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Genetic variability, heritability and genetic advance in aromatic lines of rice (*Oryza sativa* L.)

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Abstract
The forty five aromatic rice genotypes were used to study Genetic variability, heritability and genetic advance .The highest estimates of GCV and PCV was recorded for L:B ratio, 1000 grain weight and grain yield per plant. Moderate estimates of PCV and GCV values were recorded panicle length, number of tillers per sq.m., number of grains per panicle, straw yield per plant and harvest index. Almost all the characters showed high percentage of heritability. It indicate that character is least influenced by the environmental effect, suggesting scope for improvement of respective characters. The characters number of tillers per square meter, straw yield per plant, grain yield per plant showed high heritability accompanied with high genetic advance, it indicate that selection is effective for this character.

Keywords: genetic variability, heritability , genetic advance, aromatic rice ,*Oryza sativa* L.

Introduction
Plant breeding deals with the management and utilization of genetic variability. In a crop improvement programme, efficiency of selection of suitable parents depends on the amount of genetic variability present in a crop. The extent of variability in a crop population for a character is assessed by measuring genotypic and phenotypic coefficients of variation. The role of genetic factors in expression of phenotype is indicated by heritability. The expected genetic gain from selection in a population is calculated by working out the genetic advance.
Genetic variability is the pre requisite for any crop improvement programme. Improvement in any trait is solely depends on the amount of variability present in the base material of that trait. Knowledge of nature and magnitude of genetic variability helpful for planning the efficient breeding programme to improve the yield potential of genotypes and for the identification of high yielding genotypes which can be considered for release of commercial cultivars should be examined.
Heritability is the heritable portion of phenotypic variance. It is a good index of the transmission of the characters from parents to offspring. Genetic advance is also of considerable importance because it indicates the magnitude of the expected genetic gain from one cycle of selection.

Materials and Methods
The present investigation “Genetic diversity in Aromatic Lines of Rice (Oryza sativa L.)” was conducted at Agricultural Research Station, Vadgaon Maval, Pune during Kharif 2016. For the present study forty five genotypes of rice originating from different geographic regions and showing phenotypic variability for different agronomic and yield characters were used .Sowing of forty five genotypes of rice on nursery seed bed was completed on 16th June, 2016.and transplanting was done on 14th July 2016. The experiment was done by using randomized block design with three replications. All recommended agronomic practices such as weeding, fertilizer application were carried out as and when required. Observations on twelve quantitative characters viz, Days to 50 percent flowering (No.), Days to maturity (No.), Plant height (cm), Productive tillers per plant (No.), Number of tillers per sq. m. (No.), Panicle length (cm), Number of Grains per panicle (No.), , 1000 grain weight (g), Straw yield per plant (g), Length: Breadth ratio of grain, Harvest index (%) and Grain yield per plant (g) .The analysis of variance for the characters were studied as per procedure given by Pance and Sukhatme (1961) [6] and Singh and Chaudhari (1977) [10].

Results and Discussions

Variability parameters

The characters total number of productive tillers per plant, grain yield per plant, 1000 grain weight, length to breadth ratio showed higher estimates of GCV and PCV, indicating presence of large variation among the genotypes for these characters (Table-2). Therefore, simple selection can be practiced for further improvement of these characters. These results were in conformity with the finding of Kundu *et al*. (2008) [4], Padmaja *et al*. (2008) [7]. Umadevi *et al*. (2009) [12] and Devic *et al.* (2012) [2] and Sameera *et al*. (2015) [9].

The character plant height, productive tillers per square meter, grains per panicle, straw yield per plant and harvest index has recorded moderate range of phenotypic and genotypic coefficient of variation in the genotypes studied. Devic *et al.* (2012) [2] observed moderate GCV and PCV for these characters.

The characters Days to 50 percent flowering, Days to maturity and panicle length showed low genotypic and phenotypic coefficient of variation. It indicates that low range of variation found in these characters thus offers little scope for further improvement of these characters. Similar results was recorded by Lal and Chavan (2011) [5], Padmaja *et al.* (2008) [7] and Vange *et al*. (2008)

5.2.2 Heritability and genetic advance

Yield is a complex trait and depends on the component traits. Hence, the direct selection for yield alone limits the selection efficiency and ultimately results in limited success in yield improvement. Thus, the effective improvement in yield and quality may be brought about through selection of component traits. It is very difficult to judge whether observed variability is highly heritable or not. Moreover, knowledge of heritability is also essential for selection of component traits for yield improvement that indicates the extent of transmissibility of a character into future generations.

High heritability values recorded for all the characters. Days to 50 percent flowering, days to maturity, plant height , productive tillers per plant, number of tillers per sq. m, panicle length, size of grain, L: B ratio ,1000 grain weight, grain yield per plant, straw yield per plant, harvest index and grains per panicle indicating least influence of environment on these characters. These results were conformity with Umadevi *et al*. (2009) [12], Ghosh and Sharma (2012) [3], and Sameera *et al*. (2015) [9]

Heritability estimates along with genetic advance are normally more helpful in predicting the genetic gain under selection than heritability estimates alone because heritability estimates are generally influenced by the type of genetic material, sample size, method of sampling, conduct of experiment and effect of linkage. So, heritability values coupled with genetic advance would be more reliable and useful.

High heritability coupled with high genetic advance was recorded for plant height, grains per panicle, grain yield per plant and straw yield per plant, indicating that most likely the heritability is due to additive gene effects and selection may be effective for these characters. Similar results were observed by Padmaja *et al.* (2008) [7] and Patel *et al*. (2014) and Bhati *et al.* (2014).

High heritability coupled with moderate genetic advance found for the days to 50 percent flowering, days to maturity similar kind of result observed by Prajapati *et al.* (2011) [8]. High heritability and moderate genetic advance indicating that both additive and non-additive gene effects were involved in the genetic control

Estimates of variability for grain yield and components revealed that both genotypic coefficient of variation and phenotypic coefficient of variation were recorded high for productive tillers per plant, grain yield per plant , 1000 grain weight and length to breadth ratio. Moderate estimates of PCV and GCV values were recorded panicle length, number of tillers per sq.m., number of grains per panicle, straw yield per plant and harvest index. The character days to 50 percent flowering, days to maturity and panicle length registered low estimates of PCV and GCV indicating the low range of variation found in these characters in the present experimental material.

Almost all the characters showed high percentage of heritability. It indicates that character is least influenced by the environmental effect, suggesting scope for improvement of respective characters.

The productive tillers per square meter showed the highest genetic advance followed by number of grains per panicle, plant height, straw yield per plant, it indicates character is governed by additive gene action and for these characters selection will be effective.

The estimate of genetic parameters for yield components revealed that high heritability coupled with high genetic advance recorded for number of tillers per sq.m., number of grains per panicle, plant height and straw yield per plant.

Table 1: Analysis of variance for 12 characters in rice

Sr. No	Characters	MSS	
		Treatment (d. f. :44)	Error (d. f. :88)
1	Days to 50% Flowering (No.)	75.75**	0.90
2	Days to Maturity (No.)	90.53**	1.59
3	Plant height (cm.)	611.35**	4.23
4	Productive tillers/ plant (No.)	20.62**	10.53
5	Number of tillers per Sq. m.	8815.90**	341.18
6	Panicle length (cm.)	7.96**	0.81
7	No. of gains per panicle (No.)	1163.58**	197.65
8	Grain yield per plant (g)	424.53**	8.40
9	1000 Grain weight (g)	77.36**	0.14
10	Straw yield per plant (g)	518.24**	7.74
11	L:B Ratio	1.42**	0.003
12	Harvest Index	0.037**	0.001

Table 2: Variability in 45 genotypes of rice

Sr. No.	Character	Range	Mean	Coefficients of variation		Heritability % (B. S.)	Genetic advance
				G.C.V	P.C.V		
1.	Days to 50% Flowering (No.)	82.33-104.00	94.66	5.28	5.37	96.50	10.11
2.	Days to Maturity (No.)	113.67-135.67	126.45	4.31	4.42	94.90	10.93
3.	Plant height (cm.)	83.67-129.73	94.69	15.02	15.18	98.00	29.00
4.	Productive tillers/ plant (No.)	10.27-27.47	13.90	13.19	26.81	24.20	1.86
5.	Number of tillers per Sq. m.	342.33-553.33	454.18	11.70	12.39	89.20	103.42
6.	Panicle length (cm.)	16.93-24.93	19.70	7.84	9.08	74.50	2.75
7.	No. of grains per panicle	110.97-245.43	160.42	11.18	14.21	62.00	29.09
8.	Grain yield per plant (g.)	33.07-76.20	56.23	20.94	21.57	94.30	23.55
9.	1000 Grain weight (g.)	10.06-31.43	21.31	23.81	23.87	99.40	10.42
10.	Straw yield per plant (g.)	53.00-102.00	72.25	18.06	18.46	95.60	26.28
11.	L:B Ratio	1.19-4.10	2.82	24.37	24.47	99.20	1.41
12.	Harvest Index	43.67-93.67	0.77	13.93	15.03	86.00	0.21

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