Indian J. Genet., **63**(4): 349 (2003)

Short Communication

Combining ability for seedling heat tolerance in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

R. V. Singh, T. R. Sharma[1] and O. P. Khedar

Agricultural Research Station, Durgapura, Jaipur 302 018

(Received: March 2003; Revised: August 2003; Accepted: August 2003)

Poor establishment of plants in pearl millet [*Pennisetum glaucum* (L.) R. Br.] resulting in a reduction in grain yield has been frequently observed under high soil temperature and moisture stress conditions during seedling stage [1]. Breeding varieties with seedling heat tolerance is the most effective way to overcome the problem of poor crop establishment due to high soil temperature. Experimental material of this study consisted of eight inbred parents (HMS 1B, HMS 3B, RIB 335/74, D23, 20-K86, FTR 250-2-1, FTR285 and FTR 336) possessing different degree of tolerance to high temperature with diverse origins. The crosses were made in a diallel fashion excluding reciprocals. The resultant 28 hybrids and 8 parents (selfed) were raised in three replicated randomized block design during summer season of 1994 at the Agricultural Research Station, Fatehpur-Shekhawati. Each entry was grown in 2.5 m long single row, with 30 cm space between rows. On the night before sowing, 15 mm of water was applied uniformly to all plots from two parellel sprinkler lines spaced 12 m apart. The rows were opened on the day of sowing to a depth of 50 mm with the sharp edge of a metal rake, 80 seeds were immediately sown by hand and the soil replaced and compacted lightly with the flat edge of a rake to ensure good soil-seed contact. A field technique described by Peacock *et al.* [1] to screen pearl millet genotypes for seedling heat tolerance has been used in this study. Seedling heat tolerance index was calculated as the ratio of the number of seedlings survived on 17th day after sowing to the total number of seedlings emerged. The diallel data were arc sine transformed and analysed as per Griffing's model 1 and method 2 [2]. Heterosis was estimated as percent increase or decrease in performance of individual crosses over mid-parent value.

During the experimental period, the maximum soil temperature (at 5 mm soil depth) ranged from 45.0°C to 62.4°C and air temperature from 37.0°C to 45.5°C. Combining ability analysis revealed that mean squares due to both GCA and SCA were significant indicating importance of both additive and non-additive type of gene action for the inheritance of seedling heat tolerance. However, the narrow sense heritability was low (h^2 0.25), suggesting that simple mass selection would not be effective in improving the heat tolerance. Rather, reciprocal recurrent selection might be expected to be more rewarding. ANOVA analysis of diallel data indicated significant differences among parents and crosses for heat tolerance. Among the parents D23 and FTR 250-2-1 showed significant positive GCA effects (Table 1). The high GCA effect of parents was not reflected in high heterosis of crosses. Crosses HMS 3B×D23 and HMS 3B × 20-K86 were found to have the highest value of survival percentage along with high estimates of heterosis.

References

1. **Peacock J. M., Soman P., Jayachandran R., Rani A. U., Howarth C. J. and Thomas A.** 1993. Effects of high soil surface temperature on seedling survival in pearl millet. Expl. Agric., **29**: 215-225.

2. **Griffing B.** 1956. Concept of general and specific combining ability in relation to diallel crossing system. Aust. J. Biol. Sci., **9**: 463-493.

Table 1. GCA effects (diagonal), heterosis (above diagonal) and means (below diagonal) for seedling heat tolerance index

Parent	HMS 1B	HMS 3B	RIB 335/74	D23	20-K86	FTR 250-2-1	FTR 285	FTR 336
HMS 1B	–3.8**	24.0	12.5	–17.0	53.7**	–20.6	–9.1	–3.6
HMS 3B	22.4	0.1	11.2	88.3**	126.7**	21.7	48.1	40.7
RIB 335/74	21.6	18.6	0.2	54.2**	92.5**	54.2**	–3.2	72.1
D 23	19.3	39.2	33.9	3.3**	32.1	5.9	19.9	35.4**
20-K86	31.2	40.5	36.7	30.6	1.5	39.5*	–1.7	–37.6*
FTR 250-2-1	19.1	26.3	35.2	28.5	33.4	2.6*	–8.6	54.3**
FTR 285	20.2	29.3	20.3	30.0	21.7	23.6	–1.9	–8.4
FTR 336	19.0	24.3	31.7	30.5	12.2	36.0	19.7	–2.0*

* = Significant at 5 % level; ** = Significant at 1 % level

[1]Present address: Directorate of Research, Rajasthan Agricultural University, Bikaner 334 006