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Characterization of aromatic short grain rice varieties based on standard phenol test

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Abstract
The present investigation was carried out at laboratory of Department of Seed Science and Technology OUAT Bhubaneswar. To characterize aromatic short grain rice varieties by using standard phenol test. The phenol reaction is controlled by the tyrosinase enzyme in the seed coat and it is under genetic control. The phenol colour test is the index of polyphenol oxidase activity, a simple, quick and accurate test for the distinction of cultivars. In the present study, among thirty aromatic short grain rice varieties eleven aromatic short grain varieties reacted positively whereas remaining nineteen aromatic short aromatic grain rice varieties reacted negatively to standard phenol test. Based on standard phenol test, the aromatic short grain rice varieties were classified in to four groups as no change in colour (V_3, V_4, V_7, V_9, V_{11} V_{13}, V_{14}, V_{15}, V_{16}, V_{17}, V_{18}, V_{20}, V_{21}, V_{24}, V_{25}, V_{26}, V_{27}, V_{28} and V_{29}) light brown (V_5, V_6 and V_{19}), brown (V_{22}) and dark brown (V_1, V_2, V_8, V_{10}, V_{12}, V_{23} and V_{30}). Thus based on the colour reaction of palea and lemma of seeds to standard phenol test can be effectively distinguished.

Keywords: Standard phenol test, aromatic rice short grain rice varieties, colour reaction, characterization

Introduction
Rice (*Oryza sativa* L.) is the staple food crop in the world particularly in India (Subbaiah *et al.*, 2011) occupying a total of 23.3% of gross cropped area. Rice contributes 43% of total food grain production and 46% of total cereal production in India. Among the rice growing countries in the world, India has the largest area under rice (about 45 m.ha.) and ranks second in production next to China (Kaul *et al.*, 2006) [6].

Aromatic rice varieties constitute a small but special group of rice and have gained greater importance with the worldwide increase in the demand for fine quality rice (Sun *et al.*, 2008) [10]. These are preferred around the world since ages because of the excellent aroma and palatability. Aromatic rice has occupied a prime position in the Indian society. There are many known groups of aromatic varieties such as basmati rice from India and Pakistan and Jasmine rice from Thailand. Usually in India, basmati rice is grown in north western states like Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir and parts of Uttar Pradesh (Nene, 1998) [7]. Basmati types enjoy a unique place for three distinct quality features like pleasant aroma, extra-long superfine grain and extreme grain elongation and soft texture of cooked rice. Accordingly, small and medium grained aromatic rice are being regarded as a separate class of non-Basmati aromatic rice. Although no concrete documentation exists, native areas of cultivation for most of these rice are known, are referred to as indigenous scented rice.

The Protection of Plant Varieties and Farmers' Rights Act, 2001 (PPV & FR Act, 2001) recognizes the farmers as breeders who bred new varieties as well as conserved the traditional varieties. The plant varieties must fulfil the distinctiveness, uniformity, stability (DUS) criteria for protection under the Act and hence, there is a need to characterize the aromatic short grain rice varieties according to DUS test guidelines for rice prescribed by PPV and FR Authority (2007). The variety identification serves the important goals such as mitigating legal claims ad confirming intellectual property rights and maintenance of genetic purity. Plant morphological characters have been recognised as the universally undisputed descriptors for DUS testing and varietal characterization of crop varieties.

The present trend of continuous release of rice varieties from Central and State Varietal Release Committee has warranted to develop suitable techniques for varietal identification at the laboratory level particularly when the seeds have been submitted for seed purity analysis.

Maintenance of genetic purity of varieties is of primary importance for preventing varietal deterioration during successive regeneration cycles and for ensuring varietal performance at an expected level. The chemical tests reveal differences among the seeds and seedlings of different varieties. These tests require virtually no technical expertise or training and can be completed in a relatively short time. The results of these tests are usually distinct, easily interpreted and help in grouping of the genotypes.

Materials and Methods

Standard Phenol Test

Seeds of aromatic short grain rice varieties were pre-soaked in distilled water for 24 hours at 25±1ºC. Then they were transferred on to two layers of Whatman NO.1 filter paper saturated with one per cent (1 gm of phenol in 100 ml of water) phenol solution. The petridishes were covered and incubated at 25ºC. The colour reactions were noted after 48 hours. Based on the development of seed coat colour, the aromatic short grain rice varieties are classified according to Jaiswal and Agarwal (1995) [4].

No change in colour

Light brown: The colour of lemma and palea turned light brown

Brown: The colour of lemma and palea turned brown

Dark: The colour of lemma and palea turned dark brown

Results

Although a set of morphological descriptors of seed are used for broad classification of aromatic short grain rice varieties are less distinct making morphological evaluation much more difficult for identification. In view of this biochemical tests are being used concurrently to reveal chemical differences among the seeds of aromatic short grain rice varieties. They require virtually no technical expertise or skill and can be completed in a relatively short time. Since the results of these tests are usually distinct and easily interpreted, an attempt was made to characterize and identify the aromatic short grain rice varieties. Phenol colour reaction is highly specific and monogenically controlled and the response is localized in seed coat. The reaction involves melanin formation by oxidizing phenol via anthoquinones and hydroxyquinones (Joshi and Banerjee, 1970) [5].

S. No	Aromatic short grain rice varieties	Phenol colour reaction
1	Nua Acharmati	Dark
2	Nua kalajeera	Dark
3	Nua Dhusura	No change in colour
4	Nua chinikamini	No change in colour
5	Barikunja	Light brown
6	Basumati	Light brown
7	Badshabhog	No change in colour
8	Bishnubhog	Dark
9	Chatianaki	No change in colour
10	Deulabhog	Dark
11	Dhanaprasad	No change in colour
12	Dubraj	Dark
13	Dulhabhog	No change in colour
14	Dangerbasamati	No change in colour
15	Ganagabali	No change in colour
16	Gopal bhog	No change in colour
17	Heerakani	No change in colour
18	Kanak champa	No change in colour
19	Karpurabasa	Light brown
20	Kusumabhog	No change in colour
21	Mugajai	No change in colour
22	Nalidhan	Brown
23	Neelabati	Dark
24	Nanu	No change in colour
25	Pimpudibasa	No change in colour
26	Ratnasundari	No change in colour
27	Sirimula	No change in colour
28	Tulasi phoola-1	No change in colour
29	Thakurasuna	No change in colour
30	Thakurabhoga	Dark

The reaction is controlled by the tyrosinase enzyme in the seed coat and it is under genetic control. Rimpi Bora et al. (2008) [8] reported that phenol colour test is the index of polyphenol oxidase activity, a simple, quick and accurate test for the distinction of cultivars. In the present study, eleven aromatic short grain varieties reacted positively whereas remaining nineteen aromatic short grain rice varieties reacted negatively to standard phenol test. . Based on standard phenol test, the aromatic short grain rice varieties were classified in to four groups as no change in colour (V_3, V_4, V_7, V_9, V_{11} V_{13}, V_{14}, V_{15}, V_{16}, V_{17}, V_{18}, V_{20}, V_{21}, V_{24}, V_{25}, V_{26}, V_{27}, V_{28} and V_{29}) light brown (V_5,V_6 and V_{19}),brown (V_{22}) and dark brown (V_1, V_2,V_8,V_{10}, V_{12},V_{23} and V_{30}). Thus based on the colour reaction of palea and lemma of seeds to standard phenol test can be effectively distinguished). The presence of metallic ions Fe++ and Cu++ in modified phenol test enhances activity of the enzyme, since these ions acts as catalyst for the tyrosinase enzyme which was further, confirmed by Gupta and Agarwal (1988) [3]; Agarwal and Karki (1989) [1]. Anithalakshmi (2002) revealed that colour reaction test of standard phenol along with Cu++ and Fe++ ions was useful in effective identification of rice genotypes.

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References

1. Agarwal RL, Karki BS. Identification of wheat varieties on the basis of laboratory evaluation. Univ. Agric. Technol. Pantnagar Res. Bull., 1989; 116:81.
2. Anitalakshmi. Characterization and identification of cultivars based on morphological and biochemical markers in rice (*Oryza sativa* L.) M.Sc. (Agri.) thesis submitted to the University of Agriculture Sciences, Bengaluru, 2002.
3. Gupta PK, Agarwal RL. Determination of varietal purity of paddy varieties by laboratory evaluation. Oryza. 1988; 25:310-314.
4. Jaiswal JP, Agarwal RL. Varietal purity determinations in rice modification of the phenol test. Seed Sci. & Technol. 1995; 23:33-42.
5. Joshi MG, Banerjee SK. Genetics of phenol colour reaction in emmer wheat. Proc. Intl. Seed Test. Assoc. 1970; 35:207.
6. Kaul S. Economic Analysis of Productivity and Profitability in Rice Production in India, Agriculture Situation in India, 2006, 12.
7. Nene YL. Basmati rice a distinct variety (cultivars) of the Indian sub-continent, Asian Agric. Hist. 1998; 2(3):175-188.
8. Rimpi Bora, Sharmila Dutta Deka, Priyabrata Sen. Identification of rice varieties of Assam based on grain characters and reaction to certain chemical tests. Seed Res. 2008; 36(1):51-55.
9. Subbaiah PV, Sekhar MR, Reddy KHP, Reddy NPE. Variability and genetic parameters for grain yield and its components and kernel quality attributes in CMS based rice hybrids (*Oryza sativa* L.), International Journal of Applied Biology and Pharmaceutical Technology. 2011; 2(3):603-609.
10. Sun GX, Williams PN, Carey AM, Zhu YG, Deacon C, Raab A *et al*. Inorganic As in rice bran and its products are an order of magnitude higher than in bulk grain, Environ Sci Technol. 2008; 42:7542-7546.