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Studies on variability parameters for aromatic rice varieties of Chhattisgarh

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Abstract
Twenty (20) aromatic traditional rice varieties of Chhattisgarh with three checks (CG Devbhog, Dubraj Selection 1 and Pusa RH 10.) were evaluated for variability among yield and yield contributing traits in rice at Raipur (C.G.). Analyses of variance indicated that the mean sum of squares due to genotypes was found to be significant for all the traits. The highest GCV was recorded for sterile spikelets/panicle (38.70) followed by pollen fertility (%) (36.82), grain yield (g) (36.45) and biological yield (25.53).
The highest PCV was recorded for sterile spikelets/panicle (38.88) followed by pollen fertility (%) (36.83), grain yield (g) (36.49) and biological yield (25.58). The magnitude of PCV was higher than the corresponding GCV for all the traits. The significant genetic variability in any breeding material is a prerequisite as it does not only provide a basis for selection but also provide some valuable information regarding selection of diverse parents for use in hybridization programme.

Keywords: Aromatic rice varities, variability parameters

Introduction
Rice (*Oryza sativa* L.) is a major staple food and a mainstay for the rural population and their food security. It is second most cultivated cereal crop worldwide and is central to the lives of billions of people around the world (Nguyen and Ferrero, 2006) [1]. Rice belongs to the grass family or poaceae with chromosome number 2n=24. The cultivated rice belongs to genus *Oryza*. It has two cultivated (*Oryza sativa* and *Oryza glaberrima*) and twenty two wild species. Among the wild species, nine are tetraploid and the rest are diploid. Rice is a unique cereal crop in terms of its involvement with humans and dates back to 10,000 years of domestication. It is the main source of food for more than half of the globe. Asia is considered as the 'Rice Basket' of the world as it is a region with high population density and more than 90 percent of rice is being produced and consumed in Asia. Rice is also a very important crop of Indian agriculture and economy. India is known to produce some of the best quality rices around the world.

Chhattisgarh is well known for its rice diversity. The state harbours wild relatives, landraces, farmer's varieties and aromatic as well as non aromatic cultivated species Aromatic rice constitutes a small and special group of rices that regarded as best in quality and usually used in preparation of special dishes. Chhattisgarh is very popular for more than 100 traditional short slender aromatic rices, each having a unique defined aromatic variety in earlier days. It was prominently grown by the farmers of different region and they gave unique identity to that region by the name of that rice like, Vishnubhog, Jeeraphool, Shyamjeera, Bisni, Badshahbhog etc. (Patel *et al.,* 2015) [6]. Very few farmers are cultivating these varieties for their consumption, but these are in much demand by consumers. The drawback with aromatic varieties has always been that these are traditionally tall and have poor yield potential are confined to their native area of cultivation and fetch very high price in the domestic market. Therefore, for increasing the yield potential of these varieties, exploitation of hybrid technology is one of the best options. Use of cytoplasmic male sterility has achieved break-through in hybrid rice production in present era.

Materials and Methods
The material comprised of 20 aromatic rice varities of Chhattisgarh namely, Kalajeera, Tilkasturi, Dhaniyaphool, Kasturobhog, Indrabhes Dubraj, Chinnor, Tulsimogra, Kalikamod,

Ramjeera, Dhaniyadhan, Basabhog, Samundchini, Kalimuch, Jawaphool, Tarunbhog, Nagridubraj, Jaophool, Dagrikajar, Tulsibhog and Barhasal. Along with three checks CG Devbhog, Dubraj Selection 1 and Pusa RH 10.

The experiment was laid out in a randomized block design with two replications during *Kharif* 2018-19. The recommended packages of practices were followed for raising a healthy crop and all necessary plant protection measures were taken to control the pest and diseases. Observations were recorded on five randomly selected plants in both the replications for days to 50% flowering, plant height, number of tillers per plant, productive tillers per plant, panicle length, number of spikelet per panicle, number of fertile spikelet per panicle, number of sterile spikelet per panicle, pollen fertility (%), spikelet fertility percentage (%), grain yield per plant, thousand seed weight, biological yield per plant and harvest index.

Results and Discussion

The purpose of the present investigation was to generate information on morphological traits, which can throw light on the chances of further improvement of these genotypes either through selection or through hybridization programme. Analysis of variance for 14 yield and yield attributing traits in rice has been given in Table 1. The table indicated that the mean sum of squares due to genotypes was found to be significant for all the. This indicates the presence of variability among aromatic rice genotypes for yield and its contributing traits.

Table 1: Analysis of variance for yield and yield contributing traits

S. No.	Source of variation	Df	Mean sum of squares													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Replication	1	3.60	0.23	0.03	0.06	0.01	114.79	0.43	101.13	0.97	0.18	1.48	0.23	0.06	0.04
2	Genotypes	25	67.67	220.14	4.18	2.95	1747.5	2665.31	362.15	2795.48	1414.84	5.72	911.34	241.91	17.57	12.72
3	Error	25	0.95	0.87	0.08	0.57	0.29	110.69	1.72	117.02	12.52	0.05	1.91	0.30	0.02	0.08

*- significant at 5% level of significance **- significant at 1% level of significance

1. Days to 50% Flowering 2. Plant height (cm) 3. No. of Tillers/plant 4. Productive tillers/plant 5. Pollen Fertility (%)
6. Fertile spikelets/Panicle 7. Sterile spikelets/panicle 8. Total Spikelets/Panicle 9. Spikelet Fertility (%) 10. Panicle Length(cm)
11. Biological Yield (g) 12. Grain Yield (g)/plant 13. Thousand seed weight (g) 14. Harvest index (%)

Estimation of genetic parameter of variation among genotypes: The different parameters of variability in terms of phenotypic coefficient of variance (PCV) and genotypic coefficient of variance (GCV) were estimated and categorized based on their magnitude as high (>20%), moderate (10-20%) and low (<10%) given by Johnson *et al.*, (1955).

The information based on the nature of extent of genetic variation for desirable traits in selection for improvement of the crop. The knowledge of genotypic and phenotypic coefficient of variation is being useful in designing selection criteria for variable population.

Genotypic & phenotypic coefficient of variation

Genotypic and phenotypic coefficients of variation of different characters are present in the table 2 and are discussed as under.

The highest GCV was recorded for sterile spikelets/panicle (38.70) followed by pollen fertility (%) (36.82), grain yield (g) (36.45) and biological yield (25.53). The highest PCV was recorded for sterile spikelets/panicle (38.88) followed by pollen fertility (%) (36.83), grain yield (g) (36.49) and biological yield (25.58).

The magnitude of PCV was higher than the corresponding GCV for all the traits. This might be due to the interaction of the genotypes with the environment to some degree or environmental factor influencing the expression of these traits. Close correspondence between phenotypic and genotypic coefficient of variation were also observed for most of the traits indicating sufficient variability among the traits is present among the genotype. Hence, there is ample scope for improvement of these traits

Table 2: Genetic parameters of variation among genotypes

S. No.	Parameters	Mean	Range		Critical	Coefficient of variation		H^2 (bs)%	Genetic advance as
	Characters		Min.	Max.	difference 5%	PCV	GCV		percent of mean
1	Days to 50% Flowering	105.01	91.60	113.90	2.01	5.57	5.50	97.2	11.17
2	Plant height (cm)	107.14	91.60	119.55	1.92	9.81	9.77	99.2	20.05
3	No. of Tillers	8.84	77.77	12.95	0.59	16.51	16.19	96.1	32.69
4	Productive tillers	7.92	6.60	10.60	0.49	15.42	15.12	96.1	30.55
5	Pollen Fertility (%)	80.25	6.05	97.05	1.12	36.83	36.83	99	75.86
6	Fertile spikelets/Panicle	214.33	0.13	279.85	21.67	17.38	16.67	92.02	32.95
7	Sterile spikelets/panicle	34.69	168.70	75.95	2.7	38.88	38.70	99	79.34
8	Total Spikelets/Panicle	249.02	16.40	319.41	22.28	15.32	14.69	91.9	29.03
9	Spikelet Fertility (%)	85.99	194.75	92.42	1.46	6.21	6.15	98.2	12.57
10	Panicle Length(cm)	26.30	70.41	29.15	0.48	6.46	6.40	98.1	13.06
11	Biological Yield (g)	83.52	22.81	137.46	2.84	25.58	25.53	99	52.48
12	Grain Yield (g)/plant	30.15	55.62	55.72	1.13	36.49	36.45	99	75.00
13	Thousand seed weight (g)	17.80	17.20	23.62	0.34	16.66	16.64	99	34.22
14	Harvest index (%)	26.03	10.54	31.06	0.6	9.71	9.65	98.6	19.74

Heritability

The nature and extent of inherent capacity of a genotype for a character is an important parameter that determines the extent of any crop species. Genetic improvement of any character is difficult without having sufficient heritability. Estimates of heritability give some idea about the gene action involved in the expression of various polygenic traits Heritability in broad sense was calculated for each of the yield contributing trait under study Among all the genotypes (including lines, testers and checks), the highest heritability was recorded for plant height (cm) (99.2%), followed by pollen fertility (%) (99%), sterile spikelets/panicle (99%), biological yield (g) (99%), grain yield (g) (99%) thousand seed weight (g) (99%), harvest index (%) (98.6%), spikelet fertility (%) (98.2%), panicle length (cm) (98.1%), days to 50% flowering (97.2%), numbers of tiller/plant (96.1%), productive tillers/plant (96.1%) and fertile spikelet/panicle (92.02%). The lowest value for heritability was observed for total spikelets/panicle (91.9%).

Genetic advance as percent of mean

Heritability estimates along with genetic advance as percent of mean are normally more useful in predicating the gain under selection than that heritability alone. However it is not necessary that a character showing high heritability will also exhibit high genetic

Advance (Johnson *et al.* 1955). The highest amount of genetic advance as percent of mean was observed for sterile spikelets/panicle (79.34), followed by total pollen fertility (%) (75.86), grain yield (g) (75.00), biological yield (g) (52.48), thousand seed

Weight (g) (34.22), fertile spikelet/panicle (32.95), numbers of tiller/plant (32.69), productive tillers/plant (30.55), total spikelets/panicle (29.03), plant height (cm) (20.05), Harvest index (%) (19.74), panicle length (cm) (13.06), spikelet fertility (%) (12.57) and the minimum value of genetic advance as percent of mean were seen for days to 50% flowering (11.17).

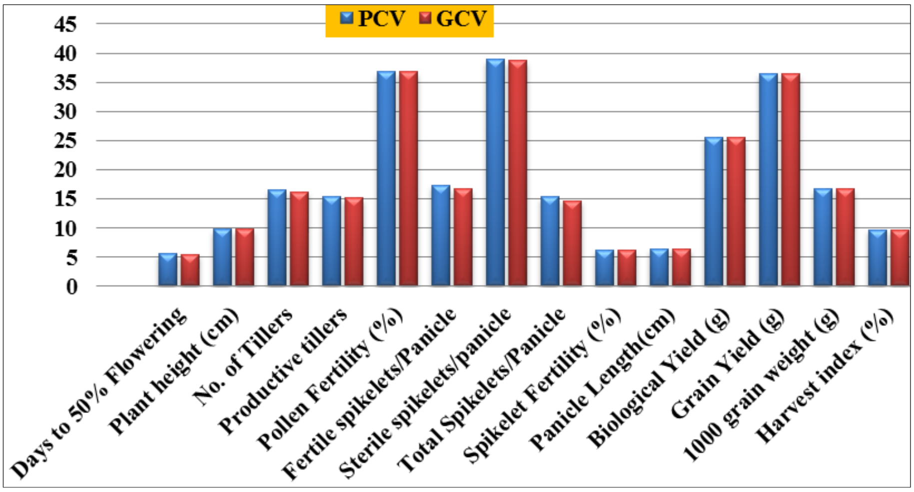

Fig 1: Graphical representation of PCV and GCV among parents

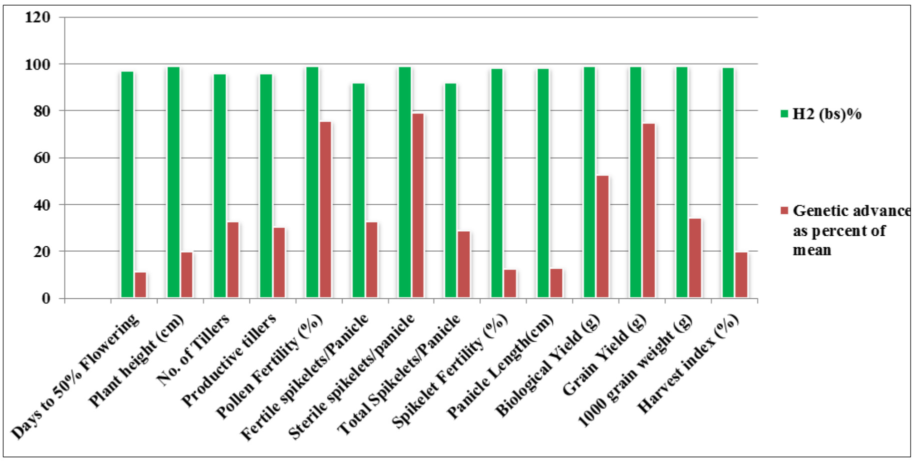

Fig 2: Graphical representation of heritability and genetic advance as percent of mean among parents

Conclusion

The significant genetic variability in any breeding material is a prerequisite as it does not only provide a basis for selection but also provide some valuable information regarding selection of diverse parents for use in hybridization programme. It was clear from the analysis of variance that variability existed among the genotypes taken under study. Significant amount of genetic variability was observed for most the quantitative traits. The significant genetic variability in any breeding material is a prerequisite as it does not only provide a basis for selection but also provide some valuable information regarding selection of diverse parents for use in hybridization programme.

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