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RESEARCH ARTICLE

GENE FREQUENCY DIVERSITY STUDIES IN INDIAN GENOTYPES OF ITALIAN MILLET [*Setaria italica* (L.) Beauv]

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ABSTRACT

The present investigation was carried out with the objective to find out the extent of gene frequency Diversity differences among 18 Indian genotypes for all the 13 characters studied during *kharif* 2008 and *rabi* 2009. It showed substantial variability in the material studied during both the seasons. High PCV coupled with high GCV was observed for grain yield per plant, ear weight, straw weight, number of productive tillers per plant, carotene and calcium content during both seasons whereas for 1000 grain weight during *kharif* only. It indicated presence of wider variability for these traits in the genotypes studied. High heritability coupled with high genetic advance as per cent of mean recorded for all characters except days to 50% flowering and days to maturity.

INTRODUCTION

Italian millet is generally raised as rain fed crop in India. It is being cultivated in Andhra Pradesh, Karnataka, Maharashtra and Hilly Areas of Northern India. This crop is grown for human food in North Africa, southeastern Europe, Japan and India. It is usually cooked whole or made into meal or into beer. It can also make useful hay or silage. In addition foxtail millet is consumed as stiff porridge called sargati, or as leavened bread known as roti, after the dehulled grain has been milled into flour. Foxtail millet with a short growing period is grown extensively in diverse agro- climatic regions for grain and fodder. It is known for its drought tolerance and is an indispensable crop of vast rain fed areas in semi-arid regions in India. It is also grown in nutrient deficient soils and possesses tolerance to pests and diseases. The grain is a good source of protein and contains β-carotene. Italian millet grain possesses 12.3% protein, 4.7% fat, 60.6% carbohydrates and 3.2% ash. In any crop improvement programme, the knowledge on extent of variability available is necessary. Presence of a wider spectrum of variability will enhance the chances of selecting a desired genotype. Besides genetic variability, knowledge on heritability and genetic advance measures the relative degree to which a character is transmitted to progeny, thereby helps the breeder to employ a suitable breeding strategy to achieve the objective. Therefore, for successful improvement of any crop, it is necessary to have a thorough knowledge on the variability present in the available breeding material. The Gene frequency Diversity studies carried out among 18 Indian genotypes for all the 13 characters studied during *kharif* 2008 and *rabi* 2009.

MATERIAL AND METHODS

The present investigation was undertaken at Agricultural College Farm, Bapatla, Guntur (Dt.), Andhra Pradesh with the 18 Indian genotypes of Italian millet [*Setaria italica* (L.) Beauv] procured from All India Co-ordinated Small Millets Improvement Project (AICSMIP), Bengaluru. The studies were carried out separately during two consecutive seasons of 2008-2009, namely k*harif* 2008 and r*abi* 2009. The genotypes were sown separately in randomized block design with four replications. Each genotype was sown in four rows of 5mts length spaced at 25 X 10 cm apart. Data were collected on 10 randomly tagged competitive plants per genotype per replication for number of productive tillers per plant, plant height, flag leaf area, ear length, ear weight, straw weight and grain yield. However data on days to 50 %flowering, days to maturity, grain protein%, calcium content and grain β-carotene were recorded on plot basis. The estimates of mean, range, phenotypic coefficients of variation (PCV), genotypic coefficient of variation (GCV), heritability (h^2_b) and genetic advance as per cent of mean (GAM) for Indian genotypes are presented in the table. Phenotypic and genotypic coefficients of variation (PCV and GCV) were computed according to Burton (1952). As suggested by Sivasubramanian and Menon (1973), GCV and PCV were categorized. Heritability in broad sense was estimated as per Lush (1940). The range of genetic advance as percent of mean was classified as suggested by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

In general for all the characters studied, the phenotypic coefficient of variation is higher than genotypic coefficient of variation. This indicates there is little influence of environment on the expression of trait. In the present study most of the characters showed high heritability coupled with genetic advance in both seasons. High heritability accompanied by high genetic advance reveals that most likely the heritability is due to additive gene effects and simple selection may be rewarding for improving a particular trait. It can be exploited by pure line selection and mass selection. High heritability coupled with low or moderate genetic advance can be exploited through heterosis breeding.

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Table 1. Mean, variability, heritability, genetic advance as percent of mean in Italian millet [*Setaria italica* (L.) Beauv] during *kharif* 2008 and *rabi* 2009 for Indian genotypes

Character	Mean		Range		GCV%		PCV%		h^2_b		GA(as % mean)	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
Days to 50% flowering	52.77	48.47	50.25 -56.00	42.00 -52.50	2.99	5.13	3.27	5.45	83.74	88.76	5.65	9.96
Plant height (cm)	75.24	107.55	59.64 -94.26	79.06 -125.57	13.7	9.70	13.85	9.79	99.03	98.16	28.27	19.81
Days to maturity	86.68	80.01	81.00 -93.00	72.75 -84.00	3.97	3.74	4.09	3.86	94.16	93.81	7.93	7.47
Number of productive tillers/ plant	3.20	9.55	2.10 - 4.80	4.38 -13.43	26.39	28.38	26.51	28.46	99.07	99.45	54.11	58.30
Flag leaf area(cm^2)	28.42	73.52	21.60 -41.58	54.62 -108.02	18.10	18.34	18.24	18.48	98.47	98.55	37.01	37.51
Ear length(cm)	11.14	18.17	8.22 -13.50	12.64 -22.61	16.10	13.86	16.15	13.95	99.32	98.71	33.05	28.38
Ear weight(g)	3.29	5.22	2.20 -5.74	3.13 -7.20	30.58	26.36	30.97	26.67	97.50	97.72	62.20	53.69
Straw weight(g)	22.48	44.63	13.42 -36.32	19.97 -66.96	28.36	26.49	28.52	26.08	98.88	97.70	58.09	53.94
1000 grain weight(g)	1.69	2.55	1.21 -2.57	2.17 -3.38	24.09	13.27	24.43	13.42	97.29	97.80	48.96	27.04
Carotene(mg/100g)	0.17	0.20	0.12 -0.28	0.12 -0.37	26.06	28.43	28.98	31.14	80.88	83.33	48.28	53.46
Crude protein %	6.90	8.55	5.30 -8.14	6.61 -9.65	12.27	9.08	12.35	9.16	98.72	98.32	25.13	18.55
Calcium content (mg/100g)	3.29	4.34	2.12 -4.90	2.56 -5.80	22.96	24.00	23.12	24.07	98.64	99.44	46.98	49.30
Grain yield/ plant(g)	9.54	30.43	2.86 -21.88	10.85 -52.78	59.88	39.00	60.72	40.08	97.22	94.67	121.63	78.17

PCV = Phenotypic Coefficient of Variation GCV = Genotypic Coefficient of Variationh^2 b= Heritability (Broad sense)

Burton (1952) and Swarup and Chaugle (1962) indicated that genetic variability together with the heritability would give a better idea on the amount of genetic advance expected out of selection. The magnitude of heritable variability is the most important aspect of genetic contribution of the breeding material, which has close relationship on its response to selection (Panse, 1957). High PCV coupled with high GCV observed for grain yield per plant, ear weight, straw weight, number of productive tillers per plant, carotene and calcium content during both seasons where as 1000 grain weight during *kharif* only. High heritability coupled with high genetic advance as per cent of mean recorded for all characters except days to 50% flowering and days to maturity in Indian genotypes. Similar findings were earlier reported by Islam *et al*. (1989), Muhammed Basheeruddin and Hussain Sahib(2004) for variability and in case heritability and genetic advance Athwal and Gian Singh(1966), Sandhu *et al*.(1974) and Gurunadha Rao and Appa Rao(1984). High heritability accompanied with low genetic advance during both the seasons indicate the role of non additive gene action in the inheritance. The high heritability is being exhibited may be due to influence of environment rather than genotype and selection for such trait may not be rewarding. Through heterosis breeding high heritability can be exploited. Similar results were earlier reported by Patil and Mohan Kumar (1989), Selvarani and Gomathinayagam (2000) and Lakshmana and Guggari (2001).

Conclusions

The genetic variability studies indicated that material used in the present investigation possessed considerable variability which provides sufficient basis for selection by the breeder. The genotypic coefficients of variation for all the characters studied were lesser than the phenotypic coefficients of variation indicating the masking effects of the environment. High PCV coupled with high GCV observed in Indian genotypes for grain yield per plant, ear weight, and straw weight, number of productive tillers per plant, carotene and calcium content during both seasons where as 1000 grain weight during *kharif* only. High heritability coupled with high genetic advance as per cent of mean recorded for all characters except days to 50% flowering and days to maturity in Indian genotypes during both seasons reveals operation of additive gene action in the inheritance of these traits and improvement in these characters is possible through simple selection.

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