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Research Article

Performance and evaluation of turmeric (*Curcuma longa* L.) genotypes based on quantitative traits for tropical regions of Tamil Nadu

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Abstract
Genetic resource of any crop makes it possible for plant breeders to create narrative plant gene combinations and decide on crop varieties. In the present study, 200 turmeric genotypes with two checks were evaluated in Augmented Randomized Complete Block Design for nineteen quantitative traits. The objective of this study was to determine the extent of variability and diversity between quantitative traits, among 200 different turmeric (*Curcuma longa* L.) genotypes. Mean values of nineteen quantitative traits for the test entries showed superiority as compared to check varieties *viz.,* BSR 2 and CO 2 excluding the length of secondary rhizome. The results of analysis of variance exhibited significance for all the quantitative traits, suggesting the existence of sufficient genetic variability among the genotypes studied. Significant values for coefficient of variation was observed for the weight of primary rhizomes plant^{-1} (55.17%) followed by weight of mother rhizomes plant^{-1}, weight of secondary rhizomes plant^{-1} and rhizome yield plant^{-1} with CV of 53.72, 52.59 and 48.26 % respectively. The genotype CL 18 recorded the maximum significant value for plant height (160.99 cm), leaf width (22.35 cm), weight of mother rhizomes plant^{-1} (289.94 g), weight of primary rhizomes plant^{-1} (452.22 g), the number of secondary rhizomes plant^{-1} (34.30) and rhizome yield plant^{-1} (970.09 g) as compared to other genotypes. The magnititude of estimates of phenotypic coefficient of variation was higher than the corresponding genotypic coefficient of variation for all the nineteen quantitative characters. Genotypic coefficient of variation ranged from 3.15 % to 12.33 % and phenotypic coefficient of variation ranged from 4.29 % to 19.36 %. Heritability and genetic advance as per cent of mean (GAM) were higher in all the nineteen quantitative traits studied in turmeric genotypes.

Key words
Turmeric, Augmented block design, Genetic variability, Rhizome yield, Heritability and Genetic advance as per cent of mean

INTRODUCTION

Turmeric (*Curcuma longa* L.) is a herbaceous perennial grown in tropical and subtropical regions of the country. Turmeric from the family zingiberaceae, is a sterile triploid species (2n=3x=63), that can be vegetatively propagated using its underground rhizomes (Ramachandran, 1961). *Curcuma* has many species *viz., C. amada* is endemic in South Asia and also found in the hills of South India, whereas, *C. aromatic* is distributed from China to Srilanka. *C. caesia* is a native of north east India and *C. zedoaria* occurs mainly in the northeastern regions of India (Ravindran *et al.,* 2007). Turmeric is also known as golden spice and spice of life (Ravindran *et al.,* 2007). The turmeric is being cultivated in around 238000 ha with the production of 1133000 mt in India (Anon., 2018). It has

more medicinal value potentials (Cousins *et al.,* 2007) *viz.,* anti-inflammatory, hepatoprotective, antitumor, antiviral activities (Ravindran *et al.,* 2007) and anticancer activity (Polasa *et al.,* 1991). In India, many researches have been done on genetic improvement of turmeric germplasm and characterization of the collections, because of its economic importance and high genetic variability found here (Chandra *et al*., 1997; Lynrah *et al.,* 1998; Singh *et al.,* 2003; Chaudhary *et al.,* 2006). In view of this context and importance of turmeric, the present study was carried out to estimate the genetic variability among 200 turmeric genotypes along with the estimate of other allied genetic parameters and identification of turmeric cultivar with high rhizome yield and quality.

MATERIALS AND METHODS

The present study was conducted during 2017-18 at Department of Spices and Plantation Crops, Horticultural College & Research Institute, TNAU, Coimbatore, Tamil Nadu, India. The experimental site is located at 11^0 7'N latitude and 77^0 59' E longitude and at a mean altitude of 426.26 M above the mean sea level. Two hundred turmeric genotypes were collected from various sources in different places of India *viz.,* Tamil Nadu, Kerala, Orissa and North East region. The field trial was laid out in Augmented Randomized Complete Block Design (Federrer, 1956). The design consisted of 20 augmented blocks with two checks and ten entries per block. All the turmeric genotypes were maintained following the regular agronomical practices along with the recommended dose of fertilizer and spacing. 20 plants were accommodated in each row. Among them, ten plants were selected and tagged for each genotype for collection of data. Check variety was randomly raised in each block. Nineteen profitable quantitative traits were recorded namely plant height (cm), the number of tillers plant^{-1}, the number of leaves plant^{-1}, petiole length (cm), leaf length (cm), leaf width (cm), the number of mother rhizomes plant^{-1}, weight of mother rhizomes plant^{-1} (g), length of mother rhizomes plant^{-1} (cm), girth of mother rhizomes plant^{-1} (cm), the number of primary rhizomes plant^{-1}, weight of primary rhizomes plant^{-1} (g), length of primary rhizomes plant^{-1} (cm), girth of primary rhizomes plant^{-1} (cm), the number of secondary rhizomes plant^{-1}, weight of secondary rhizomes plant^{-1} (g), length of secondary rhizomes plant^{-1} (cm), girth of secondary rhizomes plant^{-1} (cm) and rhizome yield plant^{-1} (g).

The analysis of variance (ANOVA) was executed by using SPSS 16.0 version. A statistical analysis was done based on the standard methods as described by Federrer, 1956. The genotypic, phenotypic and environmental coefficients of variation were calculated according to the formula given by Burton, 1952. Heritability and genetic advance were calculated as suggested by Allard (1960) and Johnson *et al.,* (1955).

RESULT AND DISCUSSION

The present study was mainly focused on estimating the genetic variability and genetic divergence of turmeric genotypes by evaluating the extent of variability. The above two factors contemplate to understand and explore the existing variability and genetic diversity in turmeric germplasm with 200 genotypes including two checks as genetic variability and genetic diversity studies have played an important role in any successful breeding program. Results of the mean performance of 200 turmeric genotypes including two checks *viz.,* BSR and CO 2 were studied for their genetic diversity. Among the different nineteen quantitative traits studied, the turmeric genotypes recorded significantly a high mean value for plant height (116.16 cm), petiole length (27.82 cm), leaf

Table 1. *Per se* performance of quantitative traits in different turmeric genotypes

Quantitative traits	Plant height (cm)	Number of Tillers	Number of leaves	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)
Check 1 (BSR 2)	94.07	3.69	6.43	22.33	54.85	11.54
Check 2 (CO 2)	101.43	6.41	9.76	22.22	30.30	10.17
Total mean	115.97	5.21	8.88	27.77	53.38	14.93
Check mean	97.75	5.05	8.09	22.27	42.57	10.85
Test Mean	116.16	5.21	8.89	27.82	53.49	14.97
SE d (Between checks)	0.73	0.15	0.19	0.45	0.32	0.15
CD (Between checks)	1.53	0.31	0.39	0.94	0.66	0.32
SE d (Between test entries)	3.26	0.66	0.84	2.00	1.41	0.69
CD (Between test entries)	6.82	1.39	1.75	4.18	2.95	1.44
SE d (Between test entries of the same block)	4.00	0.81	1.02	2.45	1.73	0.84
CD (Between test entries of the same block)	8.36	1.70	2.14	5.12	3.61	1.77
SE d (Between test entries and checks)	2.90	0.59	0.74	1.78	1.25	0.61
CD (Between test entries and checks)	6.06	1.23	1.55	3.71	2.61	1.28

width (14.97 cm), the number of mother rhizomes plant^{-1} (4.71), weight of mother rhizomes plant^{-1} (100.76 g), girth of mother rhizomes plant^{-1} (9.76 cm), the number of primary rhizomes plant^{-1} (9.92), weight of primary rhizomes plant^{-1} (149.52 g), girth of primary rhizomes plant^{-1} (7.52 cm), the number of secondary rhizomes plant^{-1} (15.98), girth of secondary rhizomes plant^{-1} (5.77 cm) and rhizome yield plant^{-1} (341.31 g) as compared to check variety BSR 2 and CO 2. The mean values of the turmeric genotypes were significantly higher as compared to the mean values of both the checks (BSR 2 and CO 2) and to the mean values of the total genotypes excluding the length of secondary rhizomes plant^{-1} and length of primary rhizomes plant^{-1} (**Table 1**).

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Quantitative traits	Number of mother Rhizome per plant	Weight of mother rhizome per plant (g)	Length of Mother Rhizome (cm)	Girth of mother Rhizome (cm)	Number of primary rhizome per plant	Weight of Primary rhizome per plant (g)	Length of primary Rhizome (cm)
Check 1 (BSR 2)	4.48	92.51	6.77	8.73	8.59	138.80	7.29
Check 2 (CO 2)	3.07	84.40	5.48	7.59	8.37	146.27	8.83
Total mean	4.77	100.64	6.44	9.75	9.90	149.45	8.05
Check mean	3.78	88.45	6.12	8.16	8.48	142.53	8.06
Test Mean	4.78	100.76	6.45	9.76	9.92	149.52	8.05
SE d (Between checks)	0.16	1.22	0.29	0.41	0.20	0.90	0.19
CD (Between checks)	0.33	2.54	0.62	0.86	0.42	1.88	0.39
SE d (Between test entries)	0.71	5.44	1.32	1.84	0.91	4.02	0.84
CD (Between test entries)	1.48	11.37	2.75	3.85	1.90	8.40	1.75
SE d (Between test entries of the same block)	0.87	6.66	1.61	2.26	1.11	4.92	1.03
CD (Between test entries of the same block)	1.81	13.92	3.37	4.72	2.32	10.29	2.15
SE d (Between test entries and checks)	0.63	4.83	1.17	1.63	0.81	3.57	0.74
CD (Between test entries and checks)	1.31	10.09	2.44	3.42	1.68	7.45	1.56

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Quantitative traits	Girth of primary Rhizome (cm)	Number of secondary rhizome per plant	Weight of secondary rhizome per plant	Length of secondary Rhizome (cm)	Girth of secondary Rhizome (cm)	Yield per plant (g)
Check 1 (BSR 2)	6.77	16.25	77.23	3.31	3.42	308.54
Check 2 (CO 2)	6.67	15.04	103.33	5.33	5.61	334.00
Total mean	7.51	15.97	91.02	3.95	5.76	341.11
Check mean	6.72	15.64	90.28	4.32	4.51	321.27
Test Mean	7.52	15.98	91.02	3.94	5.77	341.31
SE d (Between checks)	0.20	0.14	0.66	0.22	0.28	1.54
CD (Between checks)	0.41	0.30	1.37	0.46	0.59	3.21
SE d (Between test entries)	0.89	0.64	2.93	0.99	1.25	6.87
CD (Between test entries)	1.85	1.34	6.13	2.07	2.62	14.35
SE d (Between test entries of the same block)	1.09	0.79	3.59	1.21	1.54	8.41
CD (Between test entries of the same block)	2.27	1.64	7.50	2.53	3.21	17.58
SE d (Between test entries and Checks)	0.79	0.57	2.60	0.88	1.11	6.09
CD (Between test entries and checks)	1.64	1.19	5.44	1.84	2.33	12.74

The results of analysis of variance among the sources of variation revealed that all the sources *viz.,* block, total entries, check, germplasm and interaction between the check and germplasm recorded significant value for all the quantitative traits (**Table 2**).

Table 2. Analysis of variance for yield and yield attributes in turmeric genotypes

Source of variation	DF	Plant height (cm)	Number of Tillers	Number of leaves	Petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Number of mother Rhizome per plant	Weight of mother rhizome per plant (g)	Length of Mother Rhizome (cm)	Girth of mother Rhizome (cm)
Blocks	19	2.01	0.23	0.38	1.96	1.59	0.38	0.20	16.35	0.67	2.96
All Entries	201	418.33*	3.16*	3.96*	58.53*	129.25*	7.31*	3.08*	2506.44*	1.87*	3.02 NS
Checks	1	541.99*	73.98*	110.56*	0.13*	6025.06*	18.69*	19.88*	657.48*	16.65*	13.13 NS
Test Entries	199	402.29*	3.00*	4.31*	58.84*	86.26*	4.85*	3.11*	2930.08*	1.91*	2.52NS
Check vs Test entries	1	3486.27	36.17	172.66	54.76	2788.33	485.85	19.75	79948.59	21.04	92.54
Error	19	5.33	0.22	0.35	2.00	0.99	0.24	0.25	14.79	0.87	1.70
Total	239										

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Source of variation	DF	Number of primary rhizome per plant	Weight of primary rhizome per plant (g)	Length of primary Rhizome (cm)	Girth of primary Rhizome (cm)	Number of secondary rhizome per plant	Weight of secondary rhizome per plant	Length of secondary Rhizome (cm)	Girth of secondary Rhizome (cm)	Yield per plant (g)
Blocks	19	0.24	22.53	0.23	0.85	0.17	2.35	0.76	0.73	40.87
All Entries	201	19.26*	6061.60*	3.00*	1.60*	53.74*	2129.95*	2.41*	2.31*	24022.90*
Checks	1	0.46*	558.38*	23.84*	0.10*	14.64*	6808.45*	40.86*	47.96*	6480.59*
Test Entries	199	20.11*	6804.96*	3.12*	1.51*	58.47*	2291.78*	2.35*	1.94*	27132.66*
Check vs Test entries	1	129.89	136362.58	41.89	20.29	847.32	34753.20	23.87	31.86	577277.16
Error	19	0.41	8.08	0.35	0.39	0.21	4.30	0.49	0.79	23.58
Total	239									

*Significant, NS-Non significant

The sum, mean, standard deviation, coefficient of variation, minimum and maximum values of the various traits is presented in **Table 3.** The largest variation was observed for weight of primary rhizomes plant^{-1} with coefficient of variation of 55.17, followed by weight of mother rhizomes plant^{-1}, weight of secondary rhizomes plant^{-1} and rhizome yield plant^{-1} with coefficient of variation of 53.72, 52.59 and 48.26 % respectively. Leaf width, plant height and leaf length recorded the lowest variation with coefficient of variation of 14.70, 17.27 and 17.36 respectively. The genotype CL 18 recorded the maximum value of plant height (160.99 cm), leaf width (22.35 cm), weight of mother rhizomes plant^{-1} (289.94 g), weight of primary rhizomes plant^{-1} (452.22 g), the number of secondary rhizomes plant^{-1} (34.30) and rhizome yield plant^{-1} (970.09 g). The genotypes CL 44 registered the maximum girth of primary rhizomes plant^{-1} (10.81 cm) and weight of secondary rhizomes plant^{-1} (262.29 g) which were significantly superior over the rest of check varieties. The characters showing high range of variation indicated that, there is good scope for crop improvement. Similar findings were also reported by Sharma and Bora (2013) in Pea and Dabas *et al.,* (1982) in Guar. The genotypes CL 181 recorded the minimum value for girth of primary rhizomes plant^{-1} (4.24 cm) and rhizome yield plant^{-1} (96.56 g). Germplsam CL 125 recorded the minimum value for the number of primary rhizomes plant^{-1} (1.00) and weight of primary rhizomes plant^{-1} (12.07 g). CL 229, CL 243 and CL 271 recorded the minimum values for the number of leaves plant^{-1} (5.10) whereas; CL 211 and CL 266 recorded the minimum value for the number of mother rhizomes plant^{-1}.

The variation among the mean of two hundred turmeric genotypes were highly significant for all nineteen quantitative traits. Thus, indicating the existence of

sufficient genetic variability among the turmeric genotypes studied **(Table 4)**. Similar results were reported by Aragaw *et al.,* (2011). The study of analysis of variance and critical difference revealed highly significant values among for all the nineteen traits studied suggesting that considerable genetic diversity existed among the population. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) obtained indicated the presence of considerable amount of genetic variability; which exhibited a wide scope of selection for the improvement of characters. The amount of genotypic and phenotypic variability among the population is necessary in developing better varieties and initiating a breeding program. The results of coefficient of variation showed that the PCV was higher than the GCV for all the quantitative traits. The genotypic and phenotypic coefficient of variation was moderate to high for nearly all the characters except genotypic coefficient of variation for girth of mother rhizomes plant^{-1} (Table 4). Genotypic coefficient of variation ranged from 3.15 to 12.33 and phenotypic coefficient of variation from 4.29 to 19.36. significantly high value for genotypic coefficient of variation was recorded for the weight of primary rhizomes plant^{-1} (12.33 %), weight of mother rhizomes plant^{-1} (11.98 %), weight of secondary rhizomes plant^{-1} (11.75 %) , rhizome yield plant^{-1} (10.79 %), the number of secondary rhizomes plant^{-1} (10.68 %), the number of primary rhizomes plant^{-1} (10.01 %), the number of mother rhizomes plant^{-1} (7.91 %), length of secondary rhizomes plant^{-1} (7.72 %), the number of tillers plant^{-1} (7.16 %), petiole length (6.06 %), the number of leaves plant^{-1} (5.01 %), length of primary rhizomes plant^{-1} (4.62 %) and girth of secondary rhizomes plant^{-1} (4.16 %). It indicated that though the character is least influenced by the environmental effects, a major part of the phenotypic variability in these characters was contributed by only additive gene inheritance and hence the improvement can be made by simple selection. Similar results were also obtained for phenotypic coefficient of variation in all the quantitative traits of turmeric genotypes. These results indicated that, the high coefficient of variation is an important factor for selection. The above characters agree with the findings of Prajapati *et al.,* (2014) for weight of secondary rhizome per plant, weight of primary rhizomes per plant and the number of secondary rhizomes per plant in turmeric.

Table 3. Mean performance of different turmeric genotypes on quantitative traits

Quantitative traits	Sum	Mean	Standard Deviation	Co efficient of variation	Min imum	Name of germplasm	Max imum	Name of germplasm
Plant height (cm)	23231.11	116.16	20.06	17.27	70.30	CL 227	160.99	CL 18
Number of Tillers	1042.10	5.21	1.73	33.26	2.10	CL 58	9.60	CL 27
Number of leaves	1778.50	8.89	2.08	23.35	5.10	CL 229, CL 243 & CL 271	14.50	CL 4
Petiole length (cm)	5564.70	27.82	7.67	27.57	7.62	CL 95	49.22	CL 113
Leaf length (cm)	10697.47	53.49	9.29	17.36	29.72	CL 159	78.19	CL 250
Leaf width (cm)	2994.50	14.97	2.20	14.70	9.12	CL 106	22.35	CL 18
Number of mother Rhizome per plant	955.50	4.78	1.76	36.89	1.00	CL 211 &CL 266	8.90	CL 39
Weight of mother rhizome per plant (g)	20152.66	100.76	54.13	53.72	19.33	CL 266	289.94	CL 18
Length of Mother Rhizome (cm)	1289.30	6.45	1.38	21.44	3.68	CL 159	10.56	CL 193
Girth of mother Rhizome (cm)	1952.87	9.76	1.59	16.26	5.24	CL 4	13.82	CL 9
Number of primary rhizome per plant	1983.70	9.92	4.48	45.21	1.00	CL 125	24.30	CL 25
Weight of primary rhizome per plant (g)	29904.64	149.52	82.49	55.17	12.07	CL 125	452.22	CL 18
Length of primary Rhizome (cm)	1609.88	8.05	1.77	21.93	2.04	CL 116	12.84	CL 16
Girth of primary Rhizome (cm)	1503.36	7.52	1.23	16.35	4.24	CL 181	10.81	CL 44
Number of secondary rhizome per plant	3195.50	15.98	7.65	47.86	4.70	CL 219	34.30	CL 18
Weight of secondary rhizome per plant	18204.98	91.02	47.87	52.59	42.82	CL 231	262.29	CL 44
Length of secondary Rhizome (cm)	788.79	3.94	1.53	38.83	1.31	CL 226	10.78	CL 164
Girth of secondary Rhizome (cm)	1153.88	5.77	1.39	24.11	1.80	CL 115	9.75	CL 8
Yield per plant (g)	68262.28	341.31	164.72	48.26	96.56	CL 181	970.09	CL 18

Table 4. Performance of different turmeric germplasm based on genetic parameters

Quantitative traits / Genetic Parameters	EV	PV	GV	ECV	PCV	GCV	Heritability	GA	GAM
Plant height (cm)	5.33	25.18	19.85	1.99	4.32	3.84	78.83	8.15	7.02
Number of Tillers	0.22	0.36	0.14	9.00	11.50	7.16	38.75	0.48	9.18
Number of leaves	0.35	0.55	0.20	6.64	8.32	5.01	36.22	0.55	6.21
Petiole length (cm)	2.00	4.84	2.84	5.09	7.91	6.06	58.66	2.66	9.56
Leaf length (cm)	0.99	5.26	4.26	1.86	4.29	3.86	81.11	3.83	7.16
Leaf width (cm)	0.24	0.47	0.23	3.26	4.57	3.21	49.19	0.69	4.63
Number of mother Rhizome per plant	0.25	0.39	0.14	10.49	13.13	7.91	36.26	0.47	9.81
Weight of mother rhizome per plant (g)	14.79	160.56	145.76	3.82	12.58	11.98	90.79	23.70	23.52
Length of Mother Rhizome (cm)	0.87	0.92	0.05	14.45	14.88	3.54	5.67	0.11	1.74
Number of primary rhizome per plant	0.41	1.40	0.98	6.47	11.92	10.01	70.50	1.72	17.31
Weight of primary rhizome per plant (g)	8.08	347.92	339.84	1.90	12.47	12.33	97.68	37.53	25.10
Length of primary Rhizome (cm)	0.35	0.49	0.14	7.37	8.70	4.62	28.19	0.41	5.05
Girth of primary Rhizome (cm)	0.39	0.45	0.06	8.34	8.91	3.15	12.46	0.17	2.29
Number of secondary rhizome per plant	0.21	3.12	2.91	2.84	11.05	10.68	93.40	3.40	21.27
Weight of secondary rhizome per plant	4.30	118.67	114.37	2.28	11.97	11.75	96.38	21.63	23.76
Length of secondary Rhizome (cm)	0.49	0.58	0.09	17.75	19.36	7.72	15.92	0.25	6.35
Girth of secondary Rhizome (cm)	0.79	0.84	0.06	15.37	15.92	4.16	6.81	0.13	2.23
Yield per plant (g)	23.58	1379.04	1355.45	1.42	10.88	10.79	98.29	75.19	22.03

EV: Environment variance, PV: Phenotypic variance, GV: Genotypic variance, ECV: Environment coefficient of variation, PCV: Phenotypic coefficient of variation, GCV: Genotypic coefficient of variation, H^2: Heritability, GA: Genetic advance, GAM: Genetic advance as per cent of mean

The heritability and genetic advance as per cent of mean data recorded the highest in all the quantitative traits (Table 4). High values for estimates of broad sense heritability were observed for the characters *viz.,* rhizome yield plant^{-1} (98.29%) had recorded the highest heritability followed by weight of primary rhizomes plant^{-1} (97.68 %), weight of secondary rhizomes plant^{-1} (96.38 %), the number of secondary rhizomes plant^{-1} (93.40 %), weight of mother rhizomes plant^{-1} (90.79 %), leaf length (81.11 %), plant height (78.83 %), the number of primary rhizomes plant^{-1} (70.50 %), petiole length (58.66 %), leaf width (49.19 %), the number of tillers plant^{-1} (38.75 %), the number of leaves plant^{-1} (36.22 %), the number of mother rhizomes plant^{-1} (36.26 %) and the lowest heritability were recorded length of mother rhizomes plant^{-1} (5.67 %). Weight of primary rhizome plant^{-1} (25.10 %) had recorded the highest genetic advance as per cent of mean followed by weight of secondary rhizomes plant^{-1} (23.76 %), weight of mother rhizomes plant^{-1} (23.52 %), rhizome yield plant^{-1} (22.03%) and the number of secondary rhizomes plant^{-1} (21.27 %). Length of mother rhizome (1.74 %) had observed the lowest genetic advance as per cent of mean. Both high heritability along with a high genetic advance as per cent of mean showed that most likely, the heritability is due to additive gene effects and selection is an effective and an important factor for predicting the resultant effect for selecting the best genotypes. In the present study, high heritability along with high genetic advance as per cent of mean was observed for weight of primary rhizome plant^{-1}, weight of secondary rhizomes plant^{-1}, weight of mother rhizomes plant^{-1}, rhizome yield plant^{-1} and the number of secondary rhizomes plant^{-1}. Hence, it indicated the predominance of additive gene component and ample scope for improving these characters based on direct selection. The present study revealed that the turmeric genotypes exhibited a higher degree of genetic variation which offered great scope for selection of these characters. Low heritability with low genetic advance as per cent of mean revealed that these characters were highly influenced by environmental effects and selection would be efficient. These results are in agreement with the earlier findings of Rajayalakshmi *et al.,* (2013), Philips and Nair (1986) and Pathania *et al*., (1988) in turmeric.

Genetic improvement and development of high yielding varieties are dependent upon the amount and nature of genetic variability that are present in the genetic stock, the genetic variation for nineteen quantitative traits among the two hundred turmeric genotypes showed high coefficient of variation, heritability and genetic advance as per cent

of mean which is significantly higher in all the characters due to low environmental effect. Genotypes *viz.,* CL 4, CL 16, CL 18, CL 25, CL 33, CL 39, CL 44, CL 113 and CL 250 exhibited better performance for all the quantitative characters. The above genotypes would be useful for further selection programme to fix the desirable character to be exploited for developing suitable variety.

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