

## Inheritance of some qualitative characters in chickpea (*Cicer arietinum* L.)\*

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MS received 21 January 1980

**Abstract.** Inheritance of eight morphological characters, namely, prostrate growth habit; narrow, bicomponent and simple leaves; purple and light green foliage colours; light blue corolla and green seed coat colour, was studied. All the traits except the light blue corolla showed monofactorial recessive inheritance, while the light blue corolla involved interaction of two recessive factors. Joint segregations of narrow leaf and double-flowered peduncle and simple leaf and light blue corolla were studied, and in both cases no linkage was detected.

**Keywords.** Chickpea; inheritance; prostrate growth; purple foliage; flower colour; seed coat.

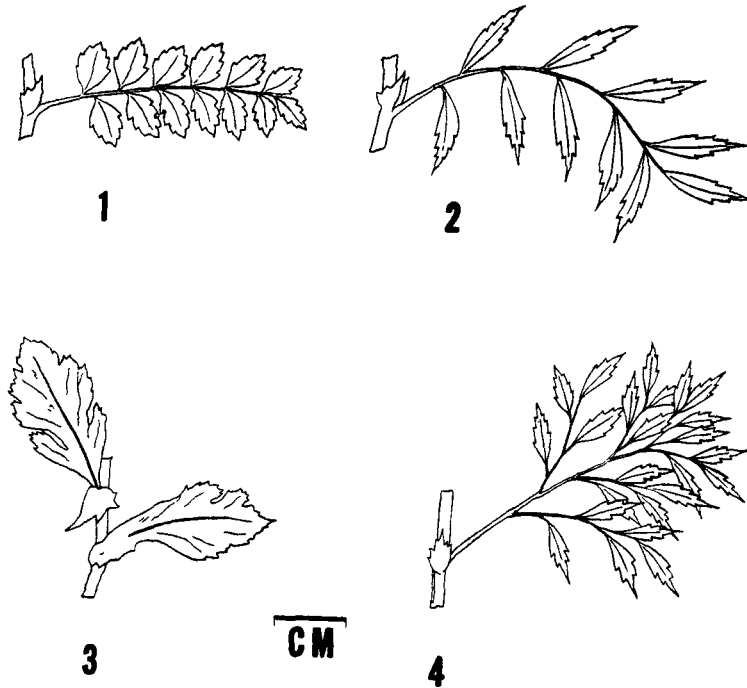
### 1. Introduction

The existence of wide morphological diversity in chickpea (*Cicer arietinum* L.) offers ample opportunity for genetic studies. Ever since this crop attracted the attention of plant breeders, several workers have analysed its various morphological traits genetically. Though we know the nature of inheritance and linkage relationships of a number of chickpea characters, the available information (van der Maesen 1972) is rather meagre to fully establish any linkage group, and much of the vast variation still remains unexplored. The spontaneous mutation rate (0.0005-0.0125%), which is significant in *Cicer* (Balasubramanian 1951), occasionally produces more diversity.

The genetic behaviour of a leaf mutant with narrow leaflets (figure 2), isolated from double-podded "desi" cultivar JG 62, during 1974-75 at the ICRISAT Centre, and inheritance of some other morphological traits such as prostrate growth habit, purple and light green foliage, simple (figure 3) and bipinnate (figure 4) leaves, light blue corolla and green seed coat are reported here.

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\*Submitted as J A No. 126 by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).



Figures 1-4. 1. Normal leaf. 2. Narrow leaflets. 3. Simple leaf. 4. Bipinnate leaf.

## 2. Materials and methods

The new leaf mutant isolated at the ICRISAT Centre is characterised by reduction in the width of the leaflets, which are narrow and long. All the cultivars selected for genetic studies were crossed to a normal desi cultivar, BEG 482, during the postrainy season 1975-76 and the  $F_1$ 's were grown in 1976-77. The characters of the parents and their  $F_1$ 's are given in table 1. Data on segregating  $F_2$  populations were obtained during 1977-78 postrainy season and are given in table 2. In crosses with simple and bipinnate leaves, ICC 5928 was used as the normal leaf parent with light blue corolla. Backcrosses to both parents, also produced during 1976-77, were grown simultaneously with  $F_2$ . The  $F_2$  segregation ratios were further confirmed from the backcross progeny data (table 3).

## 3. Results

Segregation patterns in  $F_2$  and backcrosses indicated that prostrate growth habit; purple and light green foliages; narrow, bicomponent and simple leaves; and green seed coat were all recessive-to-normal traits, showing the single gene inheritance ratio, 3 : 1. The  $F_2$  segregation ratio of 9 pink, 3 light pink, 3 blue, and 1 light blue was obtained for the light blue corolla, which indicated the involvement of two factors for corolla colour.

Table 1. Characters of parents and their  $F_1$ s.

Character	Parent I	Parent II	$F_1$
Growth habit	Semi-erect (BEG 482)	Prostrate (ICC 5434)	Semi-erect
Foliage colour	Normal green (BEG 482)	Purple (ICC 5783) Light green (ICC 5325)	Green  Green
Leaflet shape	Normal (BEG 482)	Narrow (ICC 10034)	Normal
Leaf type	Compound (ICC 5928)	Simple (ICC 8325)	Compound
	Pinnate (ICC 5928)	Bipinnate (ICC 5316)	Pinnate
Corolla colour	Light Blue (ICC 8325)	Pink (ICC 5928)	Pink
Seed coat colour	Yellow Brown (BEG 482)	Green (ICC 4957)	Yellow Brown

Joint segregation was worked out for the genes for narrow leaf and double-flowered peduncle, and for the light blue flower and simple leaf. These genes were found to be independent of each other (table 4).

#### 4. Discussion

The present studies show that the narrow leaf mutant character is governed by a single recessive gene, and is inherited independently from the recessive gene for double-flowered peduncle (table 4a). Earlier, Ramanujam and Singh (1945), and Pathak and Sahay (1964) studied the inheritance of narrow leaf mutants and found the narrow leaf character recessive to the normal compound character and monogenically inherited. The results obtained here agree with their findings (table 4a).

Patil (1959), and Argikar and D'Cruz (1963) found prostrate growth habit to be governed by a simple recessive gene. Singh and Shyam (1959), on the other hand, found spreading growth habit dominant to erect growth habit. Our observations agree with the findings of Patil (1959), and Argikar and D'Cruz (1963). Inheritance of various foliage colours was studied by Pathak and Sahay (1964). Chaudhari *et al* (1958), Argikar and D'Cruz (1962, 1963), and Bhapkar and

Table 2. Segregation data on  $F_2$ .

Character	Observed ratio	Appropriate ratio	$X^2$	P	
Growth habit	Semi-erect	92	3 : 1	0.34	0.7-0.5
	Prostrate	27			
Foliage colour	Green	298	3 : 1	0.04	0.9-0.7
	Purple	97			
	Green Light green	262 91			
Leaflet shape	Normal	151	3 : 1	0.04	0.9-0.7
	Narrow	52			
Leaf type	Compound	375	3 : 1	0.49	0.5-0.3
	Simple	116			
	Pinnate Bipinnate	120 36			
Corolla colour	Pink	261	9 : 3 : 3 : 1	2.74	0.5-0.3
	Light pink	104			
	Blue	92			
	Light blue	34			
Seed colour	Yellow Brown	87	3 : 1	0.88	0.5-0.3
	Green	35			

Patil (1962), and other colours were found to be recessive to normal green foliage. In the present investigation, the purple and light green foliage colours were also found to be recessive to normal green foliage; inheritance of (dark) purple foliage colour is reported here for the first time. The  $F_2$  segregation ratio of 3 normal green : 1 light green foliage was in agreement with the findings of Balasubramanyan (1937).

The segregation pattern in the  $F_2$  and backcrosses suggested the monogenic recessive inheritance of simple and bipinnate leaves, which agree with the earlier findings of Ekbote (1942), Vacchani (1942), Argikar (1958), Singh and Shyam (1959), and Athwal and Brar (1964).

Inheritance of light blue corolla was studied for the first time and a modified dihybrid ratio, 9 pink, 3 light pink, 3 blue, and 1 light blue, was recorded in  $F_2$  from a cross with pink corolla material. Thus, light blue flower colour is governed by the interaction of two recessive alleles. Moore and D'Cruz (1970) reported a similar digenic segregation in a cross involving parents having pink and white corollas. Khan and Akhtar (1934), Kadam *et al* (1941), and Reddy and Nayeem (1978) studied the inheritance of white flower colour and reported

Table 3. Backcross segregation data.

[Cross	Observed ratio		$X^2$ (1 : 1)	P
(BEG 482 × 5434) × 5434	Semi-erect habit	20	0.44	0.5-0.3
	Prostrate habit	16		
(BEG 482 × 5783) × 5783	Green foliage	17	0.64	0.5-0.3
	Purple foliage	22		
(BEG 482 × 5325) × 5325	Green foliage	51	0.86	0.5-0.3
	Light green foliage	42		
(BEG 482 × 10034) × 10034	Normal leaflets	38	0.01	0.9-0.7
	Narrow leaflets	39		
	Double flowers	37	0.12	0.9-0.7
	Single flowers	40		
(8325 × 5928) × 8325	Compound leaf	12	0.04	0.9-0.7
	Simple leaf (all pink flowered)	11		
(5928 × 5316) × 5928	All pinnately compound		0.00	..
(BEG 482 × 4957) × 4957	Yellow brown seeded	21	0.42	0.5-0.3
	Green seeded	17		

that pink colour was controlled by a pair of complementary genes. On the other hand, many workers have observed a monogenic segregation for pink versus white corollas.

Joint segregation studies of simple leaf and light blue corolla revealed that none of the two genes for corolla colour was linked to the gene for simple leaf (table 4b).

Argıkar (1956), Argıkar and D'Cruz (1962), and Moore and D'Cruz (1976) found the green seed coat recessive to brown, and obtained a monogenic segregation. In the present investigation, the ratio of 3 yellow brown : 1 green is in agreement with the earlier reports.

### Acknowledgements

Authors sincerely acknowledge the help received from Mr G V Reddy and Mr Sai Reddy, Field Assistants, and other field staff in taking observations. Authors also thank Drs D Sharma and P Remanandan for going through the manuscript and giving them valuable suggestions.

Table 4. Joint segregation of characters.

(a) Narrow leaf and double flower vs normal leaf and single flower.

Cross	Segregation ratio				Approx. ratio	$\chi^2$	P
	$XY$	$Xy$	$xY$	$xy$			
BEG 482 × ICC 10034	Obs.	120	31	38	9 : 3 : 3 : 1	1.72	0.7-0.5
	Exp.	114.1	38.1	12.7			

(b) Simple leaf and pink flower vs normal leaf and light blue flower.

Cross	Segregation ratio								Approx. ratio	$\chi^2$	P
	$X_1Y_1$	$X_1Y_2$	$X_1Y_3$	$X_1Y_4$	$X_2Y_1$	$X_2Y_2$	$X_2Y_3$	$X_2Y_4$			
ICC 8325 × ICC 5928	Obs.	202	79	72	22	59	25	20	27.9 : 9.3 : 9.3 : 3.1	6.14	0.7-0.5
	Exp.	207.1	69.0	69.0	23.0	69.0	23.0	23.0			

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