Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 382-384

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

FULL LENGTH ARTICLE **OPEN ACCESS**

Assessment of Genetic Variability In Turmeric (*Curcuma Longa*l.) Varieties Under Gangetic Alluvial Plains Of West Bengal

***VENUGOPAL, S., PARIARI, A.,KARTHIK, C. S. AND[1]DINESHKUMAR, P.**
Department of Spices and Plantation Crops, Faculty of Horticulture,
[1]Department of Agricultural Statistics, Faculty of Agriculture,
Bidhan Chandra KrishiViswavidyalaya, Mohanpur, Nadia, West Bengal-741252, India.
*Corresponding Author: Email- venugopal.sripathi@gmail.com

ABSTRACT
The genetic variability, heritability and genetic advance over mean were estimated for yield and quality traits in five turmericgermplasm. Wide genetic variation was observed for all genotypes like plant height,yield per plot, number of leaves per plant and curcumin content. Considering genetic parameters, high GCV was found for curcumin content (52.69%) followed by yield per plot (19.07), number of primary rhizomes per clump (14.20) and number of leaves per plant (14.02) respectively. In all cases, phenotypic variances were higher than the genotypic variances except girth of primary rhizomes which were found exactly same. Based on high heritability (h^2 b.s.) oleoresin content (99.59%), yield per plot (98.63), number of primary rhizomes per clump (97.59), number of leaves per plant (96.75) and length of primary rhizomes (96.72) were found superior and high GAM was observed for curcumin content (108.34%), yield per plot (39.01) and number of primary rhizomes per clump (28.90) found superior traits and representing additive genetic variance. Effective selection would be made considering these traits.
Key words: *Genetic variability, Heritability, Genetic advance and Co-efficient of variation.*

Received 23.07.2017 Revised 21.08.2017 Accepted 30.08. 2017

INTRODUCTION

Turmeric (*Curcuma longa* L.) is an important, sacred and ancient spice of India. It is a major rhizomatous spice produced and exported from India. Turmeric is an herbaceous perennial plant, belongs to family *Zingiberaceae*, and comprises about 70 species. Mostly it is found throughout south and South- East Asia. It is cultivated for its underground rhizomes which is used as spice and condiment, dye stuff and in cosmetic and drug industry, particularly in the preparation of anti cancerous medicines. It can be propagated by vegetative method using its underground rhizomes. India being the world's largest producer of turmeric. In India, turmeric was grown in an area of 2.33 lakh hectares with a total production of 11.90 lakh tonnes during 2014-15[1].In West Bengal, it is grown in an area of about 15,800 hectares with an annual production of 42,000 tonnes of fresh rhizome [1]. It is mainly grown in Darjeeling, Kalimpong, Nadia, Bhagwanpur areas of West Bengal. The available serves as most valuable natural reservoir for providing donor parent to improve the particular traits by genetic reconstruction of plant [2]. The progress in breeding for the economic characters that are mostly environmentally influenced is determined by the magnitude and nature of their genetic variability. Hence, it is essential to partition the overall variability into its heritable and non heritable components with the help of genetic parameters like genetic co-efficient of variation, heritability and genetic advance over mean. The present study was, therefore, undertaken to determine the genetic variability for various characters to estimate the scope of advance for selection in turmeric.

MATERIALS AND METHODS

The field experiment was carried out at Horticulture Research Farm, Jaguli, Bidhan Chandra KrishiViswavidyalaya, Nadia, West Bengal conducted during 2014-15 and 2015-16. The research station is located approximately at 23.5°N latitude, 89°E longitude having an average altitude of 9.75m from the sea level in the Gangetic alluvial plains of West Bengal. The climate of experimental site is sub-humid and

situated just south of the tropic of cancer. In summer temperature is high 25^0C to 42.18^0C, but in winter is short and mild having 11^0C to 26^0C. Generally, monsoon breaks in the month of June and continues up to September. The experiment conducted in a sandy loam texture soil having P^H range of 6.8. The trial was laid out in Randomized Block Design (RBD) with four replications using five varieties of turmeric viz. Suguna, Alleppy Supreme, Rashmi, Rajendra Sonia and Duggirala. The rhizomes were planted in second week of April each year in ridge and furrow method at spacing of 30 cm between rows and 25 cm between the plants. and followed all the cultural practices as per standard package of practice as and when required. The observations on growth, yield and yield attributes were recorded on five randomly selected plants from each plot and curcumin (g/100 g) was estimated in the laboratory by the method given by [3]. The data collected from the field were subjected to statistical analysis by following procedure laid out[4]. For determination of standard error of mean (S**.** Em.±) and the value of critical difference (C. D) between the treatment means as 5% level of significance [5]. The genotypic and phenotypic variances were calculated according to [6]and [7]. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated by the method suggested by [8]. Whereas, heritability in broad sense for yield and its components were worked out by using formula suggested by [9]. Genetic advance as per cent of mean (GAM) was calculated by the method suggested [6].

RESULTS AND DISCUSSION

The analysis of variances showed that, the variances due to treatments (genotypes) was highly significant (at P= 0.05) for all thetraits studied(Table-1), indicating thereby the presence of genetic variability in the experimental material. The estimates of mean, range, environmental variance (EV), genotypic variance (GV), phenotypic variance (PV), environmental co- efficient of variance (ECV),genotypic co- efficient of variance (GCV), phenotypic co-efficient of variance (PCV), heritability (h^2b.s.), genetic advance (GA) and genetic advance as per cent of mean (GAM) for different characters are presented in Table-2. High GCV was found for curcumin content (52.69%) followed by yield per plot (19.07) and number of primary rhizomes per clump (14.20)respectively. In general, PCV estimates were higher than GCV estimates for all studied traits. It indicates that the presence of maximum amount of genetic variability which emphasized the wide scope of selection for the improvement of these characters [10]. The influence of environment was minimum when difference between GCV and PCV was less in magnitude for all studied characters [10]. Genotypic variance (GV) was highest for plant height (65.88), yield per plot (4.09), number of leaves per plant (3.48) and curcumin content (2.54%)respectively [11]. Based on high heritability (h^2b.s.)oleoresin content (99.59%), yield per plot (98.63), number of primary rhizomes per clump (97.59), number of leaves per plant (96.75) and length of primary rhizomes (96.72)were found superior and high GAM was observed for curcumin content (108.34%), yield per plot (39.01) and number of primary rhizomes per clump (28.90)found superior traits and representing additive genetic variance. therefore, effective selection can be made for these traits as similar reported by [12] and [13]. Continuous selection for yield and quality traits is known for fixing of genetic variability in crop plants [14]. The present study indicated a broad genetic base in the turmericgermplasm of India.

Table-1: ANOVA for yield and quality contributing traits in turmeric

Source	df	Pl. ht. (cm)	No. of Tiller /plant	No. of leaves /plant	No. of primary rhizomes / clump	Length of primary rhizomes (cm)	Girth of primary rhizomes (cm)	Yield/ plot (kg)	Curcumincontent (%
Replications	3	6.95	0.00	0.02	0.01	0.03	0.00	0.08	0.01
Treatments	4	270.25**	0.31**	14.04**	2.77**	2.11**	0.21**	16.45**	10.20**
Error	12	6.70	0.00	0.11	0.01	0.01	0.00	0.05	0.01

Table-2: Mean, genotypic and phenotypic coefficient of variability, heritability (broad sense) and genetic advance of yield and quality contributing traits in turmeric

Characters	Mean	EV	GV	PV	ECV	GCV	PCV	h2	GA	GAM
Plant Height (cm)	117.38	6.70	65.88	72.59	2.20	6.91	7.25	90.76	15.93	13.57
Number of tillers per plant	2.33	0.003	0.07	0.08	2.45	12.03	12.27	96.01	0.56	24.28
Number of leaves per plant	13.31	0.11	3.48	3.60	2.56	14.02	14.26	96.75	3.78	28.42
Number of primary rhizomes per clump	5.85	0.01	0.68	0.70	2.23	14.20	14.37	97.59	1.68	28.90
Length of primary rhizomes (cm)	5.82	0.01	0.52	0.54	2.28	12.44	12.65	96.72	1.46	25.21
Girth of primary rhizomes (cm)	2.25	0.004	0.05	0.05	3.08	10.12	10.58	91.48	0.44	19.95
Yield per plot (Kg)	10.62	0.056	4.09	4.15	2.24	19.07	19.20	98.63	4.14	39.01
Curcumin content (g/100g)	3.03	0.01	2.54	2.56	3.34	52.69	52.80	99.59	3.28	108.34

ACKNOWLEDGEMENT

At the outset, I express my sincere gratitude to my beloved Chairman, Dr. AnupamPariari, Professor, Department of Spices and Plantation Crops, Bidhan Chandra KrishiViswavidyalaya, Mohanpur who have meticulously planned the undertaken Research programme. The assistance and help received during the course of investigation was been duly acknowledged.

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CITATION OF THIS ARTICLE

Venugopal, S., Pariari, A.,Karthik, C. S. And Dinesh Kumar, P. Assessment of Genetic Variability In Turmeric (*Curcuma Longa*l.) Varieties Under Gangetic Alluvial Plains Of West Bengal. Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 383-384