Plant Archives Vol. 26, No. 2, 2026 pp. 2633-2639 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.2.361

AGRO-MORPHOLOGICAL CHARACTERIZATION IN GERMPLASM ACCESSIONS IN RICE (*Oryza sativa* L.)

Lavanya Prabha Sahu*, Prabharani Chaudhari, Hemlata Ohdar and Mayuri Sahu

Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, 492 012, India.

*Corresponding author E-Mail: misslavanya8497@gmail.com

(Date of Receiving-28-07-2026; Date of Revision-29-09-2026; Date of Acceptance-07-10-2026)

ABSTRACT

Rice (*Oryza sativa* L.) is an important staple crop and a major source of food and nutritional security. Characterization and documentation of germplasm diversity are essential for the identification, conservation and effective utilization of genetic resources in rice breeding programmes. The present study was conducted to characterize rice germplasm accessions based on agro-morphological traits under field conditions during *Kharif* 2020 at the Research cum Instructional Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The experimental material comprised 50 rice germplasm accessions selected from a collection of 500 accessions along with seven standard check varieties. The experiment was laid out in a Randomized Block Design with two replications, and observations were recorded on 19 agro-morphological characters following DUS descriptors for rice. Considerable variation was observed among the 57 genotypes for most of the characters studied. High variation was recorded for early plant vigour, basal leaf sheath colour, leaf blade colour, auricle colour, stigma colour, panicle exertion, panicle type, flag leaf angle, awning, leaf senescence, hull colour, sterile lemma colour and threshability. Moderate variation was observed for leaf pubescence, kernel colour, aroma, coleoptile colour and apiculus colour, whereas ligule shape showed no variation. Several accessions exhibited distinctive morphological features and were identified as unique genotypes. IC517398, IC386140, IC458406X, IC378553, IC463062, IC514243, IC377829 and IC74800X were distinguished by one or more specific morphological characters such as uniform purple basal leaf sheath, dark green leaf blade, distinct hull and kernel colours, coloured sterile lemma and presence of aroma. These accessions may serve as useful reference material for DUS testing and as morphological markers for distinguishing rice germplasm. The observed morphological diversity indicates the presence of useful variability among the studied germplasm accessions, which can be exploited in rice improvement programmes.

***Key words*:** Rice, germplasm, agro-morphological characterization, DUS descriptors, genetic diversity, germplasm conservation

Introduction

Rice (*Oryza sativa* L.) is a staple food for more than 100 countries and serves as a primary source of dietary energy and protein for nearly half of the global population, thereby having immense nutritional and economic significance (Pathak *et al*., 2019). It is a vital component of food security and daily diet in many Asian countries (Kumar and Kar, 2020). Although remarkable progress in rice production and productivity was achieved during the Green Revolution, yield levels have now reached a plateau, posing a major challenge to meet the increasing food demands of the rapidly growing population, particularly in developing and underdeveloped nations.

Agro-morphological characterization of germplasm plays a fundamental role in assessing the extent of diversity present within rice accessions. It facilitates the identification of distinct, stable, and desirable traits based on observable plant characters, which are essential for

Table 1: List of germplasm accessions used in the experiment.

S. No.	Accession No.	S. No.	Accession No.
1.	IC-386140	26.	IC-463986
2.	IC-216827	27.	IC-283005
3.	IC-121886	28.	IC-126331
4.	IC-461904	29.	IC-518800
5.	IC-217358	30.	IC-458608
6.	IC-206758	31.	IC-125755
7.	IC-516693	32.	IC-386358
8.	IC-458657X	33.	IC-458005
9.	IC-449598	34.	IC-459489
10.	IC-203364	35.	IC-514384
11.	IC-217772	36.	IC-377829
12.	IC-463062	37.	IC-115641
13.	IC-218829	38.	IC-459795
14.	IC-126210	39.	IC-378183
15.	IC-126468	40.	IC-218729
16.	IC-114501	41.	IC-206352
17.	IC-115726	42.	IC-300416
18.	IC-377660	43.	IC-74800X
19.	IC-378252	44.	IC-133944
20	IC-378553	45.	IC-114573
21	IC216830	46.	IC205951
22	IC134905	47.	IC514243
23	IC593995	48.	IC517398
24	IC378408	49.	IC378032
25	IC458406X	50.	IC207460

varietal identification and selection in breeding programs. Such characterization not only aids in the effective utilization of genetic resources but also provides a basis for selecting promising genotypes with superior agronomic performance (Gupta *et al.*, 2014). The broader principles of morphological characterization and trait association are widely recognized across various crop species. Similar strategies have been successfully utilized for the assessment of genetic diversity and yield traits in cowpea (Sahu *et al.*, 2026), grass pea (Sahu *et al.*, 2022), linseed

Table 2: List of morphological characters observed during work.

Sr.	Morphological Traits	Sr.	Morphological Traits
1.	Coleoptile colour	11.	Flag leaf angle
2.	Early plant vigour	12.	Awning
3.	Basal leaf sheath colour	13.	Hull colour
4.	Leaf blade colour	14.	Aroma
5.	Leaf pubescence	15.	Leaf senescence
6.	Auricle colour	16.	Kernel colour
7.	Ligule shape	17.	Sterile lemma colour
8.	Stigma colour	18.	Apiculus colour
9.	Panicle exertion	19.	Threshability
10.	Panicle type		

Table 3: Frequency distribution of agro-morphological characters studied in rice genotypes.

S. No.	Character-istics	Category	NG	FQ
1	Coleoptile colour	1-Colourless	0	0
		2-Green	56	98.24
		3-Purple	1	1.75
2	Early plant vigour	1-Poor	17	29.82
		2-Good	27	47.26
		3-Very good	13	22.8
3	Basal leaf sheath colour	1-Green	42	73.68
		2-Purple	7	12.28
		3-Purple lines	7	12.28
		4-Uniform purple	1	1.75
4	Leaf blade colour	1-Pale green	36	63.15
		2-Green	5	8.77
		3-Dark green	1	1.75
		4-Purple tips	3	5.26
		5-Purple margin	8	14.03
		6-Purple blotch	3	5.26
		7-Purple	0	0
5	Leaf pube scence	1-Glabrous	0	0
		2-Intermediate	13	22.8
		3-Pubescence	44	77.19
6	Auricle colour	1-Green	45	78.94
		2-Light purple	2	3.5
		3-Purple	10	17.54
7	Ligule shape	1-Truncate	0	0
		2-Acute	0	0
		3-Split	57	100
8	Stigma colour	1-White	30	52.63
		2-Light green	0	0
		3-Yellow	8	14.03
		4-Light purple	2	3.5
		5-Purple	17	29.82
9	Panicle exertion	3-Partially exerted	11	19.29
		5-Mostly exerted	20	35.08
		7-Well exerted	26	45.61
10	Panicle type	1-Compact	18	31.57
		5-Intermediate	19	33.33
		9-Open	20	35.08
11	Flag leaf angle	1-Erect	23	40.35
		3-Semi-erect	7	12.28
		5-Horizontal	21	36.84
		7-Deflex	6	10.52
12	Awning	1-Absent	50	87.71
		9-Present	7	12.8
13	Leaf s enescence	3-Early	30	52.63
		5-Medium	16	28.07
		7-Late	11	19.29
14	Aroma	1-Absent	55	96.49
		9-Present	2	3.57

Continue ...3

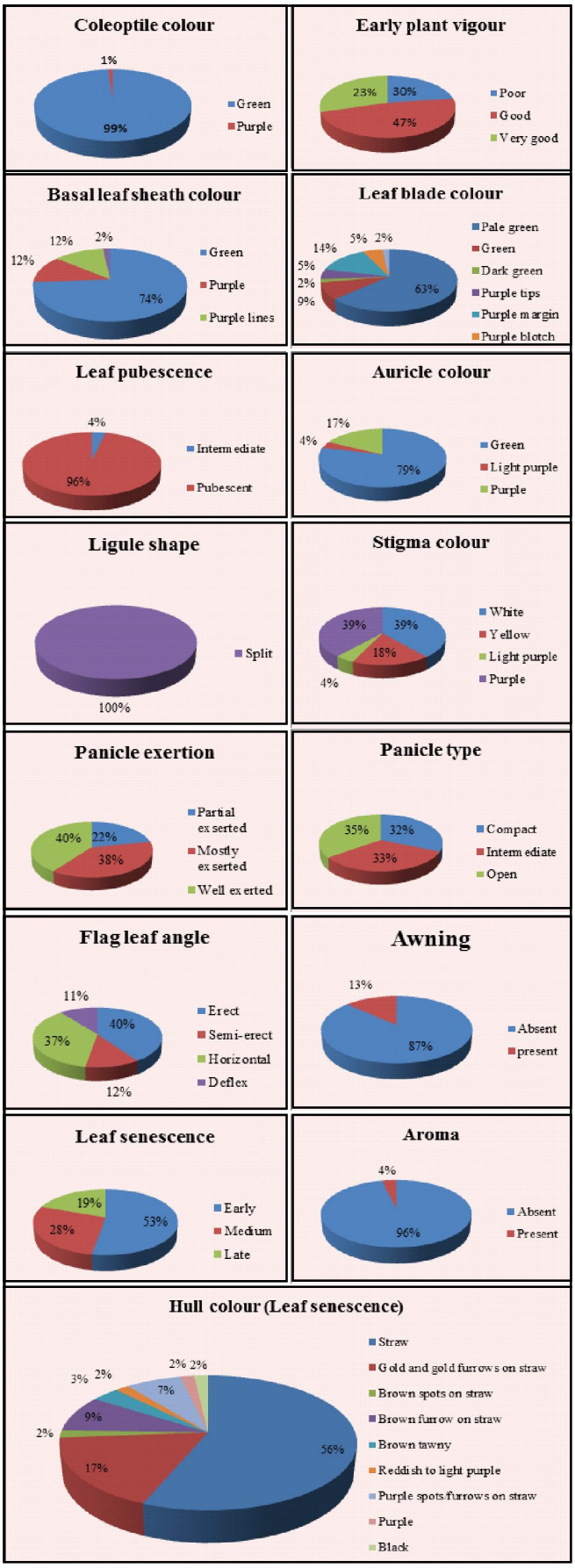
15	Hull colour	1-Straw	32	56.14
		2-Gold and gold furrows on straw background	10	17.54
		3-Brown spots on straw	1	1.75
		4-Brown furrow on straw	5	8.77
		5-Brown (tawny)	2	3.57
		6-Reddish to light purple	1	1.75
		7-Purple spots / furrows on straw	4	7.01
		8-Purple	1	1.75
		9-Black	1	1.75
16	Kernel colour	1-White	37	64.91
		2-Light brown	12	21.05
		3-Variegated brown	0	0
		4-Dark brown	2	3.5
		5-Light red	5	8.77
		6-Red	1	1.75
		7-Variegated purple	0	0
		8-Purple	0	0
		9-Dark purple	0	0
17	Apiculus colour	1-White	16	28.07
		2-Straw	4	7.01
		3-Brown(tawny)	10	17.54
		4-Red	3	5.26
		5-Red apex	0	0
		6-Purple	24	42.1
		7-Purple apex	0	0
18	Sterile lemma colour	1-Straw	39	68.42
		2-Gold	16	28.07
		3-Red	1	1.75
		4-Purple	1	1.75
19	Thresh-ablity	1-Difficult	1	1.75
		5-Intermediate	8	14.03
		9-Easy	48	84.21

NG: No. of genotype; FQ: Frequency (%)

(Sahu and Sahu, 2017), and mutant populations of lathyrus (Netam and Sahu, 2025). Furthermore, integrating these morphological evaluations with molecular approaches, such as the use of simple sequence repeats (SSR) markers, significantly enhances the precision of genetic diversity assessments, as demonstrated in aromatic rice (Patel *et al*., 2015).

Material and Methods

The recent research study was conducted at the Research cum Instructional farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during *Kharif*, 2020. The experimental



Continue Fig .1

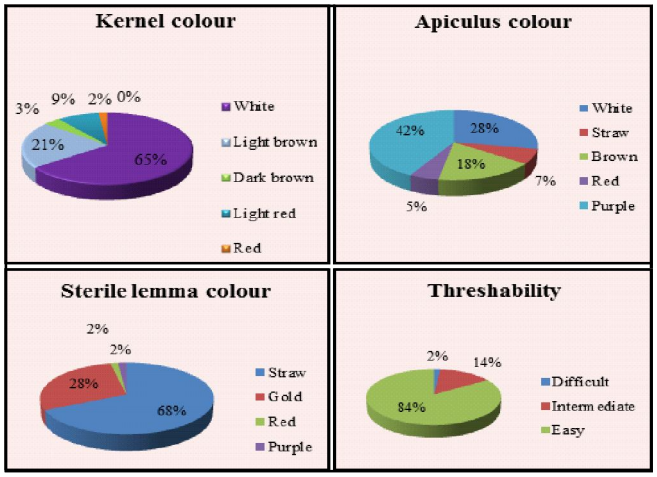


Fig.1: Pie charts for frequency distribution and percentage value of 19 agro-morphological characters.

materials consisted of fifty rice germplasm accessions alongside seven checks, namely Dagad Desi, RRF-127, RRF-140, DRR Dhan-42, MTU-1010, Annada, and Swarna (Table 1). These fifty germplasm accessions were selected randomly from a collection of five hundred germplasm accessions provided by DBT, New Delhi. The experiment was laid out in a Randomized Block Design with two replications. The plant materials were raised in a bed nursery sown in the last week of June 2020.

Twenty-three-day-old seedlings were transplanted into the field. Each replication consisted of the fifty-seven genotypes. Each entry was transplanted in two rows where row-to-row spacing was 20 cm and plant-to-plant spacing was 15 cm. Check varieties were randomized within the blocks. All recommended packages of practices were adopted throughout the crop growth period, and need-based plant protection measures were taken up to raise a healthy crop.

Table 4: List of unique genotypes based on morphological characters studied.

Sr.	Character	Category	Genotype
1.	Basal leaf sheath colour	Uniform purple	IC517398
2.	Leaf blade colour	Dark green	IC386140
3.	Hull colour	Brown spots on strawReddish to light purple Purple Black	IC458406X IC378553 IC463062 IC514243
4.	Kernel colour	Dark brown Red	IC386140, IC377829 IC517398
5.	Sterile lemma colour	Red Purple	IC514243 IC463062
6.	Aroma	Present	IC-74800X and IC-514243

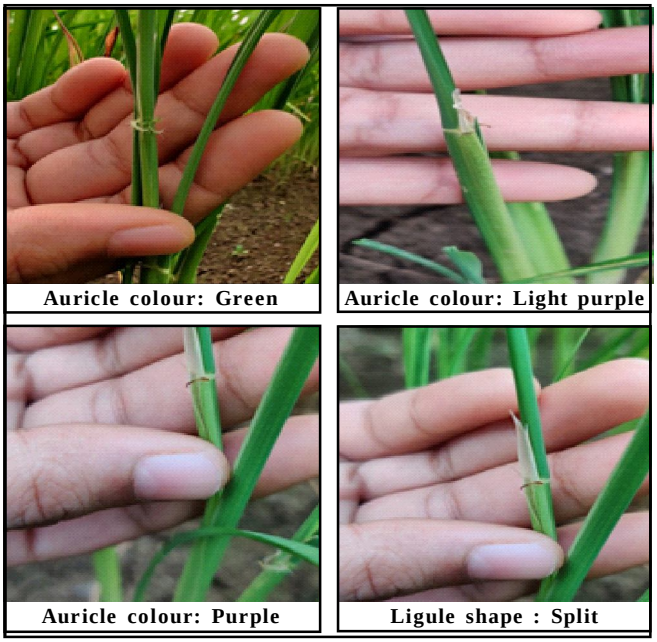


Fig. 2: Auricle colour.

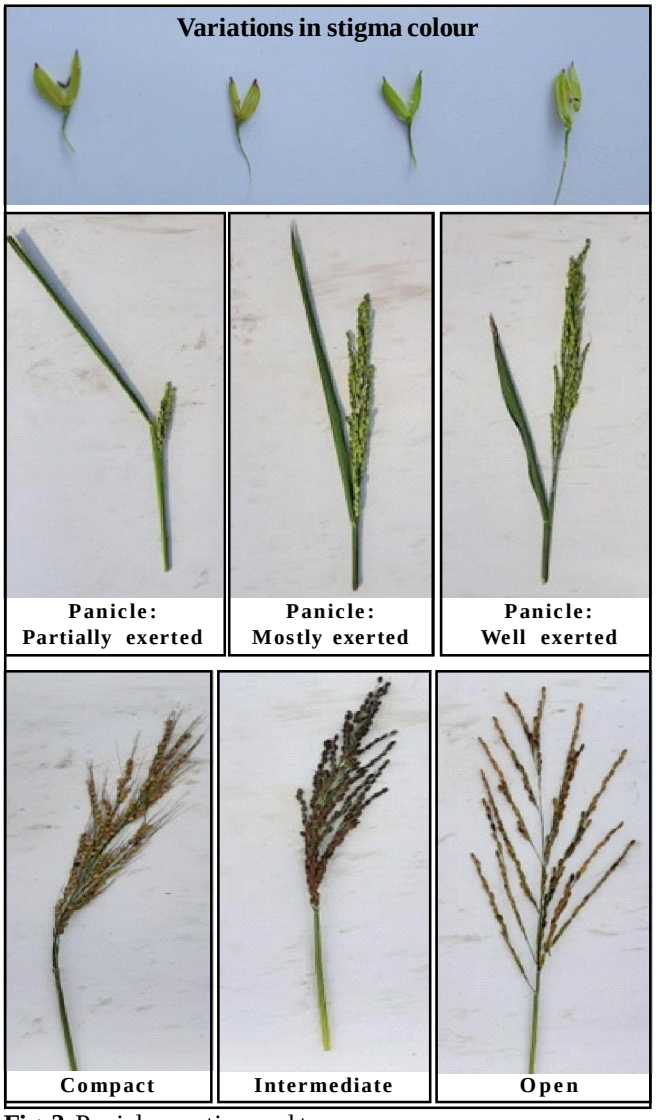


Fig. 3: Panicle exertion and type.



Fig. 4: Flag leaf angle.

Observations were recorded on five randomly selected plants for nineteen agro-morphological characters (Table 2). Characterization was performed at different growth stages based on the DUS descriptors for rice suggested by the Directorate of Rice Research (DRR) Hyderabad and the NBPGR-IRRI Rice Advisory Committee (1980). The nineteen morphological characters evaluated included: coleoptile colour, early plant vigour, basal leaf sheath colour, leaf blade colour, leaf pubescence, auricle colour, ligule shape, stigma colour, panicle exertion, panicle type, awning, leaf senescence, aroma, hull colour, kernel colour, apiculus colour, sterile lemma colour, and threshability.



Fig. 5: Awning.

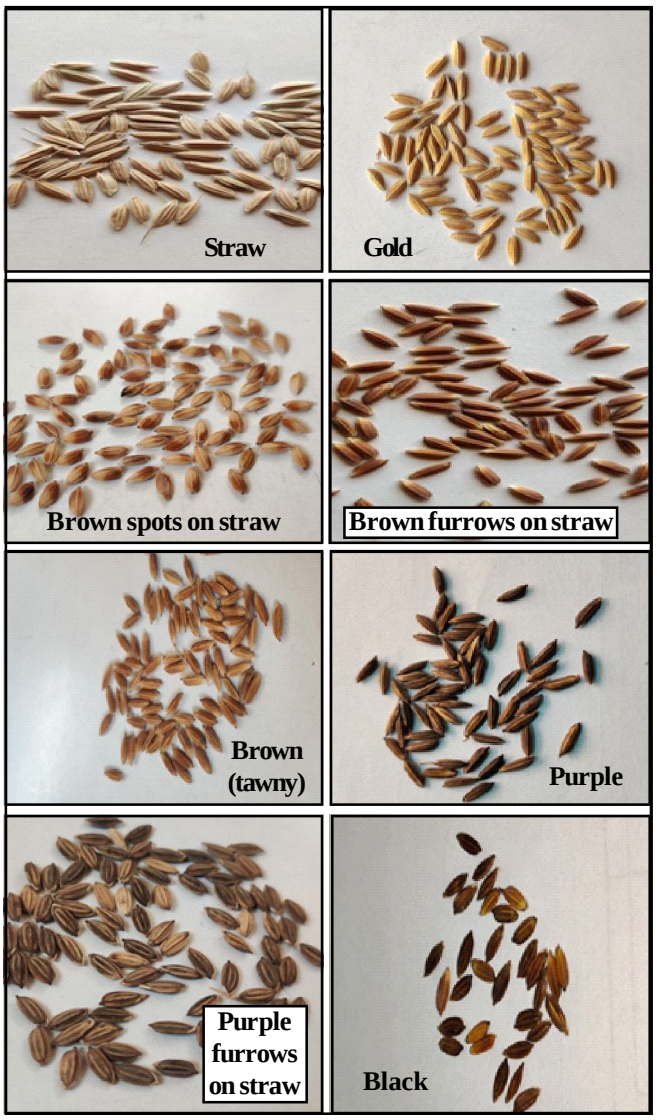


Fig. 6: Variations in hull colour.

Results and Discussion

Morphological characterization of the fifty-seven genotypes (fifty germplasm accessions along with seven standard check varieties) was completed for the nineteen different characters. The frequency distribution of the

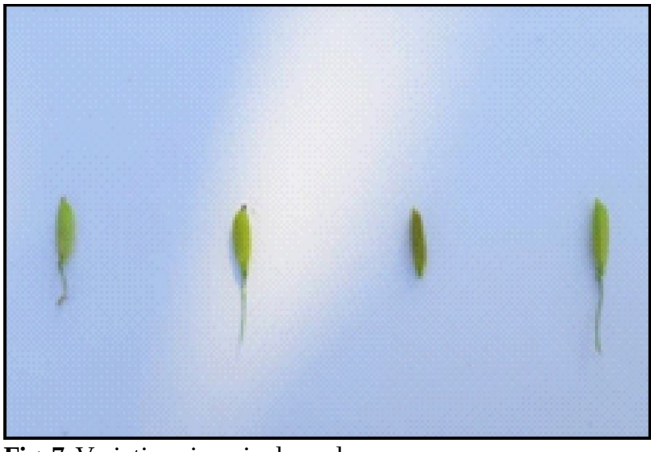


Fig. 7: Variations in apiculus colour.



Fig. 8: Highest 100 seed weight recoded.

fifty-seven genotypes for these various agro-morphological traits is comprehensively depicted in Table 3.

High variations were observed for the characters including early plant vigour, basal leaf sheath colour, leaf blade colour, auricle colour, stigma colour, panicle exertion, panicle type, flag leaf angle, awning, leaf senescence, hull colour, sterile lemma colour, and threshability. Moderate variations were recorded for leaf pubescence, kernel colour, aroma, coleoptile colour, and apiculus colour. The character of ligule shape exhibited no variations across the accessions. This broad spectrum of agro-morphological variation corroborates the findings of several earlier diversity assessments in rice germplasm, which similarly reported distinct variability in vegetative and reproductive traits essential for crop improvement (Nascimento *et al*., 2011; Sarawgi *et al*., 2013; Pachauri *et al*., 2017; Umarani *et al*., 2017; Vageeshvari *et al*., 2020).

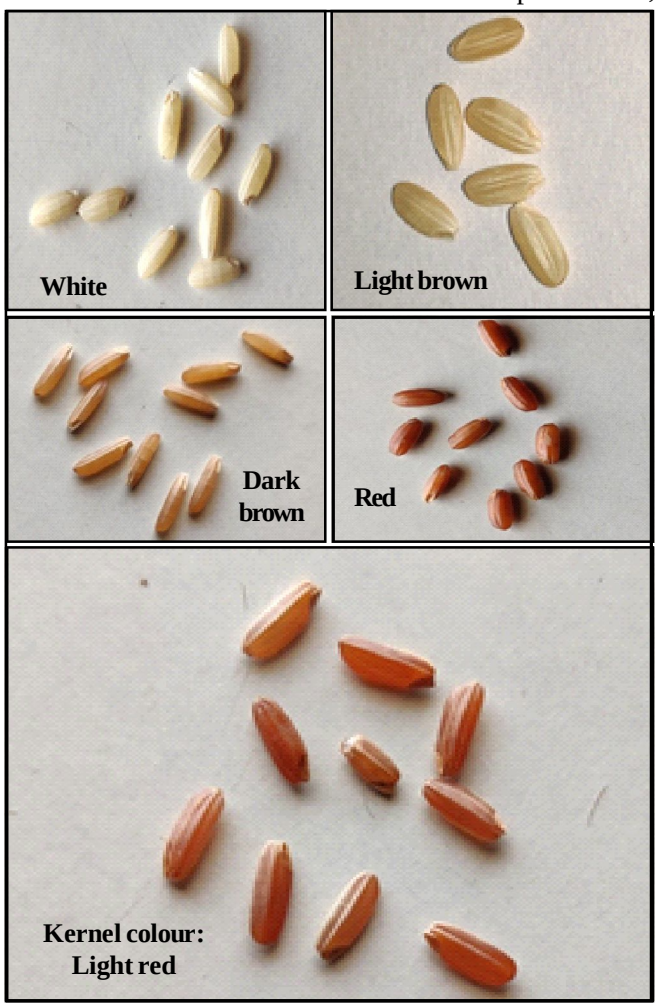


Fig. 9: Variations in kernel colour.

On the basis of the presence of distinctive morphological characters, several accessions were identified as unique genotypes (Table 4). These unique accessions include IC517398 (basal leaf sheath colour: uniform purple), IC386140 (leaf blade colour: dark green), IC458406X (hull colour: brown spots on straw), IC378553 (hull colour: reddish to light purple), IC463062 (hull colour: purple), and IC514243 (hull colour: black). Additionally, unique variations were noted in IC386140 and IC377829 (kernel colour: dark brown), IC514243 (sterile lemma colour: red), and IC463062 (sterile lemma colour: purple).

Conclusion

The accessions *viz*. IC517398, IC386140, IC458406X, IC378553, IC463062, IC514243, IC377829, and IC74800X were found to possess unique character combinations. These distinct genotypes can be effectively utilized as reference varieties for DUS testing or can act as morphological markers for distinguishing among diverse germplasm materials in future breeding programs.

References

Gupta, R., Tetwar S. and Nair S.K. (2014). Agro-morphological characterization of rice germplasm of Chhattisgarh. *International Journal of Plant Sciences*, **9(1)**, 257-262.

Kumar, R. and Kar S. (2020). Variability Studies in Local Rice Genotypes Using Agro-Morphological Characterization. *International Journal of Current Microbiology and Applied Sciences*, **9(1)**, 2397-2406.

Nascimento, W.F., Silva E.F. and Veasey E.A. (2011). Agro-morphological characterization of upland rice accessions. *Scientia Agricola*, **68(6)**, 652-660.

NBPGR-IRRI Rice Advisory Committee. (1980). *Descriptors for rice (Oryza sativa L.)*. The International Rice Research Institute, Manila, Philippines, 6-8.

Netam, P. and Sahu M. (2025). Morphological characterization of mutant population of lathyrus (*Lathyrus sativus* L.). *Plant Archives*, **25(1, Supplement)**, 698–706.

Pachauri, A.K., Sarawgi A.K., Bhandarkar S. and Ojha G.C. (2017). Agromorphological characterization and morphological based genetic diversity analysis of Rice (*Oryza sativa* L.) germplasm. *Journal of Pharmacognosy and Phytochemistry*, **6(6)**, 75-80.

Patel, N.B., Dhirhi N., Shrivastava R. and Sahu M. (2015). Molecular characterization of aromatic rice (*Oryza sativa* L.) using simple sequence repeats (SSR) markers. *Plant Archives*, **15(2)**, 1151–1156.

Pathak, H., Voleti S.R., Meera Shaik N., Tripathi R., Sailaja B., Nayak A.K., Subba Rao L.V., Mondal B., Reddy J.N. and Mohapatra T. (2019). *Reorientation of All India Coordinated Crop Improvement Projects: The Case of Rice*. NRRI Research Bulletin No. 18.

Sahu, M., Khute I.K., Parihar R., Nag S.K., Banerjee S. and Prabha N. (2026). Molecular characterization of cowpea genotypes for genetic diversity using RAPD and ISSR techniques. *Legume Research*, 1–9.

Sahu, M., Mishra A. and Pandey H. (2022). Characterization and assessment of genetic diversity in local and improved accessions of grass pea (*Lathyrus sativus* L.) for green forage yield traits. *Range Management and Agroforestry*, **43(2)**, 237–246.

Sahu, M. and Sahu D. (2017). Characterization and association studies in Linseed (*Linum usitatissimum* L.) germplasm accessions. *Bulletin of Environment, Pharmacology and Life Sciences*, **6(4)**, 291–297.

Sarawgi, A.K., Subba Rao L.V., Parikh M., Sharma B. and Ojha G.C. (2013). Assessment of variability of Rice (*Oryza sativa* L.) germplasm using agro-morphological characterization. *Journal of Rice Research*, **6(1)**, 14.

Umarani, E., Radhika K., Padma V. and Subbarao L.V. (2017). Agromorphological characterization of Rice (*Oryza sativa* L.) landraces based on DUS descriptors. *International Journal of Pure & Applied Bioscience*, **5(4)**, 466-475.

Vageeshvari, Chaudhari P.R. and Gauraha D. (2020). Genetic diversity analysis of grain yield and quality traits in rice germplasm accessions (*Oryza sativa* L.) by principal component analysis. *International Journal of Chemical Studies*, **8(6)**, 108-111.