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Genetic diversity studies for yield and quality parameters in aromatic breeding lines of rice (*Oryza sativa* L.)

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Abstract
An experiment become performed to estimate the genetic range parameters for yield and high-quality developments in 67 aromatic breeding line rice. The inter cluster distance changed into most among cluster (29666.74) II and VII and that they show most range and crossing genotype display high hetrosis. The advanced high yielding fragrant traces with precise great developments may be without delay released as range after multiplication testing. The elite traces for aroma and yield may be used for development of breeding lines. Cluster I containing 15 genotypes exhibited maximum mean values (table 4. Eight) for plant peak (136. Fifty eight), filled spikelet in step with plant (126.31), extent enlargement (64) and Cluster II with 8 genotype had maximum imply values for cooking length (9.06), ASV value (five) even as cluster III thirteen containing genotype had maximum cluster imply values for powerful tiller consistent with plant (eighty two.49), milling % (sixty two. Sixty four) . Cluster IV containing highest 16 genotypes exhibited maximum imply values for panicle period (27.103). The genotype present in cluster V exhibited maximum values for gel consistency (65.72), harvest index (38. Seventy four), take a look at weight (26.17) and Cluster VI containing 7 genotype exhibited maximum suggest values for day of maturity (141.88), day of 50% flowering (111.05) hulling % (73.16). Final cluster VII containing 6 genotype exhibited highest imply values for spikelet consistent with plant (167.Ninety two) and flag leaf duration (58.32). R1624-sixty one-3-61-1, R1656-2151-1-412-1, Anterved, R1624-61-2-60-1, Jiradhan, are high yielding fragrant strains with true quality and that they may be applied in profitable breeding software and may be decided on for variety release after testing.

Keywords: Rice diversity, cluster, mean value

Introduction

Rice is the largest cereal crop within the global that gives more energy to hundreds of thousands of humans. Rice contributes approximately 45% of India's cereal manufacturing and is the main staple meals for greater than 60% of the U.S.A.'s population. Rice is a tropical plant it thrives in a hot and humid climate and is often grown in rain fed situation, masking each the highlands and the lowlands. Rice is cooked with the aid of boiling or eaten alone in a extensive range of soups, aspect dishes and plenty of different cuisines. Rice belongs to genus Oryza and cultivated species are *Oryza sativa* and *Oryza glaberrima* and 22 wild species however nearly all rice cultivated global belongs to *Oryza sativa* L. (Annual species), whereas the opposite species is a perennial one, i.E. *Oryza glaberrima*. The Asian cultivated rice (*Oryza sativa* L.) originated in south -East Asia.

Rice is grown in one of a kind nations like China, India, Thailand, Japan and so forth. China is principal grower of rice, after that India is the second largest producer U.S.A Rice is cultivated all over nations except Antarctica. In India, rice is in particular grown in all the states. "Rice is life" turned into the well-known theme of the international rice yr 2004, which denote its overwhelming importance as a food and exchange item. The call for for food in maximum components of worldwide will be double by using the 12 months 2025 and almost triple via 2050. India covers greater than 30% of general cultivated location and contributes extra than 40% of overall meals production. In India rice manufacturing for 2015-2016 quantities to 104.41 million tonnes, 2400 kg /hectare of productivity protecting an area of 434. Ninety nine lakh hectares. The vicinity decreased to 431. Ninety four lakh hectares in 2016-17 with an increase in 110.15 million heaps of production and 2550 kg /hectare of productiveness (Annual file 2017-18). India has 42.95 million ha acreage with 111.01 million tonnes of manufacturing (anonymous, 2018a) [2]. Chhattisgarh is known as "Indian rice bowl". The rice has big biodiversity in Chhattisgarh.

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The biodiversity serves as a supply and gives variety to wide variability. Chhattisgarh produces 6. Ninety one million heaps in 3.79 million ha of place (Nameless, 2018b) [10].

Earlier focus become laid on excessive yield and resistance to bugs /illnesses in the course of varietal production. However now in all rice developing nations, fine is the main breeding objective in the breeding programme. So the breeders are consciousness in satisfactory characters. Sobha *et al.* (2008) [9] studied the pleasant characters of 78 launched sorts for India. Rice types having excellent cooking, top look, true milling and eating parameters, may be taken into consideration a superior grain excellent rice variety which at once increases the full monetary value of rice. "Grain yield improvement is the high goal of plant breeders for numerous a long time but demand for correct high-quality rice is likewise expanded in contemporary decade as living preferred of people are being steadily advanced (Rathi *et al.*, 2010) [7]. In Chhattisgarh kingdom, extra than 23,250 rice germplasm have been conserved which has super variety for unique fine features *viz.*, precise cooking fine, aroma, grain kind and form, kernel color etc. Brief grain fragrant rice of Chhattisgarh is maximum famous because they're of advanced grain pleasant. Fragrant rice considered as an vital part among the sub- institution of rice having first-rate quality with a good deal higher price than excessive satisfactory non-fragrant rice in worldwide marketplace. It is recognised for its nut like aroma and taste because of the chemical compound 2-acetyl-1-pyrroline. Typically in India, the fragrant rice Basmati referred to as "Queen of fragrance" is famous for its fragrance and delicate flavour. It is a variety of long grain, slender shape, medium texture and less chalkiness (Kamath *et al.*, 2008) [4]. Other than basmati rice, many cultivars of aromatic brief medium grained rice is grown in particular region in the states which include Bihar, Orissa, Madhya Pradesh, West Bengal, Chhattisgarh, Uttar Pradesh and so forth. The aromatic pleasant of scented rice is a key aspect that increases the cost of rice at the international market (Naik *et al.*, 2006) [5]. The achievement of any varietal development programme depends on how tons genetic variation there is inside the programme. The life of variability is most large in any breeding programme for powerful choice. Seeking to the need of fragrant fine rice, the present have a look at became done.

Fabric and Methods
67 aromatic rice accessions together with five checks particularly Dubraj, Badshah bhog, Chhattisgarh Sugandhit Bhog, Chhattisgarh Devbhog, Indira Sugandhit Dhan. Throughout kharif (wet season) 2019, all the sixty seven fragrant rice accessions were raised following vital package and practices. In the end, aroma check through leaves had been performed wherein sixty seven fragrant genotypes and a couple of testers had been selected wherein one non-aromatic search turned into achieved for the analysis. The experiment changed into executed at studies cum academic Farm, branch of Genetics and Plant Breeding, university of Agriculture, Indira Gandhi Krishi Vishwavidalaya, Raipur, (C.G.), India and the excellent work done of exceptional lab, Dept. Of Genetics and Plant Breeding. The statistical analysis become carried out using OPSTAT and XLSTAT softwares.

Outcomes and Discussion
In the present have a look at, all of the 67 genotypes were grouped into seven clusters (figure 4.2 and desk four.6) gives an concept about the large quantity of genetic range in the material. Singh *et al.* (2009) [11] reported "non-parallelism among geographic and genetic diversity was determined within the cluster patterns of the genotypes." The maximum wide variety of genotypes become discovered in cluster IV containing sixteen genotypes, observed by cluster I containing 15 genotype, cluster III 13 genotype, cluster II eight genotype, cluster VI 7 genotype, cluster VII 6 genotype, cluster five passing 2 genotype (table 1).

A extensive version among cluster imply values become found for all of the characters under study. Cluster I containing 15 genotypes exhibited maximum imply values (table 3) for plant top (136.Fifty eight), stuffed spikelet per plant (126.31), had rice recovery (59.15), extent enlargement (sixty four) and total tiller per plant (eight.10). Cluster II with 8 genotype had highest imply values for cooking duration (nine.06), ASV price (5), grain width (3.85), (3.53 kernel width), L/B ratio (3.3076) and amylase content (1.39) at the same time as cluster III 13 containing genotype had highest cluster mean values for powerful tiller in keeping with plant (eighty two.49), milling % (sixty two.64) and spikelet fertility % (6.89). Cluster IV containing maximum 16 genotypes exhibited highest imply values for panicle length (27.103). The genotype found in cluster V exhibited highest values for gel consistency (65.72), harvest index (38.74), check weight (26.17) and grain yield in keeping with plant (19.93). Cluster VI containing 7 genotype exhibited highest mean values for day of maturity (141.88), day of 50% flowering (111.05), hulling % (73.16), grain period (nine.Fifty two), kernel duration (8.61) and cooking width (5.73). Ultimate cluster VII containing 6 genotype exhibited maximum mean values for spikelet consistent with plant (167.92) and flag leaf length (58.32).

The cluster analysis helps to determine the genetic distance among the genotypes. This is the pre-requisite for deciding any plant breeding programme. When there is high inter cluster distance between two cluster shows more diversity and crossing of these genotypes give better heterotic combination .When high intra cluster of two different cluster show low diversity and selection will be rewarding. To realize greater variability and strong heterotic cause, parents should be choosen from two different clusters having broader inter cluster distance. The findings of the study are in agreement to the observations of Sarawgi *et al.* (2000) [12], Naik *et al.* (2006) [5], Pandey *et al.* (2009) [6], Kiani (2013) [13], Anjali *et al.* (2014) [1], Sowmiya and Venkatesan (2017) [14] and Shivani *et al.* (2018) [8].

Table 1: Clustering patterns of 67 rice genotypes.

Cluster number	Number of genotypes	Name of genotypes
1	15	R2054-685-1-205-1, R1624-61-1-59-1, R1896-82-1-60-1, Chinnor, Maidubraj, C G sugandhit bhog (c), Badsah bhog (c), Dubraj, Banspatri, Kalikamod,chhatri, Kubrimohar, C G Sugandhit bhog, Dubraj, Indira Sugandhit dhan-1(c)
2	8	R1919-537-1-160-1, R1915-115-1-88-1, R2281-308-1-185-1, R2282-552-1-309-1, Kadamphool, loktimachhi, kasturi, R2054-147-3-105-1
3	13	R1624-61-3-61-1, R5024-147-1-103-1, R2054-147-2-104-1, R2032-87-1-23-1, R2155-266-2-156-1, Anterved, C G Devbhog, R2369-483-1-259-1, R2400-562-1-339-1, R2400-562-2-340-1, R2369-480-1-257-1, R2369-481-1-258-1, R2369-479-1-256-1
4	16	R1656-2151-412-1, Tulsimanjari, Atmashital, Javaphool, JDP-GB-38, RGT-264, RGL-910, Jiradhan, Maharaji, Jaigundi, Lohandi, Chhatri, Jatashankar, Lahsunbhog, Bhaisa poonchi, Badshah bhog (c).
5	2	CG Devbhog (c), R1624-61-2-60-1
6	7	RGM-504,Chinikapoor,Shamjira, Dhawara sawa, R2369-475-1-251-1, R2369-475-2-252-1, R2369-478-1-255-1
7	6	Indira Sugandhit Dhan-1 (C), Fundri, Kerghul, Shrikamal, Tilkasturi, Bagmuchh

Table 2: Estimates of intra (diagonal and bold) inter cluster distance among 7 clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
Cluster 1	2619.72	16159.51	6724.15	7725.76	5899.77	7289.18	6355.75
Cluster 2		6204.92	7472.82	8664.76	8831.1597	10694.21	29666.74
Cluster 3			2243.02	5692.26	5137.8980	5330.34	16448.44
Cluster 4				3413.68	6668.2906	6298.86	16277.10
Cluster 5					1858.6572	7656.67	13625.31
Cluster 6						3090.33	1423.68
Cluster 7							5407.37

Table 3: Cluster Means for 27 yield and quality related characters

Class	C1	C2	C3	C4	C5	C6	C7
PH	136.58	134.48	128.62	132.00	128.45	131.53	134.32
PL	25.67	25.63	26.04	27.10	25.76	24.96	27.03
FLL	54.5	51.19	54.09	43.31	47.96	54.1	58.33
TTPP	8.11	7.58	8.025	7.59	7.97	7.86	7.71
ETPP	6.85	6.75	6.89	6.87	6.63	6.88	6.87
SPP	163.84	142.40	147.62	150.62	156.32	161.97	167.92
FSPP	126.31	111	122.11	122.75	119.09	118.46	125.18
SF%	78.02	74.35	82.49	81.07	76.03	73.30	74.33
DYFF	109.3	103.18	106.2	108.95	109.22	111.06	110.44
DYM	138.4	130.95	134.95	137.8	139.11	141.89	140.06
TW	24.60	23.02	23.96	25.38	26.17	23.50	25.03
GYPP	17.70	18.50	16.915	17.03	19.94	16.67	18.51
GL	8.49	8.48	9.05	8.76	8.98	9.53	8.25
GW	3.34	3.86	3.51	3.31	3.32	3.41	3.36
KL	7.65	7.72	8.115	8.1	7.98	8.61	7.28
KW	2.98	3.53	3.04	2.97	2.92	2.87	3
L:B	2.58	3.31	2.70	2.76	2.76	3.02	2.43
H%	70.01	64.56	72.21	72.35	70.01	73.17	70.83
M%	63.11	54.0	62.6	60.86	59.86	60.85	62.04
ASV	3.85	5	4.2	4.35	3.56	3.94	4.33
GC	58.5	64.18	61.2	62.15	65.72	47.44	56
VE	64	61	63.6	62.9	62.28	59.82	63.06
AC	0.26	1.40	0.26	0.28	0.29	0.26	0.21
CL	8.32	9.06	8.22	8.1	8.57	8.82	8.03
CW	3.87	4.80	3.59	3.59	3.98	5.73	3.64
HI	37.64	37.40	36.64	38.42	38.74	36.25	38.58
HRR	59.15	54.86	55.97	57.00	54.62	55.29	58.76

PH = Plant height, PL= Panicle length, FLL= Flag leaf length, TTPP= Total tiller per plant, ETTP= effective tiller per plant, SSP= spikelet per plant, FSPP= Filled spikelet per plant, SF% = Spikelet fertility %, DYFF= Day to 50% flowering, DTM= Day to maturity, TW = test weight, GYPP= Grain yield per plant, GL= grain length, GW= Grain width, KL = Kernel length, KW= Kernel width, L:B ratio = Length breadth ratio, ASV= Alkali spreading value, GC= Gel consistency, VE= Volume expansion, AC= Amlose content, KL= Kernel length, KW= Kernel width, HI =harvest index, HRR= head rice recovery.
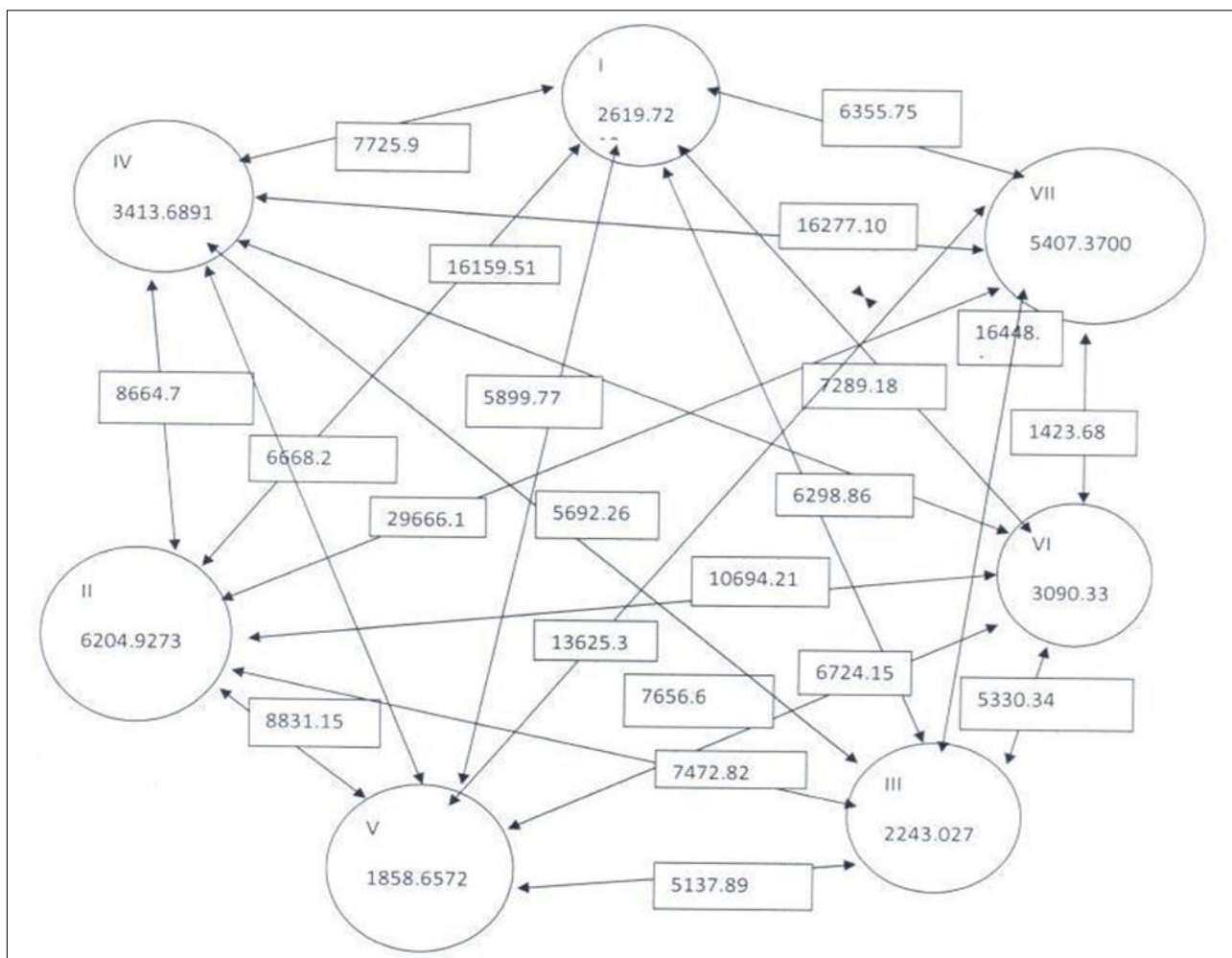
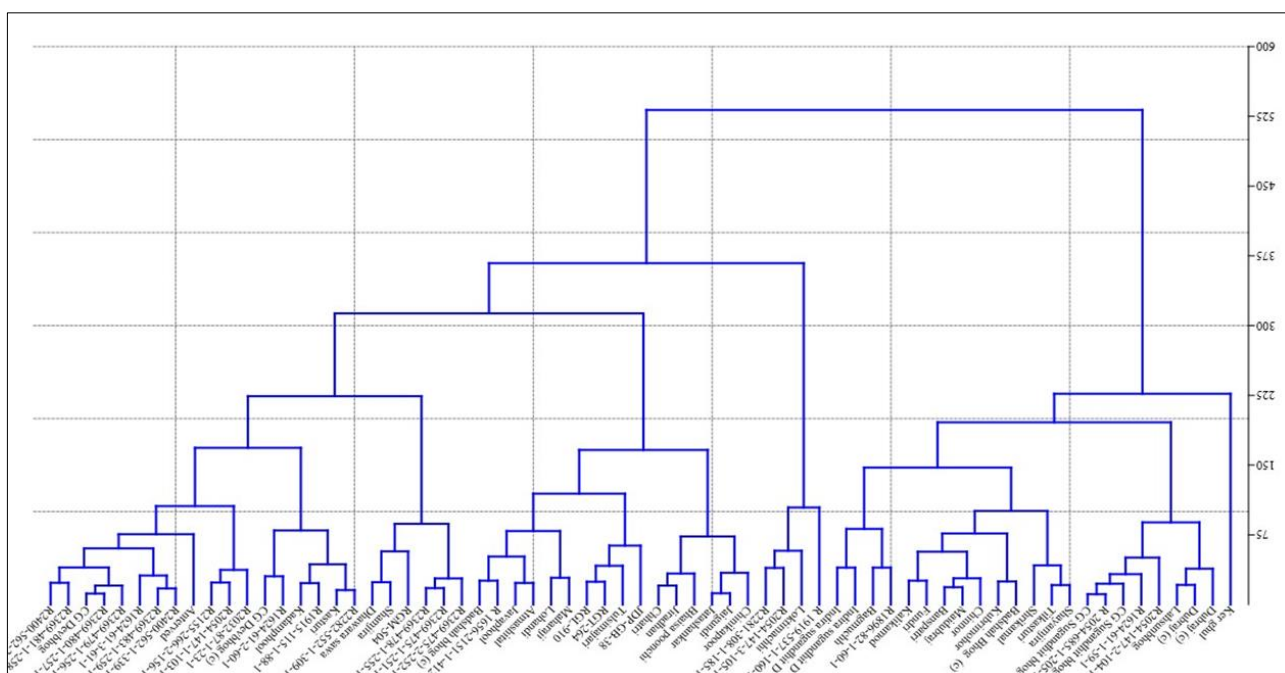**Fig 1:** Cluster diagram with inter and intra cluster distance

Fig 2: Dendrogram using Agglomerative Clustering Method

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