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Genetic Variability Studies in Turmeric (*Curcuma longa* L.) under Southern Dry Zone of Karnataka

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ABSTRACT

Nineteen turmeric genotypes were raised in randomized block design to study the Variability, Heritability and Genetic advance of growth and yield characters during the year of 2012-13. Variability accompanied the PCV estimates were higher than GCV indicating the role of environment. High Heritability was observed for the characters *viz*, plant height (94.82cm), number of tillers per plant (80.97), number of leaves per plant (92.77), petiole length (80.36 cm), leaf area index (69.28 dm^2), number of mother rhizome (89.34), number of primary fingers (89.48), number of secondary fingers (95.05), Weight of mother rhizome (94.08), Weight of primary rhizome (98.73), Weight of secondary fingers (97.55), Length of Mother Rhizome (97.55), Length of primary fingers (87.14), Length of secondary fingers (75.30), Fresh rhizome per plot (79.92), Fresh rhizome Yield per hectare (96.72) suggesting that selection will be effective for these characters. High heritability along with high genetic advance as a per cent over mean for characters *viz*, Plant height, Number tillers per plant, Number of mother rhizome, Number of primary fingers, Number of secondary fingers, Weight of mother rhizome, Weight of primary fingers, Length of primary fingers, Length of secondary fingers, Fresh rhizome per plot, Fresh rhizome Yield per hectare, hence there is ample scope for improving these characters for direct selection.

Key words: *Curcuma longa L, Genetic variability, GCV, PCV, Heritability, Genetic advance over percent mean.*

INTRODUCTION

Turmeric (*Curcuma longa* L.) is one of the important spice and dye yielding crops grown in India since time immemorial. It is regarded as a symbol of well being and good fortune, and is being widely used in ceremonies and religious functions. Turmeric of commerce is the dried underground rhizome of *Curcuma longa* L. It is an erect herbaceous perennial belonging to the family Zingiberaceae and native to South East Asia.

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Turmeric of the commerce is valued for its deep yellow colour and pungent aromatic flavour due to the presence of colouring matter 'curcumin' and an volatile oil 'termerol' respectively. It is also an important condiment which finds a unique place in culinary arts and as colouring agent in textile, food, confectionary, cosmetics and drug industries, besides its use in the preparation of anticancer and medicines.

In India, it is mainly grown in Andra Pradesh, Orissa, West Bengal, Tamil Nadu, Assam, Maharashtra, Karnataka, Bihar and Kerala. However, Andra Pradesh occupies 38 percent of total area and 58.5 percent of total production of the country. The national productivity of the crop is 5100 kg per ha.

MATERIALS AND METHODS

The investigation was carried out at College of Horticulture, Mysore, during 2012-13. using sixteen genotypes *viz.*, Co-1, Salem, Prabha, Krishna, Rajapuri, Prathibha, PTS-24, Cuddapah, Alleppey, Bidar-1, Bidar-4, CLI-327, CLI-14, CLT-325, Belgaum Local and Erode, The experiment was set to a randomized complete block design with three replications in open field condition. Each replication was represented by 5 rows of 2.0m length and the spacing was 30 cm between rows and plants, the net plot size was 1.5 m × 0.9 m. Healthy and disease free uniform sized fingers of 15 g with well developed buds were selected for planting.Recommended
package of practices and plant protection meas ures were followed to raise a healthy crop[9].
Data recorded on various characters were subj ected to analysis of variance. Genotypic coeff icient of variation (GCV), phenotypic coefficient of variation (PCV) was estimated by the formula given by Burton[2]. Heritability and genetic advance was calculated by following Allard[1], and Hanchinamani[3].

RESULT AND DISCUSSION

Significant variability was observed for all the characters studied (Table 1). In general the PCV estimates were higher than GCV indicating the role of environment. These results are supported by Yadav & Singh[10] and Manohar *et al*[5]., in turmeric. High estimates of heritability were observed for the characters *viz.,* plant height (94.82cm), number of tillers per plant (80.97), number of leaves per plant (92.77), petiole length (80.36 cm), leaf area index (69.28 dm^2), number of mother rhizome (89.34), number of primary fingers (89.48), number of secondary fingers (95.05), Weight of mother rhizome (94.08), Weight of primary fingers (98.73), Weight of secondary fingers (97.55), Length of primary fingers (87.14), Weight of secondary fingers (75.30), Fresh rhizome per plot (79.92), Fresh rhizome Yield per hectare (96.72) indicating that a major part of the phenotypic variability in these characters was contributed by additive gene effects and hence improvement can be made by simple selection. Similar results have been reported by Singh *et al*[8]., Nirmal *et al*[6]., Pathania *et al*[7]. and Hanchinamani[3]. Low heritability values suggested the involvement of environmental component in the expression of the character. Hence, direct selection of a particular character would be futile. Therefore, indirect selections need to be adopted.

High heritability along with high genetic advance as a per cent over mean is an important factor for predicting the resultant effect for selecting the best individuals. In the present study, high heritability was accompanied with high values of genetic advance as a per cent over mean for Plant height, Number tillers per plant, Number of mother rhizome, Number of primary fingers, Number of secondary fingers, Weight of mother rhizome, Weight of primary fingers, Length of primary fingers, Length of secondary fingers, Fresh rhizome per plot, Fresh rhizome
Yield per hectare indicating predominance of a dditivegene component. Thus, there is ample s cope for improving these characters based on d irect selection. These results in agreement with the earlier findings of Pathania *et al*[7]., Lynrah *et al*[4]., and Hanchinamani[3]. Summarizing the GCV, PCV, Heritability and Genetic advance characters, it can be concluded that emphasis is given to the genotypes which produce more

number of tillers plant^{-1}, number of mother rhizome plant^{-1} and primary fingers plant^{-1} hence better selection process for further breeding programme. From this present study (Table 2 and 3) study based on their *per se* performance of the genotypes, Salem, Rajapuri, Prathibha and CLT-325 were found to be profitable in terms of growth, yield, and quality parameters. Hence these cultivars can be recommended for growers of this southern dry zone of Karnataka, India.

Table 1: Estimation of mean, range, genotypic co-efficient of variance, phenotypic co-efficient of variance, heritability and genetic advance over per cent mean of growth and yield traits of Turmeric

Sl. No.	Characters	Range	Mean	GCV	PCV	H^2	GA% Mean
1	Plant height (cm)	37.07 - 30.60	33.74	6.90	7.08	94.82	13.84
2	Number tillers per plant	3.80 - 2.43	2.97	14.43	16.04	80.97	26.76
3	Number of leaves per plant	17.67 - 9.20	14.15	16.81	17.46	92.77	33.37
4	Petiole length (cm)	14.47 - 9.13	11.40	13.93	15.54	80.36	25.72
5	Leaf area index (dm^2)	55.83 - 39.97	48.91	9.40	11.29	69.28	16.12
6	Number of mother rhizome	2.80 - 1.49	2.01	20.06	21.22	89.34	19.06
7	Number of primary fingers	9.67 - 5.60	7.92	13.43	14.20	89.48	26.18
8	Number of secondary fingers	17.27 - 8.13	14.00	19.40	19.90	95.05	38.97s
9	Weight of mother rhizome(g)	88.56 - 48.85	73.43	16.30	16.53	94.08	32.04
10	Weight of primary fingers(g)	183.61 - 83.13	148.73	22.18	22.32	98.73	45.41
11	Weight of secondary fingers(g)	107.57 - 47.43	78.67	27.31	27.65	97.55	55.57
12	Length of primary fingers(cm)	9.15 - 6.52	7.81	11.14	11.93	87.14	21.42
13	Length of secondary fingers(cm)	7.12 – 2.91	5.12	21.13	24.35	75.30	37.78
14	Fresh rhizome kg per plot	10.08 – 4.98	8.20	18.07	18.26	79.92	36.83
15	Fresh rhizome Yield per hectare (t ha^{-1})	33.67-16.75	27.35	17.86	18.16	96.72	36.19

GCV- Genotypic co-efficient of variation **GAM- Genetic advance as per cent of mean**
PCV- Phenotypic co-efficient of variation **H^2- Broad sense heritability**

Table 2: Different growth parameters in turmeric cultivars

Cultivar	**Plant height (cm)**	**Number of tillers per plant**	**Leaf area (dm^2)**	**Leaf Area Index**
Co-1	33.73	3.00	48.80	6.47
Salem	37.07	3.80	55.80	7.40
Prabha	30.87	2.57	47.67	6.30
Krishna	31.53	2.43	39.97	5.30
Rajapuri	36.40	3.53	48.73	6.47
Prathibha	36.53	3.77	48.40	6.43
PTS-24	32.33	2.67	50.87	6.70
Cuddapah	35.73	2.87	55.83	7.40
Alleppey	33.13	2.97	55.17	7.33
Bidar-1	34.00	2.70	44.77	5.90
Bidar-4	31.14	2.73	48.67	6.43
CLI-327	35.67	2.73	44.93	5.97
CLI-14	30.60	2.90	41.84	5.53
CLT-325	36.93	3.63	51.63	6.83
Belgaum local	31.20	2.63	54.74	7.23
Erode local	33.09	2.73	44.77	5.93
S. Em ±	**0.31**	**0.12**	**1.78**	**0.23**
C D @ 5%	**0.91**	**0.35**	**5.13**	**0.68**

Table 3: Different yield and yield attributing components of Turmeric cultivars

Cultivars	No.of mother rhizome	Wt. of mother rhizome	No.of primary fingers per plant	Wt. of Primary fingers per plant	No. of secondary fingers per plant	Wt. of secondary fingers per plant	Fresh weight of rhizomes (g plant^{-1})	Fresh rhizome yield (t ha^{-1})	Curing percentage	Cured yield (t ha^{-1})	Curcumin content (%)
Co-1											
Salem	1.87	75.37	8.33	136.74	15.87	95.29	262.00	30.54	22.95	7.01	3.12
Prabha	2.63	88.56	9.67	183.61	17.27	107.57	517.28	33.67	24.70	8.31	4.56
Krishna	1.91	62.27	8.67	128.41	16.13	58.92	507.64	21.54	23.37	5.04	6.45
Rajapuri	1.62	58.13	6.73	83.13	15.75	48.93	195.69	16.75	20.89	3.49	2.75
Prathibha	2.80	84.13	9.10	179.93	16.56	105.73	511.67	32.67	19.74	6.44	4.62
PTS-24	2.47	83.73	9.13	181.27	16.28	103.04	510.06	32.56	20.37	6.63	6.21
Cuddapah	2.31	81.49	8.67	176.37	15.80	93.53	464.00	26.65	20.16	5.37	7.20
Alleppey	1.79	82.56	7.47	177.46	13.03	75.06	507.00	29.95	22.64	6.69	3.61
Bidar-1	2.02	77.47	7.13	171.86	11.00	47.43	386.99	26.20	21.94	5.74	6.39
Bidar-4	1.96	69.03	7.73	151.44	9.60	49.76	322.31	28.19	21.64	6.09	2.38
CLI-327	1.60	67.53	7.54	165.07	13.67	92.40	500.00	27.72	22.84	6.33	4.81
CLI-14	1.80	57.45	7.81	113.49	12.60	65.44	470.67	25.96	22.06	5.72	4.48
CLT-325	1.70	48.85	5.60	94.72	8.13	69.83	361.67	19.22	22.01	4.23	3.23
Belgaum	2.57	86.80	9.03	178.33	16.47	104.13	513.64	32.49	24.51	7.98	5.76
Local	1.67	80.47	6.97	122.67	12.00	68.10	424.67	25.04	22.75	5.63	4.27
Erode local	1.49	71.10	7.20	135.20	13.87	73.64	492.71	28.93	24.16	6.98	3.60
S. Em ±	**0.08**	**1.71**	**0.21**	**2.16**	**0.36**	**1.97**	**3.06**	**0.52**	**0.36**	**0.39**	**0.26**
C D @ 5%	**0.23**	**4.93**	**0.61**	**6.24**	**1.03**	**5.68**	**8.83**	**1.50**	**1.03**	**1.12**	**0.75**

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