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Genetic evaluation of aromatic short grain rice genotypes (*Oryza sativa* L.)

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Abstract
Rice (*Oryza sativa* L.) is an important cereal crop of India. Rice is the main staple food of Chhattisgarh and the region predominates with diverse genotypes of rice under cultivation. The rice bowl of India is the Chhattisgarh state conserves the vast genetic diversity of rice in all the three climatic zones of the state. The present consumer liking is getting oriented towards the pleasant aromas of rice along with the good eat ability this shift in market demand improved the scope for rice breeding for aromatic purpose. The aromatic rice fetches high price in the market along with their cooking and milling quality. Keeping in mind a study was conducted for the comparative performance of elite lines under Initial varietal Trial – 1-Aromatic Short Grain trial for yield and quality aspects at Bilaspur District of Chhattisgarh on Kharif 2015. The present study was carried out on aromatic short grain rice genotypes tested under (IVT-1-ASG) consisting of total 26 entries along with five checks Shobhni, (NC), Local check (Vishnubhog), Ketekejoha (QC), Badshahbhog (ZC), Dubraj (QC)).

The trial was conducted at Barrister Thakur Chhedilal College of Agriculture and Research Station, Sarkanda (IGKV Raipur), Bilaspur, Chhattisgarh in Randomized Block Design with two replications in Kharif 2015. The entries were tested in plot size of 11.40 sq/m with the nutrient application of 80 kg/ha Nitrogen, 50 kg/ha Phosphorous & 30 kg/ha potassium respectively. Thirty days old seedlings were transplanted by maintaining 15 cm plant-to-plant and 20cm row-to-row spacing. The findings revealed that in Kharif 2015 entries *viz.* ORJ-1142 (58.33 q/ha), SKL-022-40-32-11-43-43 (53.95 q/ha), HUR-155(51.32 q/ha) and HUR-156 (48.25 q/ha) are significantly superior over checks Shobhni (NC) (39.47 q/ha), Local check(Vishnubhog)(39.04 q/ha), Ketekejoha (QC)(27.63 q/ha), Badshahbhog (ZC)(27.63 q/ha) and Dubraj (QC) (18.83 q/ha). The significant superior entry ORJ-1142 (58.33 q/ha), shown percentage increase for yield over the checks Shobhni (NC) (47.78 %),Local check(Vishnubhog)(39.41%), Ketekejoha (QC)(111%), Badshahbhog (ZC)(111%) and Dubraj (QC) (209%). The significant superior entry SKL-022-40-32-11-43-43 (53.95 q/ha),shown percentage increase for yield over the checks Shobhni (NC) (38.68 %), Local check(Vishnubhog)(38.39%), Ketekejoha (QC)(95.25%), Badshahbhog (ZC)(95.25%) and Dubraj (QC) (186%). The significant superior entry HUR-155(51.32 q/ha), shown percentage increase for yield over the checks Shobhni (NC) (30.02 %),Local check(Vishnubhog)(31.45%), Ketekejoha (QC)(85.74%), Badshahbhog (ZC)(85.74%) and Dubraj (QC) (172%). The significant superior entry HUR-156 (48.25 q/ha),shown percentage increase for yield over the checks Shobhni (NC) (22.24 %),Local check(Vishnubhog)(23.59%), Ketekejoha (QC)(74.62%), Badshahbhog (ZC)(74.62%) and Dubraj (QC) (156%). The GCV & PCV of characters indicates moderate for flowering, plant height, panicle length,filled grain, 1000 grain weight and plot yield, while maturity and tillers recorded the lowest GCV and PCV. The heritability estimates high range for flowering, maturity, plant height, panicle length, filled grain, 1000 grain weight and plot yield, while tillers recorded the lowest heritability.

Keywords: Evolution, Genotype GCV, PCV, Aromatic and Genetic

Introduction
Rice is an important cereal crop of India. It is a lifeline crop for a large segment of the world's population, more than 91% of world's rice is produced in Asia and provides 20% of the per capita energy and 13% of the per capita protein worldwide. However, in Asia rice contributes about 35% of the energy and 28% of the protein. In India it plays an integral role for 65 per cent population, food security, income generation, employments and foreign currencies gains

for the nation. Population explosion increases the rice requirement by 2025 and is estimated to be around 1.3×10^{10} tons (Anonymous 2010) [1]. Hence it is very crucial to develop high yielding varieties. It is cultivated on foot hills of the Himalaya in the North Western parts of Indian sub-continent comprising the states of Haryana, Punjab, Uttaranchal, Uttar Pradesh, Himachal Pradesh and Delhi. On the central portion Madhya Pradesh and Chhattisgarh are the main producers. The state production data for the year 2015-16, indicates that it was grown on 38.22 lac hectares with the production of 4.80 million tonnes with 1322 kg/hectare productivity (CG Agri dept report). The national data for the same year indicates that it was grown on an area of 434.99 lac hectare with the total production of 110.15 million metric tons with the national average productivity of 2400 kg/hectare (ICAR Annual report 2017-18). In the state of Chhattisgarh Distt. Rajnandgaon was first in area and production followed by Distt.- Janjgir champa indicates its importance in the region. To overcome the aforesaid discussed constraints, it is important screen the genotypes promising for the Kharif season. Estimates of suitable genetic parameters such as critical difference, coefficient of variation, means are pre-requiste for screening of genotypic lines for making effective selections for higher yield and ancillary characters were made.

Materials and Methods

Geographically Bilaspur situated at the Plains of Chhattisgarh, in the humid sub-tropical climatic zone. This study was conducted on a loamy soil and sowing of nursery was done in the month of July 2012. Twenty six rice genotypes were tested under (IVT-1-ASG) trial consisting of total 26 entries along with five checks (Shobhni (NC), Local check (Vishnubhog), Ketekejoha (QC), Badshahbhog (ZC), Dubraj (QC)).

The trial was conducted at Barrister Thakur Chhedilal College of Agriculture and Research Station, Sarkanda (IGKV Raipur), Bilaspur, Chhattisgarh in Randomized Block Design with TWO replications in Kharif. The entries were tested in plot size of 11.40 sq/m with the nutrient application of 80 kg/ha Nitrogen, 50 kg/ha Phosphorous & 30 kg/ha potassium respectively. Thirty days old seedlings were transplanted by maintaining 15 cm plant-to-plant and 20cm row-to-row spacing.

Each entries and checks were grown in six rows of 9.50 metre in length and spaced 20cm apart. Distances between plants in rows were maintained at 15 cm by thinning. The observations were recorded on ten randomly selected plants from each entry for plant height (cm), days to 50% flowering, days to maturity, 1000-seed weight (g) and grain yield on q/ha. The statistical method used for analysis of variance for the replicated data was SPAR 2.0 for the RBD analysis and the interpretation of data done followed by (Sharma J.R., 1998) [11], (Panse & Sukhatme, 1985) [9] The significant values for the significant differences were calculated on the basis of difference brought from the calculated value and the table value obtained from the F table. Further CD and CV values are recorded to rank the genotypes on its performance basis. The estimates for variability treated as per the categorization proposed by (Siva Subramanian and Madhavamenon, 1973) [12], heritability estimates according to criteria proposed by (Johnson *et al.*1955) [6].

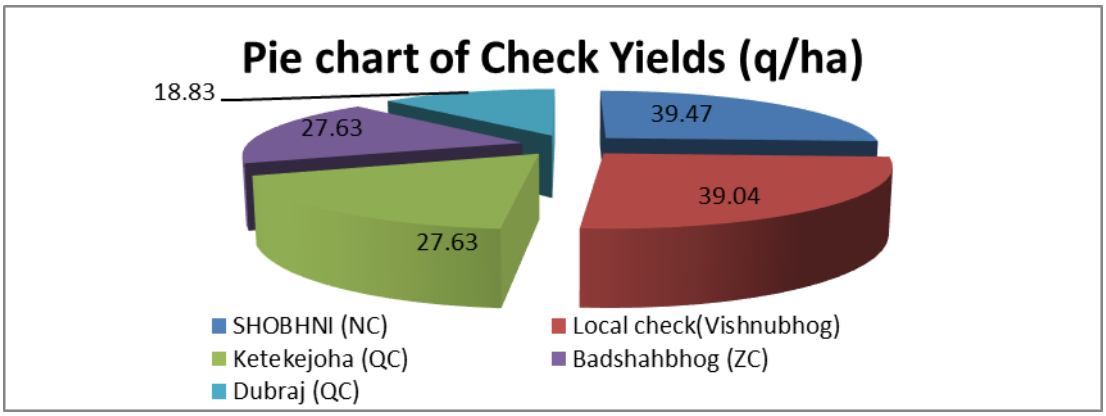
Result & Discussion

The data pertaining for yield and ancillary characters are given in **Table- 1**. Analysis of variance of replicated yield data indicates that F value for genotypes is significant revels the fact the significant differences exist among all the genotypes studied. However (critical difference) CD value and coefficient of variation valve CV % are calculated to rank the top yielders on their performance basis. Among the twenty six entries five of them are checks *viz.* Shobhni, (NC), Local check (Vishnubhog), Ketekejoha (QC), Badshahbhog (ZC), Dubraj (QC)). The comparision from CD value at 5 % level of significance (8.01) indicates that entries viz. ORJ-1142 (58.33 q/ha),SKL-022-40-32-11-43-43 (53.95 q/ha),HUR-155(51.32 q/ha) and HUR-156 (48.25 q/ha) are significantly superior over checks Shobhni (NC) (39.47 q/ha),Local check(Vishnubhog)(39.04 q/ha), Ketekejoha (QC)(27.63 q/ha), Badshahbhog (ZC)(27.63 q/ha) and Dubraj (QC) (18.83 q/ha). Data presented in Pie chart of check yield.

Table 1: Yield and ancillary data of IVT-1-ASG Trial kharif 2015

Genotypes	Days to Flowering	Days to Maturity	Plant Height (cm)	No. of Tillers	Panicle Length (cm)	Filled grains	Unfilled grains	1000 Grain Weight	Plot Yield (kg)	Yield q/ha
ORJ-1142	93	137	112.7	8	19.3	173	7	16.168	6.65	58.33
SKL-022-40-32-11-43-43	83	118	113.3	9	23.5	210	10	12.748	6.15	53.95
HUR-155	78	121	111.4	8	27.15	117	5	24.352	5.85	51.32
HUR-156	92	125	114.2	8	22	177	8	17.292	5.5	48.25
HUR-1308	88	123	123.8	6	25.2	171	9	18.172	5	43.86
SYE-381-19-46-15	115	146	111	8	20.8	175	7	12.168	4.85	42.54
Sharbati Selection-1	83	117	131.7	8	23.8	101	5	22.304	4.65	40.79
Pusa 1638-07-171-1-81-1-2	106	141	125	7	27.3	227	7	15.428	4.65	40.79
Shobhni (NC)	94	123	109.7	9	26	186	9	16.424	4.5	39.47
PUSA 1638-07-130-2-67-1-1	106	139	115.7	9	26.8	190	9	15.284	4.5	39.47
TTB-J-3-32-6	99	140	116.2	8	25.4	141	4	20.536	4.45	39.04
Local check(Vishnubhog)	111	146	148.6	8	23.9	183	8	13.148	4.45	39.04
RP-4926-358-127-83-24	94	129	109.9	7	21.7	206	14	16.78	4.35	38.16
R-2093-1536-1-660-1	74	111	100.1	8	25	120	6	23.412	4.3	37.72
RP-4993-300-22-18-5-8-1	97	129	93.5	7	22.8	192	9	14.988	4.25	37.28
RP-4926-318-119-65-	96	135	100.4	7	17.9	172	9	15.324	4.15	36.4

41-16										
TTB-J-3-35-1	100	142	120.7	8	26.2	175	9	15.624	4.15	36.4
CR3660-22-9-4	125	155	111.1	8	25.8	155	7	17.708	3.75	32.89
CR 2939-23-8-3	87	119	105.6	8	24.9	150	9	22.336	3.7	32.46
NDR 9939	117	152	146.2	7	26.6	165	11	15.536	3.55	31.14
TTB-J-4-2-2	104	144	144.1	7	29.9	162	8	17.492	3.5	30.7
CSAR 2012-10	101	138	155	7	27.6	150	7	21.32	3.4	29.82
Gandheswari	122	154	143.8	8	26.6	184	9	14.096	3.35	29.39
Ketekejoha (QC)	99	145	135.6	7	27.2	136	8	16.656	3.15	27.63
Badshahbhog (ZC)	118	151	157.9	7	23.4	186	7	11.992	3.15	27.63
Dubraj (QC)	111	149	141.9	6	22.4	170	9	18.836	5.25	18.83
Range minimum	78	111	93.5	6	17.9	101	5	11.992	3.15	18.83
Range maximum	125	155	157.9	9	29.9	227	14	24.352	6.65	58.33
CD 5%	5.35	3.66	9.59	1.84	3.38	35.53	2.75	0.18	1.20	8.01
CV %	2.60	1.31	3.78	11.96	6.68	10.27	16.91	0.50	13.17	13.17



Percent increase over checks

The significant superior entry ORJ-1142 (58.33 q/ha), shown percentage increase for yield (q/ha) over the checks Shobhni (NC) (47.78 %), Local check(Vishnubhog)(39.41%), Ketekejoha (QC)(111%), Badshahbhog (ZC)(111%) and Dubraj (QC) (209%) shown in Column diagram no.1.

The significant superior entry SKL-022-40-32-11-43-43 (53.95 q/ha),shown percentage increase for yield over the checks Shobhni (NC) (38.68 %),Local check(Vishnubhog)(38.39%), Ketekejoha (QC)(95.25%), Badshahbhog (ZC)(95.25%) and Dubraj (QC) (186%) shown in Column diagram no.2.

The significant superior entry HUR-155(51.32 q/ha), shown percentage increase for yield over the checks Shobhni (NC) (30.02 %), Local check(Vishnubhog)(31.45%), Ketekejoha (QC)(85.74%), Badshahbhog (ZC)(85.74%) and Dubraj (QC) (172%) shown in Column diagram no.3.

The significant superior entry HUR-156 (48.25 q/ha), shown percentage increase for yield over the checks Shobhni (NC) (22.24 %), Local check(Vishnubhog)(23.59%), Ketekejoha (QC)(74.62%), Badshahbhog (ZC)(74.62%) and Dubraj (QC) (156%) shown in Column diagram no.4.

Table 2: Variability, heritability and covariance for quantitative traits in rice Trial (IVT-1-ASG Kharif 2015)

Characters' Parameters	Days to Flowering	Days to Maturity	Plant Height (cm)	No. of Tillers	Panicle Length (cm)	Filled grains	Unfilled grains	1000 Grain Weight	Plot Yield (kg)
GCV	13.36	9.42	14.54	6.83	10.24	15.78	21.8	19.9	18.29
PCV	13.62	9.51	15.02	13.78	12.23	18.82	27.59	19.9	22.54
h2 (Broad)	96.34	98.11	93.66	24.6	70.19	70.26	62.45	99.94	65.85
Ge Cov	177.59	163.47	319.93	0.26	6.34	702.78	2.97	11.69	0.66
Ph Cov	13.62	9.51	15.02	13.78	12.23	18.82	27.59	19.9	22.54

GCV & PCV

The data pertaining for GCV & PCV are given in Table- 2. In the present study the high PCV recorded for plot yield (22.54). while moderate GCV and PCV recorded for flowering (13.36 & 13.62), plant height (14.54 & 15.02), panicle length (10.24 & 12.23), filled grains (15.78 & 18.82), 1000 grain wt. (19.90 & 19.90) and plot yield GCV (18.29). The low GCV and PCV was recorded for maturity (9.42 & 9.51) and tillers GCV (6.83). The results are in tune with (Ferdous, 2015) [2] for flowering and maturity, (Ferdous, 2015) [2], (Ketan & Sarkar, 2014) [7] for plant height, (Tuwar, *et al*., 2013) [13] for tillers, (Fukrei *et al*., 2011) [3] for filled grains

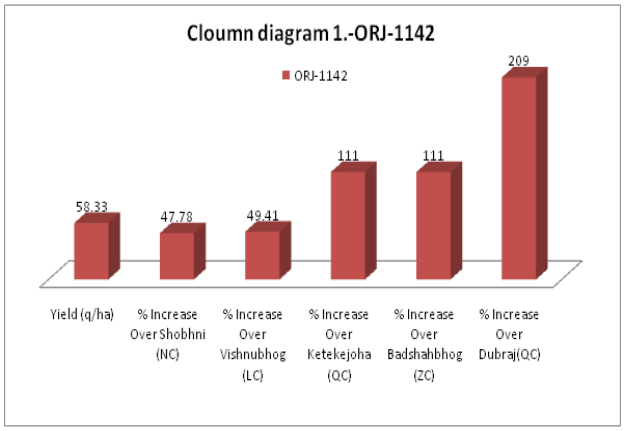
Heritability (h^2)

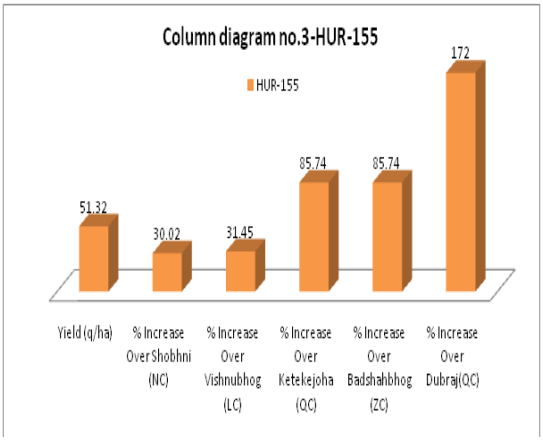
The data pertaining for heritability are given in Table-2. In the present study the high heritability was recorded for all the characters viz. flowering (96.34), maturity (98.11) plant height (93.66), panicle length (70.19), filled grains (70.26), 1000 grain wt. (99.94) and plot yield (65.85), while tillers have the lower heritability (24.60). The results are in tune with (Ferdous, 2015) [2] (Ketan & Sarkar, 2014) [7] and (Tuwar *et al*., 2013) [13] for all the characters.

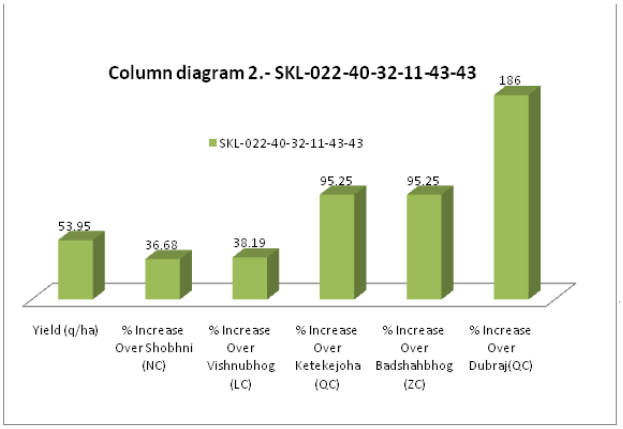
Plot yield

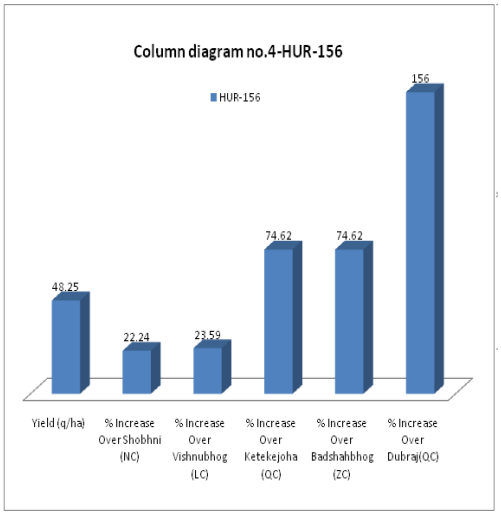
The pie chart of all 26 genotypes indicated in pie chart no. 2 for plot yield. The chart denotes that all the genotypes are producing at par yield for most of the genotypes except the

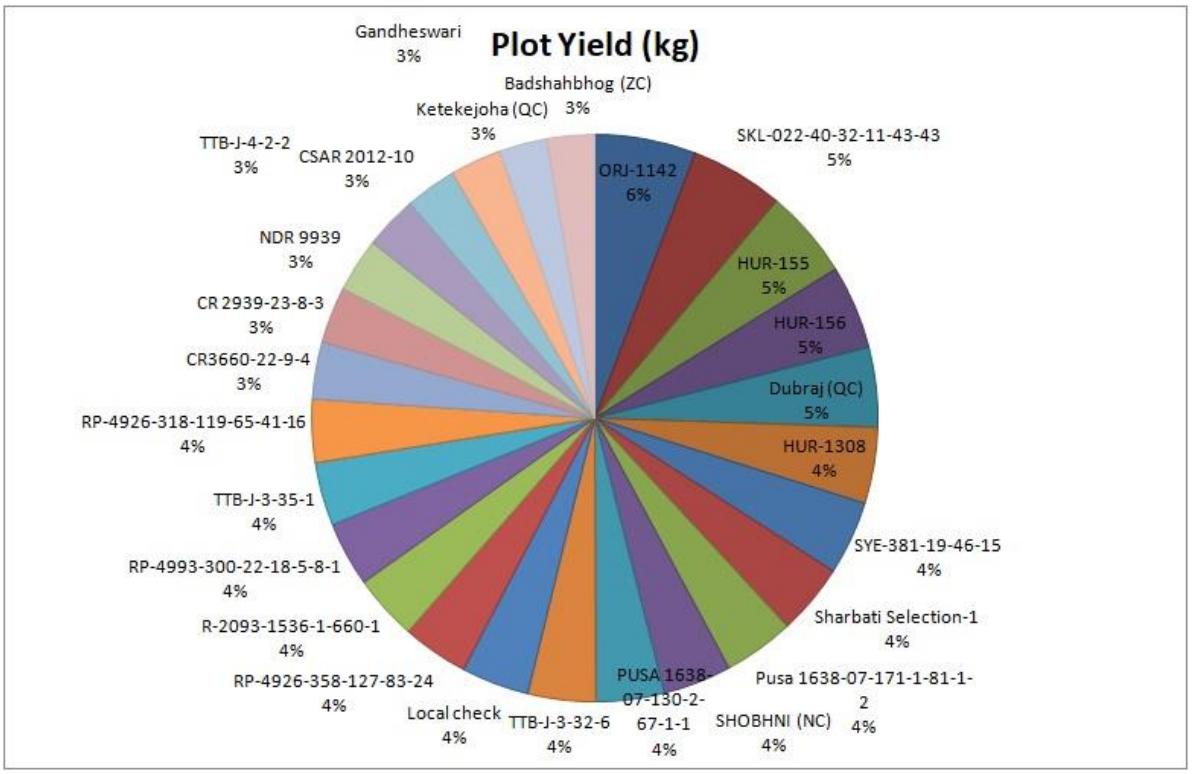
significant entries ones viz. viz. ORJ-1142 (58.33 q/ha), SKL-022-40-32-11-43-43 (53.95 q/ha), HUR-155(51.32 q/ha) and HUR-156 (48.25 q/ha).











Pie chart no 2: For plot yield

Conclusion

The above trial can be concluded that entries viz. ORJ-1142, SKL-022-40-32-11-43-43, HUR-155 and HUR-156 are significantly superior over all the national, zonal, local, and quality checks over yield hand hence recommended for the next phase of screening for varietal testing and release. The genetic parameter study also confirms that GCV, PCV and heritability also maintain the high range for the quantitative characters supports the same.

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