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Evaluation of chilli germplasm for seed quality parameters

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Abstract
Chilli is commercially cultivated due to its nutritional and pharmaceutical values. High seed germination is prerequisite for good seedling establishment. The present investigation was carried out at College of Horticulture, Mudigere during the year 2018-19 to study the varietal response for germination traits in diverse capsicum germplasm. Six germination characters were focused *viz*., test weight, germination percentage, shoot length, root length, root to shoot ratio and seedling vigour index-I. Analysis of variance revealed significant difference for all the germination traits, reflecting present germplasm is diverse for germination traits. These finding would be useful to improve germination traits in future breeding programmes.

Keywords: *Capsicum annuum*, germplasm, germination traits, germination

Introduction

Chilli (*Capsicum annuum* L.) is an important vegetable, spice and cash crop grown throughout India. It belongs to the genus capsicum under the family Solanaceae having chromosome number of 2n = 24. The primary centre of origin of chilli is said to be Mexico with secondary centre in Guatemala and Bulgaria (Salvador, 2002) [12]. Chilli is grown for its pungent fruits, which are used both green and ripe or dry form. It was introduced by Portuguese into southern parts of India and its cultivation further spread throughout India by the end of the 19th century (Bahurupe *et al*., 2013) [4].

Chilli is an indispensable spice due to its pungency, taste appealing colour and flavour. In the international spice trade, chilli comes just after the black pepper (*Piper nigrum* L.) in India. In India it is u an important ingredient in daily diet and is also used in the preparation of pickles, chutneys, sauces etc. It is a rich source of vitamin A, B, C, E and P (Quresh *et al.* 2015) [11]. The pungency of chilli is due to the presence of alkaloid capsaicin which can directly scavenge various free radicals and thus acts as an anticancerous compound.

Due to its often-cross pollinated nature the genetic variation or diversity for most of the yield attributes is considerably high in chilli. Variability is basic requirement for any crop improvement programme with, which breeder working. But still country is lagging behind to achieve optimum productivity in chilli due to the dominance of open-pollinated varieties, unimproved cultivars, heavy infestation of pest and diseases particularly viral disease. Therefore, much efforts are given to improve fruit yield and quality. So, the breeder needs to review the nature and degree of genetic divergence which is important to settle on the proper sort of parents for purposeful heterosis breeding. So, to the benefit of transgressive sergeant's, the knowledge of the genetic distance between parents is necessary (Srinivas *et al*., 2013) [13]. This facilitates the identification of promising genotypes which may further be used directly or indirectly in breeding programmes. Hence the present study was undertaken to analyse extent of genetic variability, heritability and genetic advance among different quantitative characters of chilli.

Materials and Methods

Present investigation was conducted at Genetics and Plant Breeding laboratory, College of Horticulture, Mudigere. The *in vitro* validation for presence of genetic variability in sixty-two chilli genotypes was carried out in a complete randomized experimental design. Twenty seeds per replication per genotype were sown in petri-plate containing germination paper disc. The seeds were moistened with distilled water in alternative days.

Laboratory test was conducted as per ISTA rules (*Anon.*, 1999) [2] wherein the germination test was conducted with 60 seeds for three replications for each treatment in germination paper placed in petri-plates. Normal seedlings were counted and expressed as germination percentage. The seed quality parameters like germination (%), shoot length (cm), root length (cm), were recorded at 15 days after sowing. Root to shoot ratio was calculated using formula given below.

$$\text{Root to shoot ratio} = \frac{\text{Length of root (cm)}}{\text{Length of shoot (cm)}}$$

The seedling vigour index I was calculated as per the method prescribed by Abdul-Baki and Anderson (1972) [1] and expressed in whole number.

$$\text{Seedling vigour index I} = \text{Germination \%} \times \text{Seedling length (cm)}$$

The data collected on different quantitative and qualitative traits were processed for the analysis of variance as per suggested the procedure by Panse and Sukhatme (1967) [10].

Results and Discussion

The examination of ANOVA (Table 1) in chilli genotypes for seed quality parameters revealed significant difference among the genotypes for all the characters studied. Observations *viz*., test weight (g), germination (%), shoot length (cm), root length (cm), root to shoot ratio and seedling vigour index-I were shown significant at 5 *per cent* and 1 *per cent* level of probability. The *per se* performance of all the genotypes for six different characters were mentioned in Table 3.One of the ways in which the variability of these characters assessed is through a simple approach of examining the range of variation. Range of variation observed for all the traits indicated the presence of sufficient amount of variation among the genotypes for all the characters studied.

In the present investigation, GCV ranged from 17.33 to 36.17 per cent. High estimates of GCV observed for seedling vigour index-1 (36.17%) followed by shoot length (22.33) and germination percentage (20.35). PCV ranged from 17.34 to 36.19 per cent. High estimates of GCV observed for seedling vigour index-1 (36.19%) followed by shoot length (22.34) and germination percentage (20.39).

The high GCV and PCV value is due to presence of high genetic variation among the chilli genotypes these results suggested that mainly additive gene effects govern the inheritance of such characters and therefore, selection based on phenotypic performance may prove useful. Similar results were also reported by Babu *et al.* (2016) [3], Kumar *et al.* (2017) [8], Gobu *et al.* (2017) [6], Kulkarni and Deshpande (2017) [7] and Kumar *et al.* (2018) [9].

High heritability is ranged from 99.91 to 99.96 per cent. High estimates of heritability were observed for test weight (99.91%), germination percentage (99.59%), root length (99.96%), shoot length (99.94%), root to shoot ratio (99.95%) and seedling vigour index-1 (99.96%). The values for genetic advance as per cent mean (GAM) were ranged from 35.69 to 74.53. The heigh estimates of genetic advances as *per cent* mean (GAM) was found for seedling vigour index-I (74.53%) followed by shoot length (45.99%), germination per centage (41.83%), test weight (37.89%), root length (36.68) and root to shoot ratio (35.69%).

High heritability coupled with high genetic advance over mean was reported for number of test weight (g), germination (%), shoot length (cm), root length (cm), root to shoot ratio and seedling vigour index-I. The results indicate that the variation in a character is mainly due to additive gene action. Thus, there is ample scope for improving these characters with direct selection. Similar results were also reported by Babu *et al.* (2016) [3], Kumar *et al.* (2017) [8], Gobu *et al.* (2017) [6], Kulkarni and Deshpande (2017) [7] and Debbarama *et al*. (2018) [5].

Table 1: Analysis of variance for seed quality parameters in chilli.

Source of variation/ Characters	Treatments	Error	SEM±	CD @ 5%	CD @ 1%
Degrees of freedom	61	124			
Test weight (g)	0.039**	0.00	0.007	0.019	0.025
Germination (%)	768.92**	2.57	0.926	2.59	3.37
Root length (cm)	8.39**	0.033	0.105	0.29	0.38
Shoot length (cm)	2.24**	0.006	0.046	0.13	0.17
Root to shoot ratio	0.5088**	0.002	0.028	0.078	0.101
Seedling vigour index - 1	404313.57**	464.62	12.45	34.88	45.34

* And ** indicates significance at 5% and 1% level respectively

Table 2: Estimates of mean, range, components of variance, heritability and genetic advance for seed quality parameters in chilli.

Characters	Mean	Range		GCV (%)	PCV (%)	h^2 (%)	GAM (%)
		Min.	Max.				
Test weight (g)	0.62	0.35	0.83	18.40	18.41	99.91	37.89
Germination (%)	78.62	40.00	99.00	20.35	20.39	99.59	41.83
Root length (cm)	8.90	5.39	12.60	18.78	18.79	99.96	36.68
Shoot length (cm)	3.87	1.87	5.75	22.33	22.34	99.94	45.99
Root to shoot ratio	2.35	1.35	3.18	17.33	17.34	99.95	35.69
Seedling vigour index - 1	1014.38	113.30	1710.00	36.17	36.19	99.96	74.53

Table 3: Per se performance of chilli genotypes under *in vitro* for different seed quality attributes

Genotypes	Test weight (g)	Germination (%)	Root length (cm)	Shoot length (cm)	Root to shoot ratio	Seedling vigour index-1
IC-545734	0.67	98.33	10.20	4.17	2.45	1437.00
Gottikunte -1	0.40	50.00	5.95	2.25	2.64	410.00
Green long chilli	0.62	95.00	11.03	3.60	3.06	1389.85
IC-545649	0.80	90.00	8.10	4.27	1.90	113.30
LCA-353	0.45	95.00	10.81	5.50	1.97	1549.45
IC-119556	0.53	80.00	10.33	4.49	2.30	1185.60
IC-545668	0.68	75.00	9.68	3.21	3.02	966.75
Badami local	0.64	90.00	11.25	5.38	2.09	1496.70
LCA-334	0.43	95.00	7.35	3.59	2.05	1039.30
LCA -620	0.54	90.00	12.60	3.98	3.17	1492.20
IC-545664	0.71	60.00	9.75	3.65	2.67	804.00
IC-545727	0.61	55.00	8.01	3.48	2.30	631.95

Piryapattana	0.71	65.00	7.33	3.84	1.91	726.05
Kolar	0.63	65.00	7.27	2.69	2.70	647.40
IC-119576	0.50	40.00	6.83	4.17	1.64	440.00
IC-111593	0.41	75.00	6.65	3.25	2.05	742.50
IC-545658	0.61	70.00	8.15	2.94	2.77	775.30
IC-119590	0.53	75.00	10.77	3.67	2.93	1083.00
IC-545665	0.68	85.00	10.53	4.83	2.18	1305.60
Srinivaspura	0.57	70.00	6.95	2.76	2.52	679.70
Hindupur	0.58	95.00	10.25	4.32	2.37	1384.15
IC-545729	0.66	80.00	9.70	3.87	2.51	1080.00
IC-119587	0.64	65.00	8.01	2.91	2.75	709.80
IC-545725	0.66	98.00	7.88	3.38	2.33	1126.00
G-3	0.80	85.00	9.35	5.25	1.78	1241.00
Chowdampalli-2	0.53	90.00	11.09	3.95	2.81	1353.60
IC-545723	0.83	85.00	6.80	5.02	1.35	1004.70
IC-545730	0.76	85.00	8.53	4.42	1.93	1100.75
Byadagi	0.66	97.67	11.60	5.02	2.31	1662.00
Gottikunte -2	0.54	70.00	6.60	3.05	2.16	675.50
IC-545732	0.58	70.00	7.70	4.40	1.75	847.00
IC-545652	0.71	80.00	9.10	3.79	2.40	1031.20
IC-545655	0.68	75.00	8.13	3.10	2.62	842.25
IC-545720	0.69	90.00	9.40	4.21	2.23	1224.90
IC-545733	0.60	98.67	8.75	4.30	2.03	1305.00
IC-545667	0.69	75.00	9.35	3.87	2.42	991.50
Bagepalli	0.35	85.00	9.27	3.90	2.38	1119.45
IC-545721	0.75	45.00	8.42	3.90	2.16	554.40
IC-545651	0.73	70.00	5.39	1.87	2.88	508.20
IC-545661	0.61	60.00	7.67	3.35	2.29	661.20
IC-119563	0.59	45.00	6.90	2.83	2.44	437.85
Balapuram	0.54	95.00	10.50	5.45	1.93	1515.25
IC-545728	0.76	90.00	7.87	4.21	1.87	1087.20
LCA-235	0.43	95.00	10.60	4.12	2.57	1398.40
IC-545663	0.76	60.00	11.25	4.50	2.50	945.00
IC-545669	0.80	80.00	7.28	3.31	2.20	847.20
Hosahudya	0.45	90.00	9.50	5.25	1.81	1327.50
IC-119547	0.51	85.00	8.75	2.75	3.18	977.50
IC-119585	0.66	70.00	8.20	4.68	1.75	901.60
IC-545735	0.56	98.00	10.70	5.75	1.86	1645.00
IC-545660	0.69	50.00	6.33	2.13	2.97	423.00
IC-545731	0.66	75.00	7.75	3.37	2.30	834.00
IC-545724	0.72	49.00	7.67	2.76	2.78	511.07
IC-119552	0.52	90.00	10.35	3.59	2.88	1254.60
Chowdampalli -1	0.61	98.33	10.40	4.20	2.48	1460.00
IC-545653	0.80	85.00	9.15	4.02	2.28	1119.45
LCA-625	0.61	97.33	12.20	4.90	2.49	1710.00
IC-276117	0.45	95.00	10.40	3.83	2.72	1351.85
IC-545662	0.67	80.00	7.80	3.57	2.18	909.60
IC-545648	0.68	60.00	9.75	3.43	2.84	790.80
IC-119560	0.54	70.00	6.60	3.05	2.16	675.50
G-4	0.46	99.00	9.55	4.76	2.01	1431.00
Mean	0.617	78.168	8.904	3.872	2.355	1014.38
SEM±	0.007	0.926	0.105	0.046	0.028	0.078
CD @ 5%	0.019	2.594	0.293	0.129	0.078	34.878

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