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PHENOTYPIC STABILITY IN KODO MILLET (*PASPALUM SCROBICULATUM* L.)

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ABSTRACT

Phenotypic stability was studied in 26 divergent genotypes of kodo millet for four years. The results were analysed on the basis of stability parameters for days to flower and maturity, and plant height. Variance due to genotypes, environments, and G x E interaction were significant for all the characters when tested against pooled error but plant height was not significant when tested against pooled deviation. Only genotype KMV 20 was highly stable for all the three characters studied.

Key words: Kodo millet, *Paspalum scrobiculatum*, developmental characters, stability.

The developmental characters play a vital role in attaining high yield in this crop [1]. Knowledge on the genotype environment interaction will provide information to plant breeder for successful crop improvement work. The potentiality of genotypes and stability of their performance can be judged by multienvironment testing. A breeding programme, aimed at developing stable varieties, needs information on the extent of genotype x environment interaction for yield and associated quantitative traits. Lewis [2] measured the phenotypic stability based on mean performance in the highest yielding environment with that in in the lowest yielding one. Finlay and Wilkinson [3] used linear regression as a quantitative measure of phenotypic stability to describe varietal adaptability on a range of environments. Eberhart and Russell [4] suggested that both linear (bi) and nonlinear (s^2di) components of the genotype- environment interaction should be considered while judging the phenotypic stability of a particular genotype. Information on these aspects in kodo millet is limited. Therefore, the present investigation has been undertaken to determine phenotypic stability for the developmental traits of 26 kodo millet genotypes.

MATERIALS AND METHODS

Twenty six genotypes, including 18 improved cultivars, 4 national checks, and 4 local checks, were tested for 4 years (1988-1991) in complete randomised block design with 3 replications at Jagdalpur, Madhya Pradesh. Each plot had 6 rows of 3 m length with row-to-row and plant-to-plant distances 22.5 and 7.5 cm, respectively. Observations were recorded for days to flower, days to maturity and plant height. The data were analysed for stability parameters using the model of Eberhart and Russell [4].

RESULTS AND DISCUSSION

The analysis of variance (Table 1) for stability showed that the mean differences for genotypes were significant among themselves which revealed the presence of genetic variability among the genotypes. The significant mean squares due to environments indicated the distinct effect of different environments, i.e. years. The mean squares for G x E interaction was highly significant, suggesting that the characters studied were highly influenced by change of environments [5]. The magnitude of G x E interaction variance was smaller as compared to variety and environmental variances for these characters. These results are in agreement with those of [6]. Highly significant G x E interactions of the linear and nonlinear components were observed for all the traits except days to flower (nonsignificant nonlinear component). Thus, over the diverse seasons, the linear component mainly accounted for G x E interaction for days to flower. Therefore, a prediction of performance over diverse seasons is possible for this trait. It is obvious from Table 1 that the linear components of G x E interaction were relatively greater than the nonlinear components for all the characters, indicating that the performance of genotypes for all the characters could be predicated. These results are in agreement with the earlier reports on a wide range of plant materials [3, 7, 8].

The mean performance ($\bar{X}$) and two stability parameters, regression (b) and deviation from regression (S^2d) obtained for these characters are presented in (Table 2).

Table 1. Pooled analysis of variance (mean squares) for developmental characters over four years in kodo millet

Source	d. f.	Days to flower	Days to maturity	Plant height
Genotypes	25	163.2^{**++}	137.2^{**++}	224.8^{**++}
Environments	2	272.9^{**++}	239.1^{**++}	1183.8^{**++}
Genotypes x environments	75	6.9^{**++}	15.4^{**}	17.5^{**}
Environments (1)	1	818.7^{**++}	717.7^{**++}	355.1^{**++}
Genotypes x environments (1)	25	15.3^{**++}	19.8^{**}	19.9^{**}
Pooled deviation	52	2.4	12.8^{**}	15.7^{**}
Pooled error	208	2.8	2.6	9.5

**Significant at 1% level against pooled error.

++Significant at 1% level against pooled deviation.

Table 2. Stability parameters for developmental characters in 26 genotypes of kodo millet

Genotypes	Days to flower			Days to maturity			Plant height		
	$\overline{X}$	b	S^2d	$\overline{X}$	b	S^2d	$\overline{X}$	b	S^2d
MS 3695	66.1	1.35	–1.0	108.7	0.51	12.3	59.6	1.22**	–2.1
PSc. 9	64.2	1.73**	–1.8	105.9	0.98	1.6	56.9	1.23	0.1
GPUK 1	60.4	0.83**	–2.3	101.5	2.32*	7.1	53.7	0.73	9.6
GPUK 2	67.4	1.64*	–0.5	108.5	1.33	17.5**	62.2	1.42*	–6.3
GPUK 3	66.2	1.74*	–1.1	107.0	2.41	17.9**	61.3	1.54**	–6.7
GPUK 4	65.4	1.70**	–2.5	106.7	2.84**	7.4*	62.2	1.55**	–7.6
GPUK 5	67.2	1.78**	–1.5	109.2	1.11	4.4	66.4	1.05	2.9
KMV 8	77.3	1.99	5.7**	124.1	1.09	11.9**	78.9	0.95	–2.1
KMV 20	73.5	0.59	–1.2	112.1	0.88	5.1	69.8	0.88	20.5
PSc. 136-1	72.0	0.13**	–1.6	112.2	1.42	25.8**	66.4	0.45**	–6.8**
IPs. 147-1	67.3	1.72**	–2.1	110.2	1.62	9.5*	66.3	0.72	–5.8
PSc. 1	66.7	1.89**	–2.6	113.7	1.33	17.9**	60.9	0.78	3.5
Pali	72.9	0.17**	–2.6	111.5	1.37	14.7**	66.6	1.14	17.6
D. 73	74.2	0.45	–2.2	120.1	1.58	10.5**	73.3	0.33	11.6
JNK 364	72.9	0.27	–0.1	112.7	0.76	13.8**	71.3	0.55	13.8
IPs. 236-1	72.3	0.38**	–1.5	110.8	1.44	3.3	66.4	0.98	–9.4
IGBKK 1	80.7	0.50	4.6	117.6	–0.41*	7.5*	72.5	0.39*	–0.9
IGBKK 2	66.7	1.37**	–2.4	110.9	1.39	5.8*	66.1	0.96	–2.7
IGBKK 3	80.8	0.32**	–2.5	119.8	0.37	8,6*	79.3	1.88*	9.4
IGBKK 4	82.5	0.09**	1.6	120.7	0.29*	0.3	69.9	1.08	49.2**
IGBKK 5	80.1	–0.01**	–0.9	119.0	0.26	5.6*	79.4	0.90	1.2
IGBKK 6	79.8	0.47**	–1.9	121.3	–3.35**	10.5	77.4	0.58	35.3**
IGBKK 7	78.5	1.33	–0.2	119.8	–0.29	9.7**	82.0	1.26**	–9.0
IGBKK 8	79.2	0.71	–0.6	118.0	–3.18**	15.4**	67.9	1.34	0.6
IGBKK 9	79.2	0.77	12.3**	120.2	–0.13	11.7**	72.7	0.91	38.4**
IGBKK 10	67.3	2.06*	2.3	111.1	1.56	6.5*	60.6	1.17	7.2
Mean		72.3			113.6			68.0	
r ($\bar{x}$, b)		–0.612**			–0.609**			–0.127	
r ($\bar{x}$, S^2d)		0.418*			0.006			0.226	
r (b, S^2d)		0.025			–0.018			–0.193	

*,**b — Significantly differed from unity at 5% and 1% levels, respectively.

*,**S^2d — Significantly differed from 0 at 5% and 1% levels, respectively.

In this study a genotype having high mean and unit regression is considered to be superior [4].

The genotypes MS 3695, KMV 20, JNK 364, IGBKK1, IGBKK7 and IGBKK 8 showed nonsignificant stability parameters for days to flower. This indicated that these genotypes were suitable for all environments.

Regarding maturity, the values of b and s^2d were nonsignificant for the genotypes PSc 9, GPUK 1, KMV 20 and IPs 236-1. The remaining genotypes, except GPUK 4, IGBKK1, IGBKK6, and IGBKK 8, had low mean with nonsignificant bi and significant s^2d. This means that these genotypes fluctuated with change in the environment. The genotype KMV 20 could be stable with early maturity.

The highest plant height was recorded in IGBKK 7 (82 cm). Most of the varieties studied had nonsignificant values of b and s^2d for this trait and as such could be considered to be stable for plant height. However the genotypes PSc 9, Pali, IGBKK 8 and IGBKK 10 with regression around unity and nonsignificant deviations from regression appeared to be stable for this attribute under different environments.

Correlation coefficients among the stability parameters $\overline{X}$, b and s^2d indicated that there was no significant correlation among these parameters in case of plant height and days to maturity (Table 2). It was, therefore, suggested that all the three stability parameters should be taken into account while breeding for stable varieties of kodo millet.

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