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Genetic variability and association studies in double podded lines of chickpea (*Cicer arietinum* L.)

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Abstract

*Chickpea (*Cicer arietinum *L.) is the most important pulse crop of India and Rajasthan. India is the highest producer of chickpea, yet has to import it from other countries to meet the huge domestic demand. Therefore, genetic variability and correlation was worked out among a set of double podded lines of chickpea to assess the yield advantage of double podded lines over the single podded ones. The results indicated the higher mean performance of single podded varieties for seed yield as compared to double podded lines. Seed yield showed positive correlation with number of pods per plant and seed weight but number of pods per plant had negative correlation with seed weight, therefore, due to increased number of pods per plant, seed size and weight per pod might have reduced resulting in the overall reduction of yield per plant.*

Key words: chickpea, double pods, variability, correlation

Introduction

Chickpea (*Cicer arietinum* L.) is the most important pulse crop contributing 39 and 48 percent respectively, to the total area and production of pulses in the country. The productivity of chickpea is higher than the national productivity of pulses. Pulses are an integral component in a balanced vegetarian diet as a source of protein to combat malnutrition besides playing an important role in crop rotation and maintaining soil fertility. In India, chickpea is cultivated in an area of 9.67 m.ha. with the production of 10.09 m. tons and productivity of 1043 kg/ha (2018-19). It occupies 1.57 m. ha. area in Rajasthan giving production of 1.68 m tons (2017-18) while zone V (humid south eastern plain zone) contributes 3 and 5 percent, respectively to the total area and production of the state with the productivity higher than the national and state average. Although, India is the highest producer of chickpea, yet has to import it from other countries to meet the huge domestic demand. Therefore, increasing chickpea production through effective breeding approaches is a prime concern of Indian agriculture. Chickpea bears both single and double pods per peduncle; however single pod is dominant over the latter. Keeping in view the importance of chickpea, a few chickpea genotypes with double pods were assessed for yield and yield contributing traits along with single podded check varieties to study the variability parameters and association status of double pods on pod number, seed weight and seed yield of chickpea.

Materials and methods

The experimental trial was conducted at Agricultural Research Station, Kota (Agriculture University, Kota) during *rabi* 2014 – 15 with eleven genotypes including six double podded lines and five checks in randomized block design with three replications. The spacing between row to row and plant to plant was maintained at 30 and 10 cm respectively. All the recommended package of practices was followed to raise a good crop. The observations were recorded on randomly selected five competitive plants from each plot for yield and yield contributing traits *viz.,* plant height (cm), number of pods per plant, 100- seed weight (g) and seed yield (g) while for days to maturity, the observation was recorded on plot basis. The data were analysed using standard statistical procedures. The details of the material used are provided as under.

S.No.	Entry / Check	Nature of pods
1	RKG 13 – 539	Double
2	RKG 13 – 501	Double
3	RKG 12 – 298	Double
4	RKG 12 – 297	Double
5	RKG 12 - 309	Double
6	RKG 13 - 511	Double
7	GNG – 469 (C)	Single
8	GNG – 1581 (C)	Single
9	Pratap Chana-1 (C)	Single
10	JG-14 (C)	Single
11	JG 2000 –87 (C)	Double

Results and discussion

The analysis of variance showed significant differences among all the genotypes studied indicating sufficient variability in the experimental material offering a good scope of effective selection for developing promising genotypes. The results showed moderate genotypic and phenotypic variance (Table 1) for all the characters (except days to maturity) indicating possibility for making effective selections. while heritability estimates were high for all the characters. The phenotypic variance was higher than the corresponding genotypic variance for all the characters suggesting environmental influence over the traits. However, the difference between the PCV and GCV estimates were low indicating strong genetic makeup and lesser influence of the environment. Similar results were also obtained by Raju *et al*. (2017).

Seed yield was negatively correlated with days to maturity and plant height while it's positive association was found with number of pods per plant and 100 – seed weight. The number of pods per plant showed strong positive correlation with seed yield while its strong negative correlation was observed with days to maturity and 100 – seed weight. This implies that a model plant type of chickpea for harvesting high yields should be early maturing, medium tall, bearing higher number of pods with medium bold seed. The mean performance of single podded varieties was observed to be higher for seed yield. Among the double podded lines evaluated, only one genotype RKG13 - 539 was at par with the best check variety JG -14 for seed yield. In contrary to the past reports signifying the yield advantage of the double podded lines to the extent of 6 – 11 percent (Sheldrake *et al*. 1978), no significant yield increase of double podded lines was found over the single podded checks in our study which is in conformity to the earlier studies by Knights (1987) and Rubio *et al*. (2004). Single poddedness is a trait dominant over double poddedness. Homozygous recessive allele of this gene (ss) governs the production of double flowers and pods per peduncle, therefore, it's difficult to obtain a plant having absolute double pods rendering any significant yield increase. Kumar *et al*. (2000) indicated that the "s" allele has unstable penetrance and variable expressivity. The increased number of pods and seeds contributes to the higher yield. However, there was a slight decrease in seed size of the double-podded genotypes. In the present study also, since seed yield had shown positive correlation with number of pods per plant and seed weight but number of pods per plant had negative correlation with seed weight, therefore, due to increased number of pods per plant, seed size and

Table 1: Genetic parameters among a set of double podded lines and check varieties of chickpea (*Cicer arietinum* L.)

Characters/ Parameters	Seed yield / plot (g)	Days to maturity	Plant height (cm)	No. of pods/ plant	100 – seed weight (g)
Mean	558.78	117.57	52.37	50.56	21.60
Minimum	373.33	113.00	38.40	33.50	15.98
Maximum	760.00	122.00	61.10	61.50	26.73
GCV	19.602	2.668	11.476	18.954	17.718
PCV	20.889	2.746	13.118	19.822	17.900
H^2b	0.881	0.944	0.765	0.914	0.980
GA (5%)	211.735	6.280	10.832	18.878	7.807
GAM (5%)	37.892	5.341	20.683	37.335	36.127

Table 2: Phenotypic correlation estimates among a set of double podded lines and check varieties of chickpea (*Cicer arietinum* L.)

Characters/ Parameters	Seed yield / plot (g)	Days to maturity	Plant height (cm)	No. of pods/ plant	100 – seed weight (g)
Seed yield / plot (g)	1.0000	-0.7728 ***	-0.0849	0.4206 *	0.0062
Days to maturity	-0.7728 ***	1.0000	0.5060 **	-0.4422 **	0.2933
Plant height (cm)	-0.0849	0.5060 **	1.0000	0.3229	-0.8360***
Number of pods per plant	0.4206 *	-0.4422 **	-0.3229	1.0000	-0.3903 *
100 – seed weight (g)	0.0062	0.2933	0.8360 ***	-0.3903 *	1.0000

weight per pod might have reduced resulting in the overall reduction of yield per plant.

Conclusion

Our study emphasizes the importance of single podded lines / varieties only for achieving higher yield levels. Thus, it can be concluded that instead of using double podded lines directly as a variety, these can be used in crossing programme for transferring specific traits in already adapted high yielding varieties. However, the results may vary with the material studied, methodology used, sample size and the prevailing environmental conditions.

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