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Short Communication

Genotype x environment interaction for grain quality traits in emmer wheat (*Triticum dicoccum* (schrank.) Schubl.)

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Emmer wheat is a traditionally cultivated wheat in Northern Karnataka, Southern Maharashtra, Saurashtra region of coastal Gujarat, parts of Tamil Nadu and Andhra Pradesh, and grown in an area of one lakh hectares with a total production of 2.5 lakh tonnes [1]. This wheat is hard with more vitreous nature and has superior milling and functional quality. It is also a good source of protein, dietary fiber, β-carotene with low fat content. It also possesses high degree of resistance to rust diseases and tolerance to terminal heat stress. It is commonly used for the preparation of various traditional pasta products and fetches premium price in the market as compared to durum and bread wheat. The cultivation of this wheat needs to be popularized in non-traditional areas for its exceptional grain qualities. For this, experimental level evaluation of potential genotypes over different zones for quality parameters should be done. With this objective in mind, 10 emmer wheat lines (DDK 1025, DDK 1028, DDK 1029, DDK 1030, MACS 2947, MACS 2956, MACS 2961, HW 1095, NP 200, and DDK 1009) drawn from different wheat improvement centres in the country along with durum (MACS 2846) and bread wheat (MACS 2496) were evaluated over seven locations (Ugar, Arabhavi, Dharwad in Karnataka, Pune in Maharashtra, Wellington in Tamil Nadu and Vijapur and Junagadh in Gujarat) across India during 2004-05 winter for four important grain quality traits.

The experiment was laid out in randomized complete block design with four replications. Each experimental plot consisted of 12 rows of 6 m length and the planting distance was 23cm between rows. The data were recorded on 1000-grain weight (g), sedimentation value (ml), β-carotene and protein content. The sedimentation value (ml) and β-carotene were estimated using the protocol provided by Misra and Gupta [2]. The protein content was determined *by* non-destructive method using 1241 Infratec Analyzer Unit (FOSS Analytical AB, Box 70, SE-26321 Hoganas, Swedan). Stability analysis was done as per the model proposed by Eberhart and Russell [3].

The mean squares of genotypes and environment for all the characters were significant indicating that the genotypes were distinct in their attributes and the environments were different from one another. Mean squares due to genotype x environment interaction showed significance for sedimentation value and protein content indicating differential behavior of genotypes under seven different environments. But for 1000-grain weight and β-carotene, the performance of the genotypes was predictable across environments. Considerable G x E interaction for protein content was reported earlier [4]. Genotype x Environment (Linear) component was significant for sedimentation value, β-carotene and protein content suggesting significant differences among the regression coefficients of 12 genotypes. Thus differential performance of varieties when grown over seven environments is predictable. The mean squares for pooled deviation were significant

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Table 1. Analysis of variance for stability

Source	df	1000 grain weight	Sedimen-tation value	β-caro-tene	Protein content
Genotypes	11	121.59**	295.24**	1.96**	0.35**
Environment	6	66.13**	13.09**	2.82**	0.73**
Genotype x Environment	66	7.63	4.89**	0.33	0.24**
Einv. + (Var. * Env)	72	12.51**	5.54*	0.54**	0.29*
Environment (linear)	1	396.79**	78.54**	16.95**	4.37**
Genotype x Environment (linear)	11	12.61	9.60**	0.66**	0.50**
Pooled deviation	60	6.86**	3.58**	0.24**	0.18**
Pooled error	231	0.41	0.33	0.009	0.05

*,**Significant 5% and 1% levels, respectively

for all the traits. This is indicative of unpredictability of deviations of test genotypes due to genotype x environment interactions.

According to Eberhart and Russell [3] a stable genotype is one which shows (i) a high mean yield (ii) a regression co-efficient equal to unity (b_i=1), and (iii) a mean square deviation from regression equal to zero (S^2d_i). In interpreting the results of the present investigation, S^2d_i was considered as the measure of stability [5]. Then the type of stability was decided based on regression coefficient (b_i) and mean values [6]. If b_i is equal to unity, a genotype was considered to have average stability (same performance in all the environments). If b_i was more than unity, it is suggested to have less than average stability (good performance in favourable environments) and if b_i is less than unity, it is reported to have more than average stability (uniform performance even under poor environments).

The estimates of stability parameters in respect of four characters are presented in Table 2. The general mean for 1000-grain weight was highest at Pune and Wellington (42.51g) followed by Arabhavi (41.50g). High sedimentation value was noticed at Jungadh (26.48g) and Vijapur (26.04g). High β-carotene and protein content were recorded at Wellington (4.54 ppm) and Ugar (13.81%), respectively. For 1000-grain weight, the genotype NP 200 released during 1965 was stable with high mean. None of the emmer wheat genotypes were found to be stable for sedimentation value. The bread wheat variety MACS-2496 was better across environments for β-carotene. For protein content, DDK 1009 was found to be highly stable with higher mean.

Table 2. Stability parameters for four quality traits in emmer wheat

Genotype	1000-grain weight			Sedimentation value			β-carotene			Protein content		
	$\overline{X}$	b_i	S^2d_i	$\overline{X}$	b_i	S^2d_i	$\overline{X}$	b_i	S^2d_i	$\overline{X}$	b_i	S^2d_i
DDK-1025	41.40	1.52**	7.88**	29.93	3.25**	3.16*	4.00	0.51*	0.04	13.59	-1.02	-0.03
DDK-1028	36.28	1.18**	1.54	29.82	0.29	6.50**	4.07	0.54	0.12*	13.51	2.88**	0.37
DDK-1029	40.22	0.91*	6.70**	22.61	1.14	0.50	3.98	1.36**	0.05	13.34	0.001	0.09
DDK-1030	38.92	0.44	5.94**	22.43	0.04	1.46	3.98	20.06**	0.35**	13.44	2.06**	0.04
MACS-2947	38.71	1.55**	4.71*	19.00	1.37	6.62**	3.34	0.56	0.04	13.56	0.50	0.10
MACS-2956	40.29	2.16**	7.76**	17.96	2.44**	3.44*	3.30	0.15	0.15**	13.65	0.08	0.06
MACS-2961	37.74	1.24**	12.57**	24.25	1.63*	0.86	3.53	0.79*	0.05	13.31	0.97	0.08
HW-1095	40.87	0.17	3.22	24.86	0.86	1.08	3.45	0.27	0.47**	13.41	2.42**	0.36
NP-200	40.13	1.41**	1.83	23.00	1.20	3.72*	3.30	0.53	0.09*	13.45	1.47	0.10
DDK-1009	37.03	0.78*	9.91**	22.82	1.17	2.02	4.23	2.21**	1.20**	14.16	1.19	-0.05
MACS-2846	52.08	0.20	2.56	23.14	0.10	8.00**	5.14	1.68**	0.11*	13.41	-0.24	0.05
MACS-2496	36.57	0.44	3.49	42.50	-1.47*	1.25	4.05	0.93*	0.06	13.56	1.70**	0.32
Overall mean	40.03			25.19			3.86				13.53	

*,**Significant at p= 0.05 level and 0.01 level, respectively

References

1. **R. R. Hanchinal, H. C. Lohithaswa, S. A. Desai, K. K. Math, B. N. Patil, I. K. Kalappanavar and Nirmala B. Yenagi.** 2004. Current Status of Emmer Wheat (*Triticum dicoccum* (Schrank.) Schubl.) Cultivation in India. *In*: Wheat for Tropical Areas. Proc. Nat. Symp. Wheat Improvement for Tropical Areas, 23-25 September, 2004, Indian Agricultural Research Institute. Regional Staion, Wellington, Tamil Nadu, K.A. Nayeem, M. Sivasamy and S. Nagarajan (eds.): 117-120.
2. **B. K. Misra and Gupta R. K.** 1995. Protocols for evaluation of wheat quality. Tech. Bulletin 3, Directorate of Wheat Research, Karnal.
3. **S. A. Eberhart and Russell W. A.** 1966. Stability parameters for comparing varieties. Crop Sci., **6**: 36-40.
4. **Rakesh Yadava and Singh T. B.** 2003. Stability analysis in wheat for grain protein, Indian J. Genet., **63**: 337-338.
5. **Breese E. L.** 1969. The measurement and significance of genotype environment interactions in grasses. Heredity, **24**: 27-44.
6. **K. W. Finlay and Wilkinson G. N.** 1963. The analysis of adaptation in a plant breeding program. Aust. J. Agric. Res., **14**: 742-754.