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Study of Heterosis in Aromatic Rice (*Oryza Sativa* L.) for Quality Characters

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ABSTRACT

A field experiment was conducted during *kharif,* 2010 using 7 parents and 7 F_1s to study the heterosis for 6 quality characters i.e. milling recovery, hulling recovery, head rice recovery, kernel length, kernel length after cooking and volume expansion ratio. Significant positive heterosis and heterobeltiosis was observed for kernel length after cooking in the cross combination PUSA1121× MTU1010, volume expansion ratio in the cross combinations PUSA1121×SYE632002, PUSA1121×MTU1081 and RNR2354×MTU1081 and head rice recovery in the cross PUSA1121×MTU1081. Significant negative heterosis was recorded for milling recovery, hulling recovery and kernel length. Heterosis in negative direction for kernel length indicated reduction in kernel length of crosses, which is useful for the selecting short grain type aromatic genotypes. Based on the results, the crosses, PUSA1121×MTU1081 for head rice recovery, PUSA1121×MTU1010 for kernel length after cooking, RNR 2354 × MTU 1081, PUSA1121×SYE63002 and PUSA1121×MTU1081 for volume expansion ratio and PUSA 1121× MTU 1010 and RNR2354 × MTU1010 for kernel length were identified as better crosses for further advancement to develop pure lines with high quality.

Key words : Aromatic rice, Quality characters, Heterosis, Heterobeltiosis.

As scented rice has got a premium price in international market, it is a major source of earning foreign exchange to the country. In the light of recent food crisis, expecting a shortage of food grains, the Government of India banned the export of non-basmati rice, but on the other hand, permitted the export of basmati rice. Basmati rice is mostly exported to Gulf, European countries and the United Kingdom.

Aromatic rice has got paramount importance in breeding programmes in the countries, which are self sufficient in their production. Preference is given for kernel length, size, shape, appearance and cooking quality characters especially kernel elongation ratio. As such the plant breeders should focus their attention towards the improvement of both Basmati types and aromatic short grain rices for quality and high yield potential. Yield is a complex character determined by a large number of component characters which are considered important in plant breeding. Successful application of biometrical procedures to understand genetics of quantitative characters helped the breeders to systematically plan for result oriented breeding programmes. The challenge of quality improvement also needs to be addressed by evolving cultivar genotypes that combined high yield potential with quality attributes meeting stringent national and international standards.

MATERIAL AND METHODS

The material for the present investigation comprised of seven parents and their corresponding 7 F_1 crosses obtained following Line X Tester design (Kempthorne,1957). Salient features of the parents were described in Table 1.The experiment was conducted in randomized block design with three replications at Rice Section, Agricultural Research Institute, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad during *kharif,* 2010. All the parents and F_1s' were planted in rows of 3 m length with 20 x 15 cm spacing. Recommended agronomic, cultural and plant protection practices were followed.

Five competitive plants for each parent and F1 per replication were randomly selected for data generation. Ten grams of representative sample was used for estimating milling and head rice

recovery with Satake huller and Kett type T2 polisher respectively. Kernel dimensions were obtained using dial micrometer.

Heterosis in F_1 hybrids was calculated using Standard.

RESULT AND DISCUSSION

Four hybrids recorded negative significant heterosis for milling recovery (%) and remaining three crosses showed negative non significant heterosis. Significant negative heterobeltiosis was expressed by 5 hybrids while two crosses had negative non significant heterobeltiosis fir this trait.

Significant negative mid parental heterosis and heterobeltiosis was exhibited by 2 cross combinations (PUSA 1121× Sye 632002 and PUSA1121 × MTU 1010) for hulling recovery (%). Two crosses showed non significant heterobeltiosis and remaining crosses had non significant positive heterobeltiosis, which indicated that magnitude of heterosis is very low in the material used.

Head rice recovery (%) is one the most important quality attributes that enhances the chances of commercial success of a variety. Sidhu (2001) reported that head rice recovery generally ranges from 25 to 65 per cent. The cross combination PUSA1121x MTU1081showed significant positive heterosis over mid parent for this trait which was useful for improvement. Significant negative heterosis was exhibited by 5 crosses while one cross showed non significant heterosis. Six crosses expressed negative significant heterobeltiosis and remaining one cross .had negative non significant heterobeltiosis. Considering the performance of all the hybrids for milling traits cross PUSA1121 X MTU1081 was found to be consistent in terms of manifestation of heterosis in desirable direction. Heterosis for these traits was earlier was reported by Singh and Lal (2005), and Shivani *et al*. (2009).

Significant negative heterosis and heterobeltiosis were exhibited by 2 crosses (PUSA1121 ×MTU1010 and RNR2354 × MTU 1010) for kernel length (mm). Three crosses had negative non significant heterosis and two crosses showed positive non significant heterosis. Four hybrids recorded negative non significant heterobeltiosis while remaining one cross showed positive non significant heterobeltiosis for this trait. Exhibition of heterosis in negative direction for this trait indicated reduction in kernel length of crosses. This phenomenon could be successfully exploited in selecting short grain aromatic genotypes suiting the local demand. Negative heterosis for kernel length was also reported earlier by Raju *et al.*(2005).

For kernel length after cooking (mm), the cross PUSA1121XMTU1010 recorded significant

Table 1. Salient features of parents.

S.NO.	PARENTS	PARENTAGE	DESCRIPTION
1	YAMINI	BR 4-40/ Pak basmati	Aromatic ,long slender ,130 days duration
2	PUSA - 1121	Pusa 614-1-2/ Pusa 614- 2-4-3	Aromatic, long slender, 135 days duration
3	RNR- 2354	RNR M7/ RNR19994	Aromatic, short slender,135 days duration
4	BM- 71	Vajram /W40// IR64	Non aromatic, long slender, 145 days duration, resistant to BPH.
5	MTU- 1010	Krishnaveni / IR64	Non aromatic, long slender ,125 days duration, tolerant to BPH and WBPH
6	Sye- 632002	Selection from Shiram	Non aromatic, medium slender, 135 days duration, very small and more grains per panicle
7	MTU -1081	BPT-5204 / Jaya	Non aromatic medium slender, 125 days duration, tolerant to BPH

TABLE 2. Estimates of Heterosis (H1) and Heterobeltiosis(H2) for quality character.

S.NO	CROSSES	MEAN	H1	H2
1	**MILLING RECOVERY**			
	YAMINI×MTU1010	64.83	-6.40*	-8.13**
	PUSA1121×MTU1010	60.80	-12.23**	-13.84**
	PUSA1121×SYE632002	66.47	-8.05*	-10.19**
	PUSA1121×MTU1081	70.13	-1.54	-2.46
	RNR2354×MTU1010	66.97	-4.09	-6.57*
	RNR2354×SYE632002	60.13	-17.45**	-18.75**
	RNR2354×MTU1081	71.27	-0.72	-0.88
2	**HULLING RECOVERY**			
	YAMINI×MTU1010	76.19	1.41	-3.23
	PUSA1121×MTU1010	76.57	-3.41	-4.05
	PUSA1121×SYE632002	74.77	-6.31**	-6.31*
	PUSA1121×MTU1081	74.93	-5.17*	-6.10*
	RNR2354×MTU1010	80.40	2.70	2.12
	RNR2354×SYE632002	78.30	-0.66	-1.88
	RNR2354×MTU1081	80.90	3.67	3.41
3	**HEAD RICE RECOVERY**			
	YAMINI×MTU1010	50.83	-12.12**	-12.25**
	PUSA1121×MTU1010	48.77	-7.98**	-15.81**
	PUSA1121×SYE632002	50.47	-13.95**	-27.11**
	PUSA1121×MTU1081	60.70	6.80*	-7.47**
	RNR2354×MTU1010	58.53	-0.02	-1.06
	RNR2354×SYE632002	55.50	-13.55**	-19.84**
	RNR2354×MTU1081	58.80	-5.74*	-10.37**
4	**KERNAL LENGTH**			
	YAMINI×MTU1010	2.46	-10.26	-12.02
	PUSA1121×MTU1010	2.09	-19.07**	-25.48**
	PUSA1121×SYE632002	2.01	-11.58	-14.71
	PUSA1121×MTU1081	2.35	4.75	-0.28
	RNR2354×MTU1010	2.13	-14.57*	-23.93**
	RNR2354×SYE632002	2.08	-4.95	-5.02
	RNR2354×MTU1081	2.22	3.01	1.68
5	**KERNAL LENGTH AFTER COOKING**			
	YAMINI×MTU1010	10.57	-9.04	-9.53
	PUSA1121×MTU1010	18.67	61.43**	59.82**
	PUSA1121×SYE632002	9.23	-9.57	-19.34**
	PUSA1121×MTU1081	9.93	2.73	-13.22*
	RNR2354×MTU1010	8.67	-20.42**	-25.80**
	RNR2354×SYE632002	8.23	-13.67*	-18.48**
	RNR2354×MTU1081	8.43	-1.10	-6.60
6	**VOLUME EXPANSION RATIO**			
	YAMINI×MTU1010	5.08	2.42	-0.07
	PUSA1121×MTU1010	4.13	-3.84	-14.74**
	PUSA1121×SYE632002	4.99	22.04**	12.46**
	PUSA1121×MTU1081	4.50	14.80**	9.85*
	RNR2354×MTU1010	3.83	-22.87*	-24.84**
	RNR2354×SYE632002	4.27	-10.55**	-16.34**
	RNR2354×MTU1081	5.14	11.71**	0.72

positive heterosis and heterobeltiosis. Four hybrids exhibited negative non significant heterosis and two crosses had negative significant heterosis. Significant negative heterobeltiosis was expressed by 4 hybrids while remaining crosses showed negative non significance heterobeltiosis for this trait. Heterosis and heterobeltiosis of negative direction was observed by Krishna Veni *et al*. (2005).

The ratio of expansion in volume of cooked rice indirectly gives an idea about the water uptake capacity .Three cross combinations recorded significant positive mid parental heterosis for volume expansion ratio, while two crosses showed significant positive heterobeltiosis which was desirable. Two cross combinations had negative non significant heterosis and three crosses exhibited negative significant heterobeltiosis for this trait. Singh and Lal (2005) and Shivani *et al*. (2009) reported positive and negative significant heterosis and heterobeltiosis.

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