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RESEARCH ARTICLE

# Agro-morphological characterization of rice germplasm of Chhattisgarh

■ **RUPLATA GUPTA, SANGEETA TETWAR AND SUNIL KUMAR NAIR**

## SUMMARY

Germplasm can serve as a good source of resistance against biotic and abiotic stresses like drought and insect pest and diseases but they are often inferior to commercial cultivars because of several agronomically undesirable features such as poor plant type, spreading habit, high grain shattering, long awns, purple pericarp and/or red kernel and low yield. The amount of genetic variation in germplasm accessions and genetic relationships between genotypes are important considerations for designing effective breeding programs. The present studies were carried out to characterize fifty three rice accessions from IGKV, Raipur, Chhattisgarh germplasm. These germplasm accessions were evaluated for fourteen morphological and seventeen agronomical characters. The specific genotypes S: 663, K: 1514, J: 311 were identified for agronomical characteristics. These may be used in hybridization programme to achieve desired segregants for higher yield.

**Key Words :** Morphological and agronomical charaters, Germplasm, Variation

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Rice (*Oryza sativa* L.) belonging to family Poaceae is one of the world's most important food crops. It is grown in 115 countries in different parts of the world and provides staple food to more than half of the world's population. India has largest area under rice in the world and ranks second in production next to China.

The cultivated rice of Asia is supposed to have originated in the South and/ or South East Asia. India forms a major part of this region thus, it is traditionally rich in the diversity of rice including the wild progenitors of cultivated rice (Singh *et al.*, 2001). Genetic diversity probably serves as an insurance against crop failure (Subba Rao *et al.*, 2001).

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Variability in quantitative characters was studied by Bhide (1926). He concluded that number of tillers per plant and panicle length showed continuous variation. Variability and heritability in twenty one genotypes of rice was studied considerable amount of variability was observed for all the quantitative characters (Kavitha and Reddy 2002).

## MATERIAL AND METHODS

A total of fifty three rice accessions were selected from a collection of rice germplasm in Indira Gandhi Krishi Vishwavidyalaya, Raipur. The experiment was conducted in *Kharif* 2011 to evaluate the fifty three traditional rice germplasm accession and four checks in a Randomized Block Design. The seeds were sown on 10$^{th}$ August, 2011 and transplanted on 27$^{th}$ August 2011. Each line was sown in two replications and each row was having 3.5 m length. The distance between row-to-row and plant-to plant was 20 cm and 15 cm, respectively. Check varieties within the blocks were randomized. Twenty seven days old seedlings were manually transplanted keeping single seedling per hill. Observations were recorded on five randomly selected plants

**Table A : Description of qualitative characters**

| Sr. No. | Characters | Growth stage | Categories or type | Symbols |
|---|---|---|---|---|
| 1. | Coleoptile colour | 7 days old seedling | Green | 1 |
| | | | Purple | 2 |
| | | | Others | 3 |
| 2. | Early plant vigor | 15 DAT | Poor | 1 |
| | | | Good | 2 |
| | | | Very good | 3 |
| 3. | Basal leaf sheath colour | Early to late veg. | Green | 1 |
| | | | Purple lines | 2 |
| | | | Light purple | 3 |
| | | | Purple | 4 |
| 4. | Leaf blade colour | Late veg. | Light green | 1 |
| | | | Green | 2 |
| | | | Dark green | 3 |
| | | | Purple tips | 4 |
| | | | Purple margin | 5 |
| | | | Purple blotch | 6 |
| | | | Purple | 7 |
| 5. | Leaf pubescence | Late veg. | Glabrous | 1 |
| | | | Intermediate | 2 |
| | | | Pubescent | 3 |
| 6. | Ligule colour | Late veg. | White | 1 |
| | | | Purple lines | 2 |
| | | | Purple | 3 |
| 7. | Ligule shape | Late veg. | Acute | 1 |
| | | | Cleft | 2 |
| | | | Truncate | 3 |
| 8. | Collar colour | Late veg. | Pale green | 1 |
| | | | Green | 2 |
| | | | Purple | 3 |
| 9. | Auricle colour | Late veg. | Pale Green | 1 |
| | | | Purple | 2 |
| 10. | Flag leaf angle | At flowering | Erect | 1 |
| | | | Intermediate | 2 |
| | | | Horizontal | 3 |
| | | | Descending | 4 |
| 11. | Stigma colour | At flowering | White | 1 |
| | | | Light green | 2 |
| | | | Yellow | 3 |
| | | | Light purple | 4 |
| | | | Purple | 5 |
| 12. | Awning | Flowering to maturity | Absent | 0 |
| | | | Short and partly awned | 1 |
| | | | Shortly and fully awned | 5 |
| | | | Long and partly awned | 7 |
| | | | Long and fully awned | 9 |
| 13. | Hull colour | After harvesting | Straw | 1 |
| | | | Gold | 2 |
| | | | Golden brown | 3 |
| | | | Brownish furrow on straw | 4 |
| | | | Purple | 5 |
| | | | Purple furrow on straw | 6 |
| | | | Brown | 7 |
| | | | Black | 8 |
| 14. | Seed coat color | After hulling | White | 1 |
| | | | Light brown | 2 |
| | | | Sparkled brown | 3 |
| | | | Brown | 4 |
| | | | Red | 5 |
| | | | Variable purple | 6 |
| | | | Purple | 7 |

for 14 qualitative charactors. The detail descriptions of the qualitative characters are presented in Table A.

Seventeen quantitative characters were recorded, such as panicle initiation (days), panicle exertion (days), days to 50 per cent flowering, plant height (cm), panicle length (cm), total number of tillers per plant, effective tillers per plant, flag leaf length (cm), flag leaf width (cm), total number of grains per panicle, number of filled grains per panicle, no. of unfilled grains (per panicle), grain length (mm), grain width (mm), length: breadth ratio, thousand (1000) grain weight, grain yield per plant.

## RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

### Morphological characters :

Fourteen morphological characters were recorded for 53 accessions. Grouping of the germplasm in different classes is shown in the Table 1 and Fig. 1 a to 1 n.

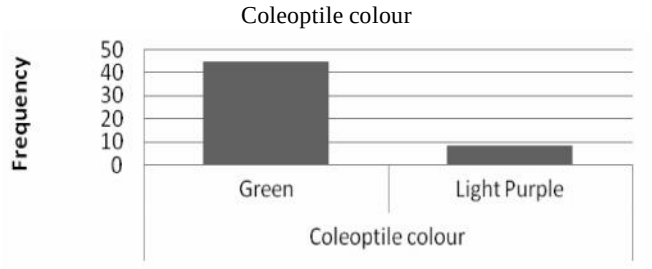


**Fig. 1 (a): Grouping based on coleoptile colour**

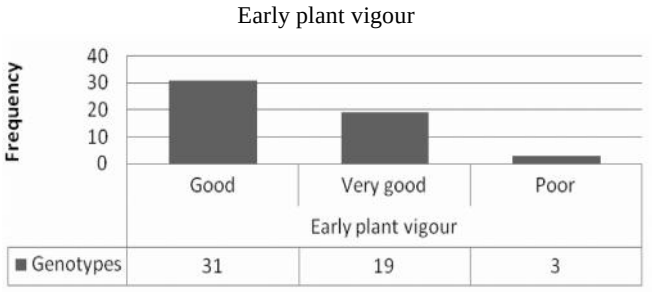


**Fig. 1 (b): Grouping based on Early plant vigour**

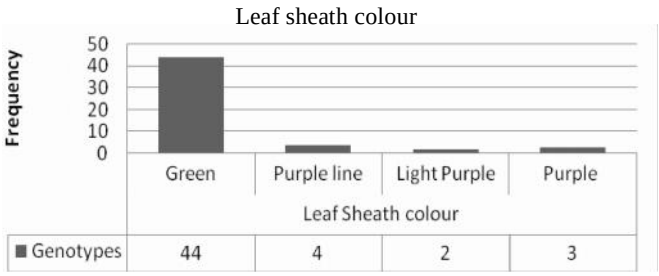


**Fig. 1 (c): Grouping based on leaf sheath colour**

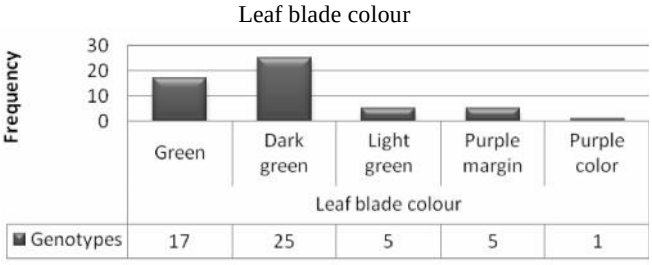


**Fig. 1 (d): Grouping based on leaf blade colour**

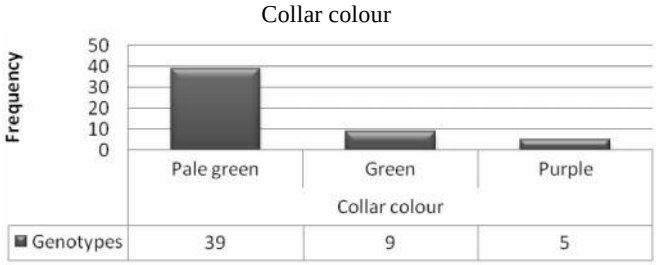


**Fig. 1 (i): Grouping based on collar colour**

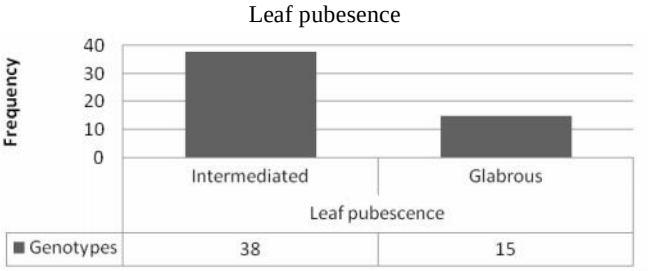


**Fig. 1 (e): Grouping based on leaf pubesence**

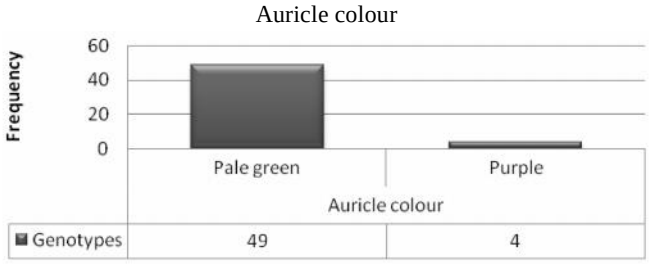


**Fig. 1 (j): Grouping based based on auricle colour**

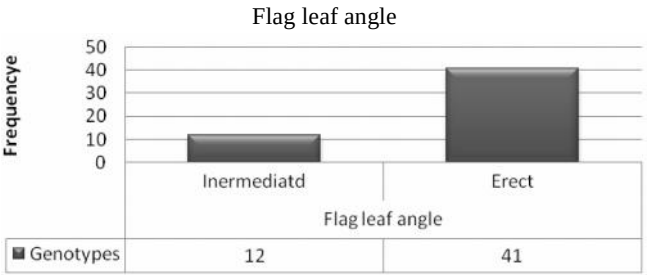


**Fig. 1 (f): Grouping based on flag leaf angle**

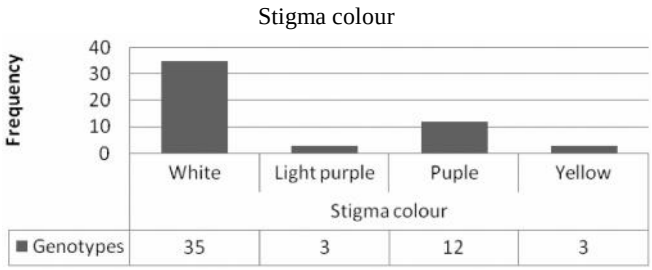


**Fig. 1 (k) : Grouping based on stigma colour**

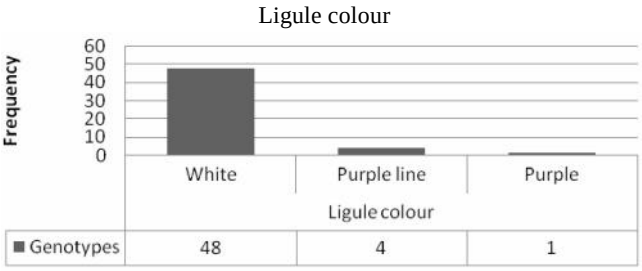


**Fig. 1 (g): Grouping based on ligule colour**


**Fig. 1 (l): Grouping based on awning**

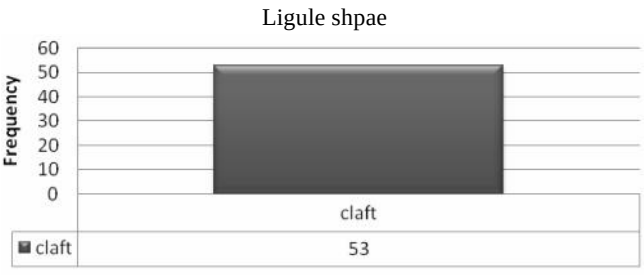


**Fig. 1 (h): Grouping based on ligule shape**

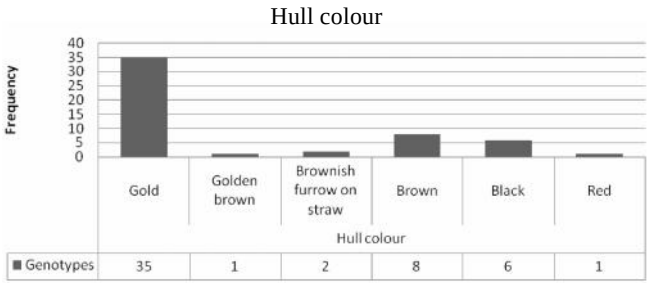


**Fig. 1 (m): Grouping based on hull colour**

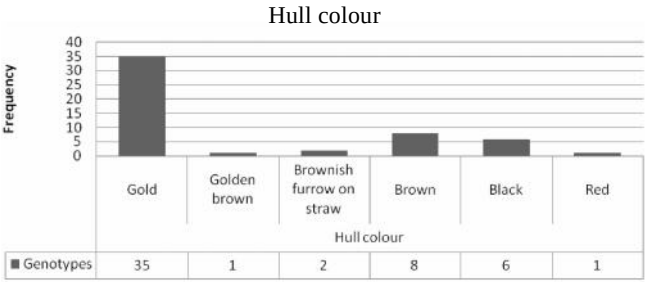


**Fig. 1 (m): Grouping based on hull colour**

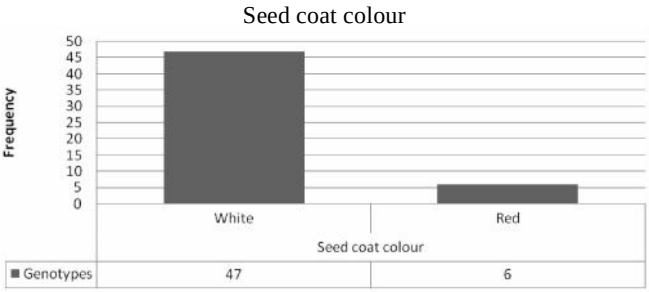


**Fig. 1 (n): Grouping based on Seed coat colour**

## Agronomical characters:

Fifty three accessions of rice germplasm were evaluated for agronomical traits. The presence of considerable variability among the 53 genotypes of rice used in present investigation for all the characters studied and provides an opportunity for further analysis and estimation of parameters of variability. The characters panicle initiation ranged from 58.50 (Mahamaya) to 112.50 (Cri11014) with mean value of 84.50. Variability in panicle initiation has also been reported by Singh *et al*. (2005). Panicle exertion (days) exhibited non significant difference among the studied genotypes ranging from 83 (Mahamaya) to 134 (Cri11014) with mean value of 108.75. Variations in panicle exsertion were also observed by previous workers (Singh *et al*., 2005). Significant differences were recorded for days to 50 % flowering which varied between 86 (P: 189) to 140.50 (Cri11014) and had mean value of 123.25. Variability in days to 50% flowering have also been reported by several workers *viz*., Singh *et al*. (2005), Arumugam *et al.* (2008), Patil *et al.* (2009).

The result of present investigation clearly indicates that sufficient variability for phenological trait is present in the material studied. Since rice is grown in array of ecosystem with different topography of land, hence early and / or late flowering genotypes can successfully be selected for using them in breeding programme. As per requirement, breeder can utilize early flowering genotypes for developing varieties for upland situation and late flowering genotypes for low land conditions.

Plant height showed significant difference among the 53 genotypes evaluated. Plant height varied between 56.50 (BD: 680) to 175.60 (j: 384) cm and had mean value of 116.05 cm. The results in general are in agreement with the findings of previous workers *i.e.* Singh *et al*. (2005), Marchezan *et al.* (2005) and Patil *et al.* (2009). Panicle length (cm) in studied

**Table 1 : Grouping of germplasm in different classes for different morphological characters**

| Sr. No. | Characters | Category | Classification of germplasm |
|---|---|---|---|
| 1. | Coleoptiles colour | Green | 45 |
| | | Light purple | 8 |
| 2. | Early plant vigour | Good | 31 |
| | | Very good | 19 |
| | | Poor | 3 |
| 3. | Leaf sheath colour | Green | 44 |
| | | Purple line | 4 |
| | | Light purple | 2 |
| | | Purple | 3 |
| 4. | Leaf blad colour | Green | 17 |
| | | Dark green | 25 |
| | | Light green | 5 |
| | | Purple margin | 5 |
| | | Purple colour | 1 |
| 5. | Pubescence | Intermediated | 38 |
| | | Glabrous | 15 |
| 6. | Flag leaf angle | Intermediated | 12 |
| | | Erect | 41 |
| 7. | Ligul colour | White | 48 |
| | | Purple line | 4 |
| | | Purple | 1 |
| 8. | Ligul shape | Claft | 53 |
| 9. | Collar colour | Pale green | 39 |
| | | Green | 9 |
| | | Purple | 5 |
| 10. | Auricle colour | Pale green | 49 |
| | | Purple | 4 |
| 11. | Stigma colour | White | 35 |
| | | Purple | 15 |
| | | Yellow | 3 |
| 12. | Awning | Absent | 45 |
| | | Short and partly awned | 1 |
| | | Shortly and fully awned | 1 |
| | | Long and partly awned | 2 |
| | | Long and fully awned | 4 |
| 13. | Hull colour | Gold | 35 |
| | | Golden brown | 1 |
| | | Brownish furrow on straw | 2 |
| | | Brown | 8 |
| | | Black | 6 |
| | | Red | 1 |
| 14. | Seed coat colour | White | 47 |
| | | Red | 6 |

53 germplasm accession showed significant difference and varied between 11.46 (BD: 680) to 30.68 (S: 663) with mean value of 21.07. Variability for panicle length was also reported by Singh *et al*. (2005) and Patil *et al.* (2009). Total number of tillers plant $^{-1}$ showed significant difference in present study and varied between 5.30 (R: 229) to 15.20 (K: 1849) and had mean value of 10.25. This result is in accordance to that reported by Singh *et al*. (2005). Effective tillers in studied germplasm accession ranged from 4.30 (BD: 575) to 14.90 (BD: 1364) and had mean value of 9.6. Number of effective tillers plant$^{-1}$ is one of the important yield contributing traits and result of present investigation revealed that significant difference was available for this trait and breeder can utilize maximum effective tillers plant$^{-1}$ showing genotypes *viz.*, BD:1364, K:1849 and BD:956 etc. in their breeding programme for development of high yielding genotypes in rice. Variability in effective tillers was also reported by Singh *et al.* (2005).

Significant variation was observed for flag leaf length (cm) in present study and it varied between 14.57(BD: 680) to 35.85 (C: 843) with mean value of 25.21. Variability in flag leaf length was also reported by Singh *et al*. (2005) and Patil *et al.* (2009). Flag leaf width (cm) in present study varied between 0.42(BD: 680) to 02.15 (K: 2034) and had mean value of 1.285. Non significant variation for this character was recorded by Singh *et al.* (2011), while significant variation was recorded by Singh *et al*. (2005). Total number of grains panicle$^{-1}$ varied between 97.17 (S: 1470) to 353.33 (V: 28) and had mean value of 225.25. Significant variability for total number of grains panicle-1 was also reported by Kaul *et al.* (1974), Marchezan *et al.* (2005) and Singh *et al*. (2005). Number of filled grains varied between 29(S: 1470) to 322.83(V: 28) and had mean value of 200.33. Variability in filled grains was also reported by Singh *et al*. (2005) and Patil *et al*. (2009). Number of filled grains per panicle is an important yield contributing trait, as it directly affects grain yield. Number of unfilled grains panicle$^{-1}$ varied between 09.33(K: 760) to 103.17(BD: 291) and had mean value of 56.25. Variability in unfilled grains was also reported by Singh *et al*. (2005). Grain length (mm) varied between 5.3(K: 2034) to 11.40 (P: 445, F: 16) and had mean value of 8.375. Grain width (mm) varied between 1.95 (S: 167) to 3.55 (J: 311) and had mean value of 2.75. Grain length: breadth ratio varied between 2.02 (S: 663) to 04.93 (P: 445) and had mean value of 3.475. 1000 seed weight (g) varied between 08.46 (BD: 291) to 33.46 (F: 16) and had mean value of 20.95. Variations in 1000 seed weight was also observed by previous workers *i.e.* Singh *et al*. (2005) and Arumugam *et al.* (2008), Patil *et al*. (2009). Grain yield plant$^{-1}$ (g) varied between 05.68 (BD: 575) to 30.84(S: 663) and had mean value of 18.25.

Based on the mean performance of genotypes for every character, desirable germplasm were selected which are presented in the Table 2.

The basic study on genotypes for yield contributing characters of rice germplasm would help in making precised breeding strategies (Sarawgi and Bisne, 2007). From the present experiment, the desirable accessions combination of higher yield were found *i.e.* 3 accessions (S: 663, K: 1514 and J: 311) in high yield with high penicle length. Significant variations in grain yield plant$^{-1}$ were also observed by previous workers *i.e.* Nandeshwar *et al.* (2010), Marchezan *et al.* (2005), Singh *et al.* (2005) and Patil *et al.* (2009).

**Table 2 : Desirable germplasm for different quantitative characters**

| Sr. No. | Characters | Name of the germplasm |
|---|---|---|
| 1. | Panicle initiation (Days) | Cri 11014, N:796, H:17 |
| 2. | Panicle exertion (Days) | Cri 11014, N:796, H:17 |
| 3. | 50% flowering (Days) earliness | P:189, K:760, L:114, Mahamaya |
| 4. | Plant height (cm) | J:384, K:760, F:16 |
| 5. | Panicle length (cm) | S:663, L:985, S:1684 |
| 6. | Total number of tillers | K:1849, KD:1364, S:1470 |
| 7. | Effective tillers | KD:1364, K:1849, BD:956 |
| 8. | Flag leaf length (cm) | C:843, U:9, B:640 |
| 9. | Flag leaf width (cm) | K:2034, J:311, K:1514 |
| 10. | Total no. of grains panicle$^{-1}$ | V:28, S:663, K:2034 |
| 11. | No. of filled grains panicle$^{-1}$ | V:28, S:663, K:2034 |
| 12. | No. of unfilled grains panicle$^{-1}$ | BD:291, J:333, BD:680 |
| 13. | Grain length (mm) | P:445, F:16, K:760, R:299 |
| 14. | Grain width (mm) | J:311, L:114, H:17, C:843, Mahamaya |
| 15. | Length breadth ratio | P:445, F:16, S:167 |
| 16. | 1000 seeds weight (g) | F:16, L:114, R:299 |
| 17. | Grain yield plant$^{-1}$ (g) | S:663, K:1514, J:311 |

**Conclusion:**

Under these studies the desirable accessions combination of higher yield S: 663, K: 1514, J: 311 were found good on the basis of agronomical characteristics. These rice accessions may be used for different hybridization programme to achieve desired segregants for higher yield.

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