

Identification of Rice Varieties of Assam Based on Grain Characters and Reaction to Certain Chemical Tests

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ABSTRACT Eleven local and popular rice varieties of Assam, were characterized on the basis of hulled and unhulled grain characters. Varieties were identified based on grain characters like grain colour, grain length, grain width, decorticated grain length, decorticated grain width, decorticated grain colour, decorticated grain shape, grain L/B ratio, grain type and 1000 grain weight. Rapid laboratory tests such as phenol, modified phenol, NaOH, FeSO₄, KOH-resistance and peroxidase tests have also been used to identify and group the rice varieties.

Key words: Chemical reaction, grain, phenol, rice, variety

The need for initial identification or for verification of varietal identity arises throughout the sequence of events from breeding to variety release, pure-seed propagation and sowing, at harvest and into marketing and processing of the harvested grain [1]. The introduction of Plant Breeder's Rights has brought even more exacting requirements for genotype identification and distinctness testing in seed certification [2]. In order to maintain high quality seed of rice, careful attention is paid at every stage of seed production to genuineness (authenticity) of variety [3]. Thus, to verify genuineness, it is necessary to identify characteristics associated with each variety. The main concern of variety testing in the laboratory is the study of morphological characters of grains as well as their chemical reactions towards various rapid chemical tests. Chemical tests are found to be quick and accurate and are used to identify varieties when it is difficult to identify them either by use of morphological characteristics or physiological tests. Phenol test, KOH test etc. offer several important advantages in terms of effectiveness of identification, distinct and readily observable characteristics and use of space. In this

investigation, both hulled and unhulled grain characters of 11 varieties were evaluated and also 6 chemical tests were performed to examine the difference between the rice varieties.

MATERIALS AND METHODS

The study material comprised of nucleus seeds of 11 recommended local and popular rice varieties of Assam, India, collected from Regional Agricultural Research Station, Titabor, Jorhat, Assam, India. The material was raised for seed multiplication at Instructional cum Research Farm of Assam Agricultural University, Jorhat in RBD with three replications. After harvesting of mature grains, these were hulled by hand to record the decorticated grain characters. Observations for grain morphological characters were made as per International Union for Protection of New Plant Varieties (UPOV) guidelines [4], Yadav *et al.* [5] and National guidelines [6]. The observations were made on hundred seeds of each variety on grain morphological characters. The data were statistically analyzed, following the method suggested by Gomez and Gomez [7]. Six chemical tests *viz.*, phenol, modified phenol, NaOH, FeSO₄,

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KOH-resistance and peroxidase tests were performed by the methods developed by Ram *et al.* [8].

Phenol test

Seeds were soaked in water for 16 hours at ambient temperature and then 50 seeds were placed in Petri dish on two layers of filter paper soaked in 1 per cent phenol solution and kept at $30^{\circ} \pm 1^{\circ}\text{C}$. The reaction was noted after 4 hours. The varieties were grouped according to phenol colour reaction.

Modified phenol test

Seeds were soaked in 0.4 per cent CuSO_4 solution overnight at $20^{\circ} \pm 1^{\circ}\text{C}$. Then 50 seeds were placed in a Petri dish lined with filter paper presoaked with 1 per cent phenol solution and kept at $30^{\circ} \pm 1^{\circ}\text{C}$. The reaction was noted after 4 hours. Based on colour development varieties were grouped.

NaOH test

Twenty five seeds were immersed in 25 ml of 5 per cent NaOH solution and observed for colour changes for a period of 1 hour.

KOH resistance test

Fifty seeds were soaked in 1.7 per cent KOH at 30°C for 24 hours. Then the spreading of rice kernel was observed and grouped into high, medium and low resistance.

FeSO₄ test

Fifty seeds were soaked in 1 per cent FeSO_4 solution for 4 hours at 25°C . Based on colour development varieties were grouped.

Peroxidase test

Fifty seeds were placed in test tubes and 10 drops of 0.5 per cent guaiacol were added. After 10 minutes a drop of 0.1 per cent hydrogen peroxide was added. After 1 minute of adding the hydrogen peroxide the seed coat was recorded as peroxidase positive (high peroxidase activity indicated by a reddish brown solution) or peroxidase negative (low peroxidase activity indicated by colourless solution) in the test tubes.

RESULTS AND DISCUSSIONS

The study of morphological characters of grains is not only prerequisites for DUS testing, and production of pure foundation and certified seeds but is also crucial for plant quarantine activities and variety testing in the laboratory. The grain characters such as grain colour, grain length, grain width, decorticated grain length, decorticated grain width, decorticated grain shape, decorticated grain colour, grain L/B ratio, grain type and thousand grain weight could classify the varieties into few broad categories. The most common grain colour was straw in 8 varieties followed by brown in 2 varieties and only one variety Rongadoria had red grains (Table 1). Chaudhary and Sahai [9] observed straw colour as the most frequent grain colour followed by brown, while evaluating 1270 Cambodian rice germplasm. In respect of grain length, the variety Rongadoria exceptionally grouped into medium class, whereas the exceptional grain width was found in the variety Monoharsali having high grain width. The varieties were categorized into medium (7 varieties) and long (4 varieties) group based on decorticated grain length. Vanangamudi *et al.* [3] reported these two classes with respect to decorticated grain length, among the rice varieties of Tamil Nadu, India. However, with respect to decorticated grain width, all the varieties had bold grains. Decorticated grain shape categorized the rice varieties into round (Rongadoria), semi round (5 varieties), spindled (4 varieties) and half spindled (Rangilee). All the varieties had white decorticated grain colour except Rongadoria which was having red decorticated grains. Chauhan and Nanda [10], reported red and creamy white to white rice grains among the varieties from Kerala and Tamil Nadu, India. The grain L/B ratio ranged from 2.5 to 3.46. Based on grain L/B ratio 4 varieties were grouped into long bold grain type, 1 variety i.e. Rongadoria, belonged to medium slender and remaining 6 varieties were grouped into long slender grain type. Thousand grain weight ranged from 18.11g in Rongadoria to 26.54g in Bishnuprasad, thus could be extremely useful for varietal identification. Statistically significant difference was observed for all the grain characters except decorticated grain width. A few characters like grain colour, grain length, decorticated grain shape, decorticated grain

Table 1. Distinguishing grain characters of the rice varieties

Varieties	Grain colour	Grain length (mm)	Grain width (mm)	Decorticated grain length (mm)	Decorticated grain width (mm)	Decorticated grain shape	Decorticated grain colour	Grain L/B ratio	Grain type	Thousand grain weight (g)
1. Moniram	Straw	Long (7.50)	Narrow (2.44)	Medium (5.75)	Bold (2.20)	Semiround	White	3.125	Long slender	22.60
2. Monoharsali	Straw	Extra long (9.00)	High (3.20)	Long (6.20)	Bold (2.46)	Semiround	White	2.80	Long bold	23.96
3. Lakhimi	Straw	Long (7.54)	Medium (3.00)	Medium (5.50)	Bold (2.48)	Semiround	White	2.50	Long bold	25.77
4. Solpona	Brown	Extra long (8.40)	Medium (2.60)	Long (6.50)	Bold (2.20)	Spindle	White	3.20	Long slender	21.80
5. Rangilee	Straw	Extra long (8.50)	Medium (2.80)	Long (6.40)	Bold (2.40)	Half spindle	White	3.03	Long slender	24.88
6. Piyalee	Straw	Long (7.50)	Narrow (2.40)	Medium (5.10)	Bold (2.10)	Spindled	White	3.125	Long slender	23.19
7. Mahsuri	Brown	Long (7.50)	Narrow (2.40)	Medium (5.60)	Bold (2.10)	Spindle	White	3.125	Long slender	19.56
8. Bishnuprasad	Straw	Long (7.50)	Medium (3.00)	Medium (5.60)	Bold (2.50)	Semiround	White	2.50	Long bold	26.54
9. Jyotiprasad	Straw	Long (7.50)	Medium (3.00)	Medium (5.60)	Bold (2.60)	Semiround	White	2.50	Long bold	26.47
10. Satyaranjan	Straw	Extra long (9.00)	Medium (2.60)	Long (6.30)	Bold (2.20)	Spindle	White	3.46	Long slender	20.59
11. Rongadoria	Reddish brown	Medium (6.00)	Narrow (2.40)	Medium (4.60)	Bold (2.30)	Round	Red	2.50	Medium slender	18.11
S.Ed. (\pm)		0.027	0.0265	0.0083	0.0084			0.0088		0.415
CD 0.05		0.057	0.0555	0.0175	0.0175			0.0185		0.869

colour and grain type have been found unique for the variety Rongadoria, thereby helping in identifying this variety easily from other 10 varieties. As a whole all the characters have been found to be useful for identifying the varieties and can be employed as diagnostic characters for identification of the rice varieties.

Rapid chemical identification techniques are the testing procedures that utilize specific treatments to reveal chemical differences among seeds or seedlings of different varieties. The varieties were identified and grouped on the reactions to phenol, modified phenol, FeSO_4 , KOH resistance, NaOH and peroxidase test. The data are presented in Table 2 and also schematically (Schematic diagram 1).

In phenol test, three colours namely dark brown, light brown and brown colours were developed and based on this colour variation, rice varieties under study were grouped and identified. The phenol colour test, which is the index of polyphenol oxidase activity, is a simple, quick and accurate test. Vanangamudi *et al.* [11] grouped 85 rice varieties of Tamil Nadu, India based on dark brown, light brown, brown and black phenol colour reaction. In modified phenol test three distinct classes of colour *viz.*, dark brown, black and brown colour were observed. This test may lead to further sub-grouping of varieties. Four distinct types of colour were observed among the varieties with respect to FeSO_4 test. These were dark gray, light gray, gray and black. In KOH resistance test, three distinct classes were recorded

Table 2. Characterization of rice varieties by various chemical tests

Varieties	Phenol test	Modified phenol test	FeSO ₄ test	KOH-Resistance test	NaOH test	Peroxidase test
1. Moniram	Light brown	Black	Light grey	High resistant (not spreading)	No colour	Light brown
2. Monoharsali	Dark brown	Black	Light grey	High resistant (not spreading)	No colour	Light brown
3. Lakhimi	Dark brown	Black	Grey	High resistant (not spreading)	No colour	Light brown
4. Solpona	Brown	Dark brown	Light grey	High resistant (not spreading)	No colour	Colourless
5. Rangilee	Dark brown	Black	Grey	Medium resistant (semi spreading)	No colour	Colourless
6. Piyalee	Dark brown	Black	Grey	High resistant (not spreading)	No colour	Colourless
7. Mahsuri	Light brown	Brown	Dark grey	High resistant (not spreading)	No colour	Reddish brown
8. Bishnuprasad	Dark brown	Black	Dark grey	High resistant (not spreading)	No colour	Reddish brown
9. Jyotiprasad	Dark brown	Black	Grey	High resistant (not spreading)	No colour	Light brown
10. Satyaranjan	Dark brown	Black	Light grey	Low resistant (spreading)	No colour	Light brown
11. Rongadoria	Dark brown	Black	Black	High resistant (not spreading)	Light orange	Colourless

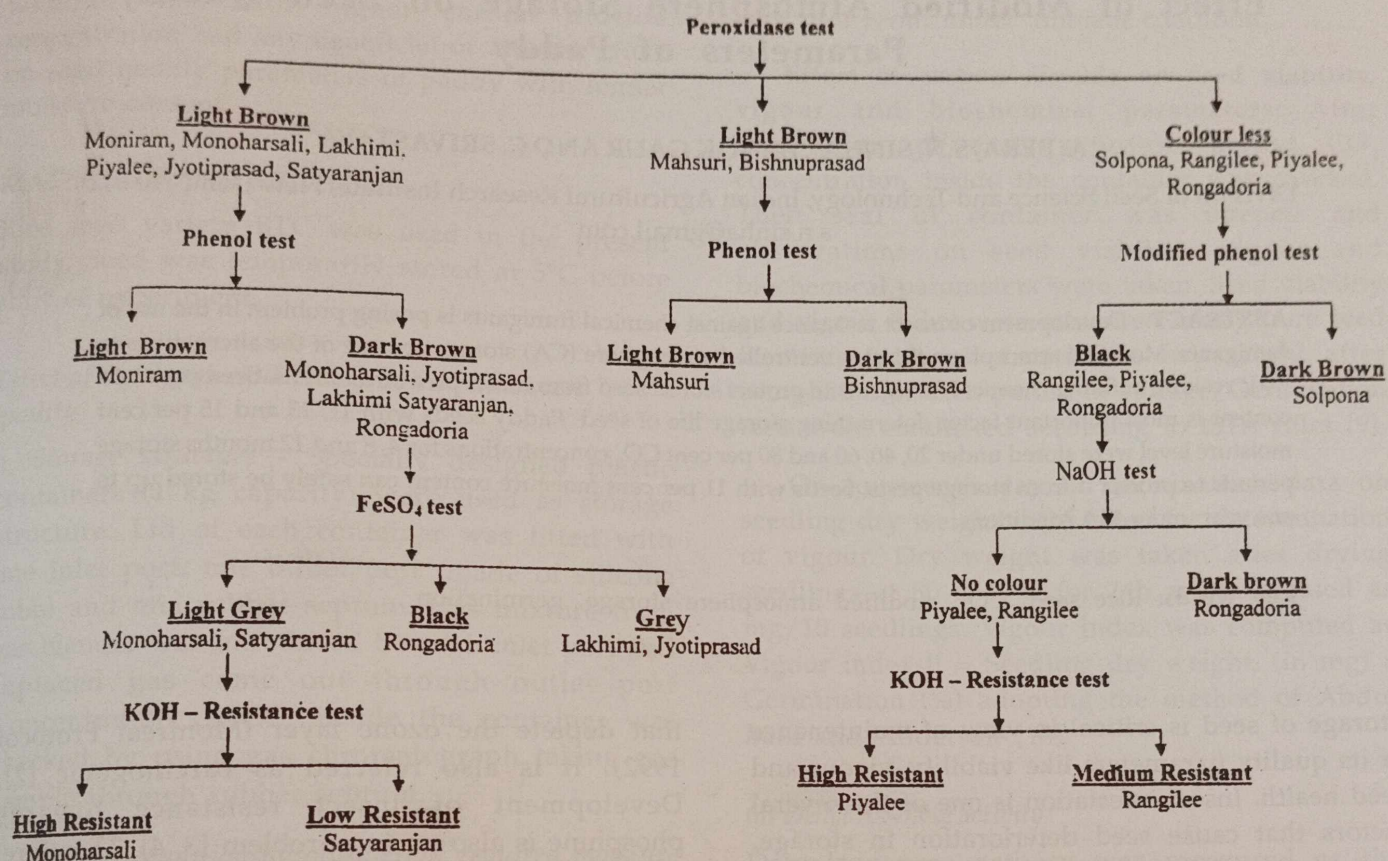
to be high resistant, medium resistant and low resistant. This test revealed the spreading nature of the rice varieties and helped in identifying the glutinous rice varieties such as Rangilee. In NaOH test, no colour was developed in the varieties except in Rongadoria which developed light orange colour. This test is mainly used to distinguish red rice varieties from the standard varieties. In peroxidase test, rice varieties were identified and grouped into three-based on development of light brown, reddish brown and colourless solution upon this test.

The present study reveals that these chemical tests can be utilized for characterization and identification of rice varieties, very effectively.

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SCHEMATIC DIAGRAM 1: Characterization of rice varieties based on chemical test



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