Indian J. Genet., 52 (4): 376–378 (1992)

INHERITANCE OF SPEED OF RADICLE EMERGENCE AND ROOT LENGTH IN CHICKPEA (*CICER ARIETINUM* L.)

R. S. WALDIA, A. K. CHHABRA,* R. P. S. TOMAR AND I. S. SOLANKI

Department of Plant Breeding, Haryana Agricultural University, Hisar 125004

(Received: July 9, 1991; accepted: January 9, 1992)

ABSTRACT

The inheritance of root length and speed of radicle emergence was studied in chickpea (*Cicer arietinum* L.) using six generations (P_1, P_2, F_1, F_2 and the first two backcrosses). The additive and additive x additive gene effects were important but nonfixable type of gene action was also present. Therefore, the improvement in these seedling attributes can be achieved through the methods employing both type of gene effects.

Key words: *Cicer arietinum*, chickpea, inheritance, root length, radicle emergence.

The root development has been found to be associated with rate of radicle development in soybean (*Glycine max* (L.) Merrill), and thus can be used for the selection of genetic material to develop varieties that maximise use of soil environment [1]. Root length affects the above ground plant parts in many ways which ultimately contribute to seed yield in chickpea [2]. Vincent and Gregory [3] reported that differences in the total root length were largely attributable to differences in the length of the primary root in chickpea. There is no information on the inheritance of root length and speed of radicle emergence in chickpea. Keeping in view the importance of these attributes of seed vigour their genetics was worked out so as to make use of the information for chickpea improvement.

MATERIALS AND METHODS

The experimental material comprised six generations (P_1, P_2, F_1, BC_1, BC_2 and F_2) of four crosses, namely, H 86-92 x Bhim, H 86-92 x Arjun, PRT-3LN2 x H 86-92, and E 100y 'm' x ICCV-2. Fifty seeds of each parent, 50–60 of back crosses, 30–50 of F_1 generation, and 500 seeds of F_2 population of different crosses were grown in Petri dishes lined with filter paper at 20°C $\pm$1 in seed germinator. Seedlings with at least 2 mm radicle length were counted daily after sowing. Speed of radicle emergence (Se) was calculated as:

*Address for correspondence: B-8, Old Campus, H.A.U., Hisar 125004.

$$Se = \frac{f_1 X_1 + f_2 X_2 + \ldots + fnXn}{f_1 + f_2 + \ldots + fn} = \sum_{i=1}^{n} fi \; Xi \; / \; \sum_{i=1}^{n} fi$$

where $f_1, f_2, \ldots, fn$ — frequency (number) of seeds germinated with at least 2 mm radicle length after 1 day (X_1), 2 days (X_2), ..., n days (Xn); and $X_1, X_2, \ldots Xn$ — days taken for radicle emergence by a particular population. The root length (mm) was measured 10 days after sowing.

Means and variances of different generations were used for calculation of gene effects as suggested by Hayman [4].

RESULTS AND DISCUSSION

The mean values of seed vigour traits (Table 1) indicated wide differences among the parents. For speed of radicle emergence. The additive and dominance components were significant. The magnitude of dominance component was higher than the additive effects in all were except cross (PRT-3LN2 x H86-92). Among the non-allelic interactions, additive x additive and dominance x dominance interactions were significant in all the crosses except H 86-92 x Bhim. The additive x dominance epistasis was significant in only one cross (PRT-3LN2 x H 86-92). Complementary epistasis for speed of radicle emergence was observed in all crosses except the cross E 100 y 'm' x ICCV-2. For root length, additive gene action was significant in all the three crosses and dominance components and epistasis were absent baring one cross (H 86-92 x Bhim) where additive x dominance interaction was significant.

Table 1. Character means of the parent varieties in chickpea seedlings

Parent	Characters	
	speed of radicle emergence (days)	root length (mm)
H 86-92 (Desi)	7.16	159.0
PRT-3LN2 (Desi)	2.17	99.6
E 100y 'm' (Desi)	7.04	—
Bhim (Kabuli)	3.91	128.2
Arjun (Kabuli)	4.25	100.3
ICCV-2 (Kabuli)	2.19	—

The results indicated that the fixable gene effects were present in the expression of characters but non-fixable types were also responsible in controlling these traits. For root length similar observations were also recorded by Waldia et al. [5]. The improvement is therefore expected by using the breeding methodology which could utilize concomitantly both the additive and nonadditive types of gene effects.

Table 2. Genetic estimates of two seed vigour characters in chickpea (*Cicer arietinum* L.) through six-parameter model

Cross	m	d	h	i	j	l
			Speed of radicle emergence			
H 86-92 x Bhim	5.03**	1.44**	-1.95**	-0.36	-0.18	-0.53
H 86-92 x Arjun	5.04**	0.78**	9.19**	-1.46**	-0.22	2.37**
PRT-3LN2 x H 86-92	3.52**	-2.83**	-0.73	1.78**	-7.50**	-3.99**
E100y'm' x ICCV-2	3.54**	2.41**	-3.93**	-1.34**	-0.02	1.79*
			Root length			
H 86-92 x Bhim	145.40**	14.90**	-1.40	-2.60	-3.10**	0.40
PRT-3LN2 x H 86-92	130.00**	-30.0**	0.20	0.00	0.11*	-2.40
H 86-92 x Arjun	130.20**	30.5**	-1.65	-1.40	1.15	0.100

REFERENCES

1. R. I. Mitchell and W. J. Russell. 1971. Root development and rooting pattern of soybean under field conditions. Agronomy J., **63**: 313–316.

2. S. N. Gupta. 1985. Studies on Genetic Variability for Drought Resistance in Chickpea (*Cicer arietinum* L.). Ph. D. Thesis. Haryana Agricultural University, Hisar.

3. C. Vincent and P. J. Gregory. 1986. Differences in the growth and development of chickpea seedling roots (*Cicer arietinum* L.). Exp. Agric., **22** (3) : 233–242.

4. B. I. Hayman. 1958. The separation of estimates from additive and dominance variance in generation means. Heredity, **12**: 371–390.

5. R. S. Waldia, B. S. Dahiya and Chandgi Ram. 1988. Genetics of seedling characters in chickpea (*Cicer arietinum* L.). *In*: Proc. National Seminar of Seed Science and Technology. Haryana Agric. Univ., Hisar: 154–156.