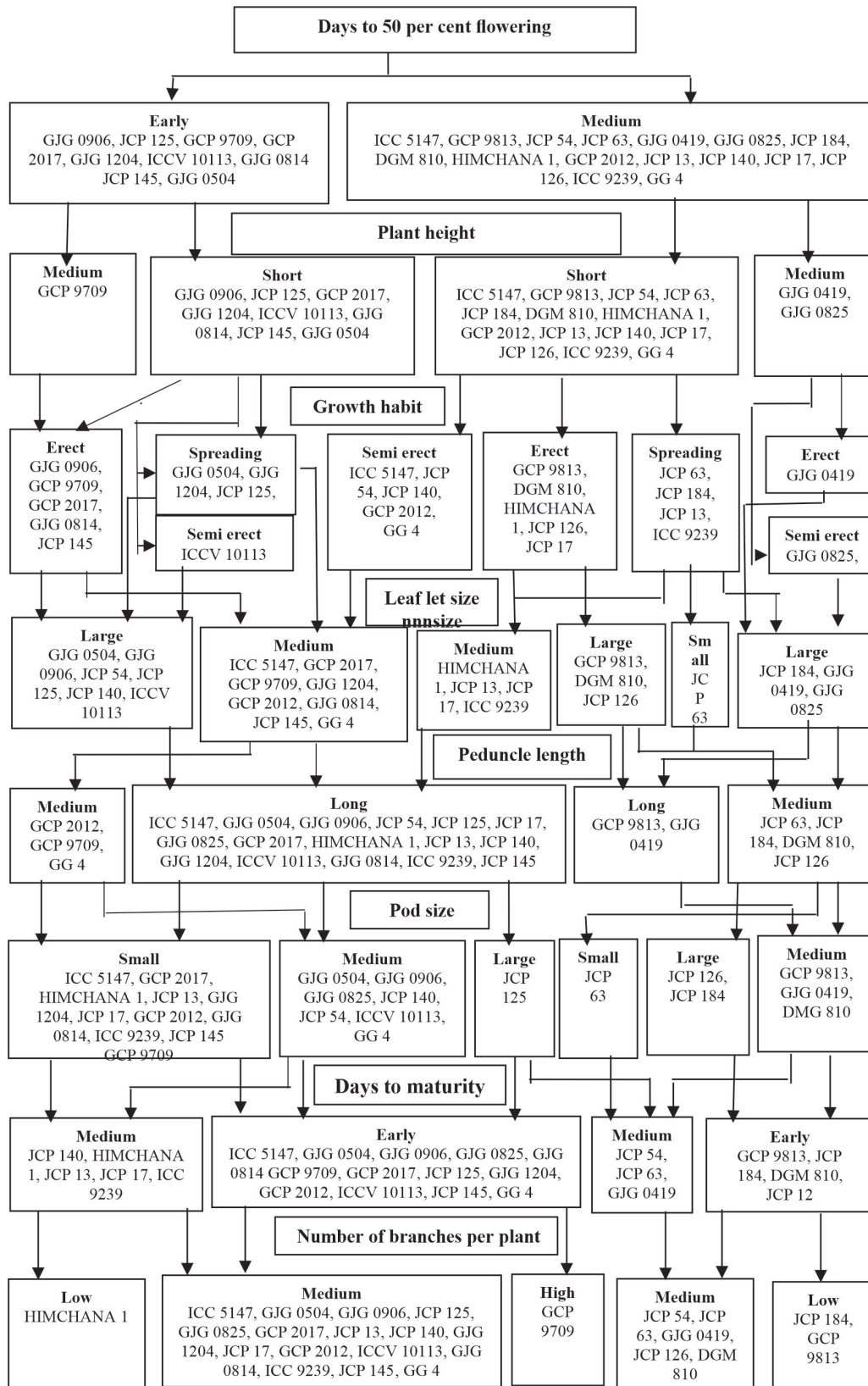


Figure 1. Chickpea genotypes identification keys on the basis of plant morphological character

Growth habit



Erect – GJG 0906



Semi erect- JCP - 140



Spreading – ICC 9239

Leaf let size



Small – JCP 63



Medium – GCP 9709



Large – JCP 140

Peduncle length



Medium – JCP 63



Long – JCP 17

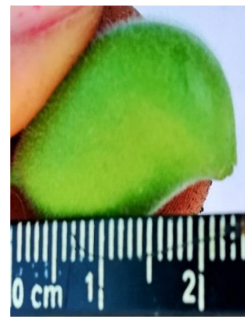
Pod size



Small – ICC 5147



Medium – JCP 54



Large – JCP 125

leaf let size, long peduncle length, medium pod size, early days to maturity and low number of branches per plant, while the genotype GJG 0906 varied from above genotypes with respect to early time of flowering and medium number of branches per plant.

Genotypes GJG 0504 and JCP 125 were having similar plant morphology viz., early time of flowering, short plant height, Spreading growth habit, large leaf let size, long peduncle length, early days to maturity and medium number of branches per plant, but differing in pod size with medium (GJG 0504) and large (JCP 125). The genotype DGM 810 was having medium time of flowering, short plant height, erect growth habit, large leaf let size, medium peduncle length, medium pod size, early days to maturity and medium number of branches per plant, while the genotype JCP 126 varied from above genotypes with respect to large pod size. The genotypes ICC 5147 and GCP 2012 were having medium time of flowering, short plant height, semi erect growth habit, medium leaf let size, small pod size, early days to maturity and medium number of branches per plant, but differing in peduncle length with long (ICC 5147) and medium (GCP 2012).

The genotype GG 4 were having medium time of flowering, medium leaf let size, medium pod size, medium peduncle length, early days to maturity and medium number of branches per plant and semi erect growth habit and short plant height. JCP 63 was having medium time of flowering, short plant height, spreading growth habit, small leaf let size, medium peduncle length, small pod size, and medium days to maturity and medium number of branches per plant.

The genotype GJG 0419 was having medium time of flowering, medium plant height, erect growth habit, large leaf let size, long peduncle length, medium pod size, and medium days to maturity and medium number of branches per plant. GJG 9709 was having early time of flowering, medium plant height, erect growth habit, medium leaf let size, medium peduncle length, small pod size, and early days to maturity and high number of branches per plant. The genotype JCP 184 was having medium time of flowering, short plant height, Spreading growth habit, large leaf let size, medium peduncle length, large pod size, and early days to maturity and low number of branches per plant.

Similar findings and grouping of genotypes based on plant morphological characters were made by Upadhyay *et al.* [3], Yadav and Shrivastava [4], Farshadfar and

Farshadfar [5], Gediya *et al.* [6] and Gnyandev [7] in chickpea. Researchers have also reported similar groupings based on morphological characteristics for identification of genotypes in sesame [8]; mungbean [9, 10]; in bread wheat [11]; in cowpea [12, 13]; in urdbean [14]; and horse gram [15].

Maintenance of variety purity is important in seed production programmes. Therefore, simple and reliable techniques need to be developed for the assessment of genetic purity and also for genotype characterization. The study suggested that plant morphological characteristics were useful in grouping and broad classification of chickpea genotypes, which are also useful for DUS testing.

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