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Genetic studies of yield and yield contributing traits in aromatic rice genotypes

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Abstract
An investigation with eighty aromatic rice genotypes was undertaken to study the genotypic coefficient of variability (GCV) and phenotypic coefficient of variability (PCV), heritability (broad sense) and genetic advance for days to 50% flowering, days to maturity, plant height, panicle number per hill, number of total spikelet per panicle, number of fertile spikelet per panicle, sterility (%), test weight and grain yield. For all the characters the estimates of GCV were smaller than the PCV, suggesting the influence of environment on the traits studies. High heritability coupled with high genetic advance for days to 50% flowering, days to maturity, plant height, number of total spikelet per panicle and number of fertile spikelet per panicle indicate that these characters were predominantly governed by additive gene action. High heritability and moderate to low genetic advance for, panicle length, panicle number per hill, sterility (%) test weight and grain yield suggested the predominantly role of non- additive gene action in their inheritance. It reflects that heterosis breeding can be used in breeding programme to generate wide genetic variability for improvement of yield in non-basmati aromatic rice.

Keywords: aromatic rice, GCV and PCV, heritability, genetic advance

Introduction
India has large number of traditional short to medium grain aromatic rices in addition to Basmati rices which was prized for excellent eating quality since ages. However, in the past, this vast genetic wealth has never been exploited. Further in an era of semi-dwarf rices were high yield has been main focus, the traditional aromatic rice cultivars got ignored and there area has drastically reduced in the region. But surprisingly, non-basmati of indica constitute over 80% of world trade and there is immediate need to improve traditional non-basmati rices. The knowledge of genetic variability present in a given set of aromatic lines for the characters under improvement is a paramount importance for the success of plant breeding programmes. Heritability and genetic advance are important selection parameters. The present investigation was, therefore, undertaken to assess the variability, heritability and genetic advance for yield enhancement and related character in non-basmati aromatic rice.

Materials and Method:
The experimental material in the present study was comprised of eighty aromatic rice germplasm (Table 1), grown in randomised complete block design with three replication at Crop Research Station, Masodha (NDUAT), Faizabad during WS 2014. Each genotype was grown in three row of 4m length with a spacing of 20cm x 15cm. Observations on five randomly selected competitive plants were recorded on days to 50% flowering, days to maturity, plant height, panicle length, number of panicle per hill, number of total spikelet per panicle, number of fertile spikelet per panicle, spikelet sterility (%), test weight and grain yield. The mean values were used for analysis of variance. GCV and PCV were calculated following the method of Burton (1952) [2]. Broad sense heritability and expected genetic advance at 5% selection intensity were estimated as suggested by Johnson *et al* (1955) [8].

Table 1: List of Genotypes Evaluated

1.	Lalkuli badan	21.	NDR IRRI 69	41.	ASGPC-12	61.	Jhilli safri
2.	Kanika bhog	22.	NDR IRRI 75	42.	ASGPC-14	62.	Jhulari
3.	Heera kani	23.	NDR IRRI 2004	43.	ASGPC-19	63.	Karungi phool
4.	Basna parijat	24.	NDR IRRI 3117	44.	ASGPC-34	64.	Rajin-7
5.	Jalaka	25.	NDR IRRI 3131	45.	ASGPC-38	65.	Rajin-12
6.	Kala jauvan	26.	Katari bhog	46.	ASGPC-39	66.	Ram kali
7.	Kala jeevan	27.	Duleraj	47.	Bayasa bhog	67.	Tulsi bhog
8.	Lechimachi-A	28.	Hankesh	48.	Muni bhog	68.	Chhatri bhog
9.	Lechi machi-B	29.	Latera	49.	Bikoni	69.	Mahun bhog
10.	Pimpudi basa	30.	Dulharia	50.	Uraibutta	70.	Raj bhog
11.	Karpura kranti	31.	Lalmati	51.	Chebdrachhal	71.	Kubri mohar
12.	Thakurana	32	Basmati B	52.	Chitra sing	72.	Lokti musi
13.	Chhabiswa	33.	Lalkahwa	53.	Duban mua	73.	Tenduphll
14.	Kheerasai	34.	Malaysia	54.	Dud gaya	74.	South
15.	IGSR-3-1-2A	35.	Sabarmati	55.	Dudgi	75.	Type 3
16.	IGSR-3-1-1	36.	Badasha pasand	56.	Dudh nag	76.	Basmati 370
17.	IGSR-3-1-5	37.	Ram dhuri	57.	Dudh raj	77.	Yamini
18.	IGSR-3-1-40	38.	Kalanamak-1	58.	Dudi kanth	78.	Taroari Basmati
19.	IGSR-2-1-6	39.	Kalanamak-2	59.	Ganjo	79.	Pusa Basmati 1
20.	NDR IRRI 67	40.	Kalanamak-3	60.	Garra kat	80.	Vasumati

Results and Discussion

Analysis of variance for grain yield and other characters revealed that the genotypes differed significantly, including the presence of enormous variability among them for the characters studied. The estimates of GCV for all the characters were smaller than that of PCV, indicating influence of environment on the traits (Table 2). However relatively smaller differences between GCV and PCV for 50% flowering, days to maturity, plant height, Panicle length, number of panicle per hill, number of total spikelet per panicle, number of fertile spikelet per panicle indicated that these were mostly governed by the genetic factors. Environmental effects strongly influence spikelet sterility (%), test weight and grain yield as evident from a larger difference between the GCV and PCV. Estimates of genotypic coefficient of variation were high for number of fertile spikelet per panicle, number of total spikelet per panicle, number of panicle per hill and grain yield confirming the earlier reports (Singh *et al* 1980 and Sharma 1998) [10, 9]. This finding supported the possibility of yield improvement through selection for these characters.

Heritability is a measure of the extent of the extent of phenotypic variation caused by the gene action. High heritability combined with high genetic advance is desirable for selection-based genetic improvement of a character (Johnson *et al.* (1955) [8]. In the present investigation, high heritability coupled with high genetic advance for days to 50% flowering, plant height, number of panicle per hill, number of total spikelet per panicle and number of fertile spikelets per panicle indicated that these characters were predominantly governed by additive gene action. This result was in close agreement with the findings of Verma *et al.* (2000) [12]. These characters could be improved through mass selection and other breeding methods based on progeny testing. High heritability associated with moderate to low genetic advance was observed for days to maturity, panicle length, test weight and grain yield suggesting the greater role of non- additive gene action in their inheritance. Similar results panicle length and test weight were reported earlier (Chakraborty *et al*. 1994 and Das *et al*. 2001) [3, 4]. The results indicated that heterosis breeding can be used in breeding programme in order to create a wide range of genetic variability for yield enhancement in aromatic rice.

Table 2: Mean, range, standard error (SE), F value, Coefficient of variation (cv) and heritability of different characters

Characters	Mean	SE	Range		CV (%)	F value	Heritability (bs)	GA (%)	GCV	PCV
			Min.	Max.						
Days to50% flowering	109.09	2.278	74.30 *(31)*	128.30 *(58)*	2.088	87.603	0.977	27.984	13.74	13.89
Days to maturity	135.85	2.269	104.00 *(31)*	153.00 *(58)*	1.670	64.183	0.969	19.037	9.38	9.534
Plant height (cm)	135.23	8.734	47.95 *(15)*	169.00 *(29)*	6.459	8.736	0.795	23.326	12.70	14.251
Panicle length (cm)	25.11	1.215	20.50 *(59)*	33.00 *(6)*	4.837	8.268	0.784	16.822	9.22	10.413
Panicle number/hill	8.983	1.158	6.00 *(72)*	16.00 *(31)*	12.887	4.616	0.644	28.644	17.32	21.595
Total spikelets/panicle	193.73	10.799	57.50 *(78)*	327.00 *(46)*	5.574	43.722	0.955	51.871	25.76	26.359
Fertile spikelets/panicle	153.65	19.924	40.00 *(40)*	314.00 *(46)*	12.967	10.745	0.830	53.709	28.62	31.423
Panicle sterility (%)	22.12	8.481	5.30 *(24)*	72.00 *(54)*	38.339	4.769	0.653	87.635	52.63	65.115
Test weight (g)	17.01	6.463	9.22 *(17)*	28.43 *(74)*	37.997	1.660	0.248	22.407	21.83	43.822
Grain yield (q/ha)	10.6	3.600	4.60 *(33)*	24.67 *(14)*	34.2	1.5	0.2	18.3	18.60	39.00

*Values in brackets are the serial no. from Table 1

Conclusion

The genetic diversity maintained in a species is considered as a function of its ecological and evolutionary history (Hamrick and Godt 1996) [5]. The high genetic diversity among rice landraces and cultivars have been described in relation to agro-morphological traits (Singh and Singh 2009; Borkakati *et al.* 2000; Jegadeeswaran *et al.* 2014) [1, 6]. The high genetic diversity among rice varieties in India is due to combined effect of wide eco-geographical conditions, diverse agro-ecosystems associated with various rice farming practices and diverse human cultural preferences (Jegadeeswaran *et al.* 2017) [7].

In the present study nature and magnitude of genetic variability, interrelationship and co-heritability were analysed

for different yield and their components traits in eighty aromatic rice germplasm during WS 2014. High genetic coefficient of variation and high phenotypic coefficient of variation with high to moderate values of heritability and high genetic advance expressed as percent of mean was observed for panicle number per hill, number of spikelet per panicle, number of fertile spikelet per panicle and panicle sterility and test weight. High heritability and high genetic advance indicates heritability is due to additive gene effects and selection may be effective for related characters (Shivani and Sreerama Reddy, 2000).

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