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RESEARCH ARTICLE

Grouping of Farmers' Varieties of Rice (*Oryza sativa* L.) Collected from West Bengal and Adjoining States

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A total of 132 Farmers' Varieties (FVs) of rice have been grouped into different classes based on the colour of basal leaf, days to 50% flowering, length of the stem (excluding panicle), length of decorticated grain, shape of decorticated grain (in lateral view), colour of decorticated grain, amylose content of endosperm and aroma of decorticated grain. Basal leaf colour of the most of the FVs was green. Based on the days to 50% flowering most of the FVs were classified under late to very late category. Again majority of the FVs were categorized into moderate and long in respect of length of the stem (excluding panicle). The rice genotypes with long slender decorticated grain have importance in international market. The FVs Uttar Banga Local-18, Birali-selection, Uttar Banga Local-17, Tulaipanji, Uttar Banga Local-14, Dudheswar-AD, Uttar Banga Local-16, Malbati, Rampha, Biroi, Uttar Banga Local-19, Kalturey, Tulaipanji-AD were classified as long slender. Decorticated coloured rice is reported to be potent sources of antioxidants and their consumption is encouraged. Decorticated grain colour of the FVs Chakhao Poireiton, Chakhao Angangbi, Chakhao Amubi, Chakhao-Selection-2, Sadabhatkalo were dark purple. Most of the FVs were non-aromatic, only 25 cultivars were found to have strong aroma on cooking and 23 were found to have mild aroma. The FVs which have been classified under desirable groups may be used for further improvement of rice based on specific character of donor.

Key Words: Grouping, Farmers' varieties, PPV&FR, Rice, *Oryza sativa*

Introduction

India rich in genetic diversity for scented and non-scented Farmers' Varieties (FVs) of rice in general and Northeastern India in particular (Roy *et al*., 1985; Talukdar *et al*., 2012; Chakravorty and Ghosh, 2013) and they are currently under production whose identity and distinctiveness needs to be established by various approaches. Landraces and wild species possess immense potential of most valuable genes which can be efficiently utilized in the breeding programmes to develop high yielding rice varieties with quality and resistance to biotic and abiotic stresses (Tirkey *et al*., 2013).

There is strong need that the local germplasm of rice to be collected, preserved and characterized in detail (Chakrabarty *et al*., 2012), subsequent development of suitable cultivar. Rice varieties have been developed traditionally by selection, hybridization and backcross with locally adapted high yielding genotypes. The numbers of parental lines are very limited which lead to narrow genetic base. Genetic uniformity in crop can be undesirable in terms of vulnerability of the crop to epidemics. A new important source for the introduction of new trait or development of new plant type is the existence of genetically diverse gene pool of scented and non-scented rice in our country. Until a collection is properly evaluated it is little practical use (Chang, 1976). Considering the importance of FVs of rice, the present investigation was planned to characterize the collected FVs of rice (Table 1) available in Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal and to identify the important traits which can be used in improvement of rice by the breeders. Based on DUS testing, the rice varieties usually are divided into different groups to facilitate the assessment of Distinctiveness. Following the guideline of Protection of Plant Varieties and Farmers' Rights (2007), the available FVs of rice at Uttar Banga Krishi Viswavidyalaya, Pundibari were grouped into different classes based on eight characters. This study will also be useful in generation of distinctiveness and subsequently registration of FVs under PPV & FRA.

Materials and Methods

One hundred thirty two Farmers' Varieties (FVs) of rice were used in this study, of which 48 were aromatic and

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Table 1. Name of the Farmers' Varieties of rice used in this study and their place of collection

Sl. No.	Name of farmers' variety	Place of collection/ source of the seed
1.	Ayangleima Phou	Central Agriculture University, Imphal, Manipur
2.	Badshabhog	Maldah district, West Bengal
3.	Baigonmacchua	Tarai Research Society, Alipurduar, West Bengal
4.	Baigonbuchi	Uttar Dinajpur district, West Bengal
5.	Betho	Alipurduar district, West Bengal
6.	Beto	Tarai Research Society, Alipurduar, West Bengal
7.	Binni	Tarai Research Society, Alipur Duar, West Bengal
8.	Birai	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
9.	Birali-Selection	UBKV, Pundibari, Cooch Behar, West Bengal
10.	Biroi	Tarai Research Society, Alipurduar West Bengal
11.	Bitti	PSBSG, Sitalkuchi, Cooch Behar district, West Bengal
12.	Boichi	Alipurduar district, West Bengal
13.	Bonnidhan	Tarai Research Society, Alipurduar, West Bengal
14.	Bora	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
15.	Chakhao Amubi	Central Agriculture University, Imphal, Manipur
16.	Chakhao Angangbi	Central Agriculture University, Imphal, Manipur
17.	Chakhao Poireiton	Central Agriculture University, Imphal, Manipur
18.	Chakhao-Selection-1	UBKV, Pundibari, Cooch Behar, West Bengal
19.	Chakhao-Selection-2	UBKV, Pundibari, Cooch Behar, West Bengal
20.	Chakhao-Selection-3	UBKV, Pundibari, Cooch Behar, West Bengal
21.	Chakhao Sempak	Central Agriculture University, Imphal, Manipur
22.	Chapka Chakhao	Central Agriculture University, Imphal, Manipur
23.	Chinakamani	BCKV, Mohanpur, West Bengal
24.	Dharam Phou	Central Agriculture University, Imphal, Manipur
25.	Dhyapa	Alipurduar district, West Bengal
26.	Dubari Komal	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
27.	Dudhekalam Motajosawa	Tarai Research Society, Alipurduar, West Bengal
28.	Dudhekalam-1	Tarai Research Society, Alipurduar, West Bengal
29.	Dudhekalam-9	Tarai Research Society, Alipurduar, West Bengal
30.	Dudheswar	Tarai Research Society, Alipurduar, West Bengal
31.	Dudheswar -AD	Tarai Research Society, Alipurduar, West Bengal
32.	Fudugey	Kalimpong, Darjeeling district, West Bengal
33.	Garu Chakhua	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
34.	Ghee Bora	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
35.	Gobindobhog	BCKV, Mohanpur, West Bengal
36.	Hatidat Komal	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
37.	Jailang Lal Komal	ICAR-CPRI- Kahikuchi, Kamrup, Assam
38.	Jaldhyapa-2	Sitalkuchi, Cooch Behar district, West Bengal
39.	Jaldhyapa-3	Cooch Behar district, West Bengal
40.	Jaldhyapa-AD	Tarai Research Society, Alipurduar, West Bengal
41.	Jasawa-AD	Alipurduar district, West Bengal
42.	Jashoya	Tarai Research Society, Alipurduar, West Bengal
43.	Jhagarikartik	Tarai Research Society, Alipur Duar, West Bengal
44.	Jhapaka	Kalimpong, Darjeeling district, West Bengal
45.	Jonroi Buna	Uttar Dinajpur district, West Bengal
46.	Kabra	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
47.	Kagey	Kalimpong, Darjeeling district, West Bengal
48.	Kaike	Tarai Research Society, Alipurduar, West Bengal
49.	Kalakali	Tarai Research Society, Alipur Duar, West Bengal
50.	Kalo Khasa	Uttar Dinajpur district, West Bengal
51.	Kalo Nunia	Cooch Behar district, West Bengal
52.	Kalobhog-Selection	UBKV, Pundibari, Cooch Behar, West Bengal
53.	Kaloboichi	Tarai Research Society, Alipur Duar, West Bengal
54.	Kalodhyapa	Tarai Research Society, Alipurduar, West Bengal
55.	Kalojeera	BCKV, Mohanpur, West Bengal
56.	Kalshepa	Tarai Research Society, Alipurduar, West Bengal

Sl. No.	Name of farmers' variety	Place of collection/ source of the seed
57.	Kalturey	Kalimpong, Darjeeling district, West Bengal
58.	Kashiya Binni	Tarai Research Society, Alipurduar, West Bengal
59.	Kataribhog	Alipurduar, West Bengal
60.	Kauka	Alipurduar district, West Bengal
61.	Kauka-Selection	UBKV, Pundibari, Cooch Behar, West Bengal
62.	Khaiyamdhan	Tarai Research Society, Alipurduar, West Bengal
63.	Khama	Alipurduar district, West Bengal
64.	Kharadhan	PSBSG, Sitalkuchi, Cooch Behar district, West Bengal
65.	Khasa	Malda district, West Bengal
66.	Kola Joha-Big	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
67.	Kola Joha-Small	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
68.	Konkoni Joha	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
69.	Ladu	PSBSG, Sitalkuchi, Cooch Behar district, West Bengal
70.	Lagidhan	Tarai Research Society, Alipurduar, West Bengal
71.	Laldhyapa	Tarai Research Society, Alipurduar, West Bengal
72.	Maitee	Kalimpong, Darjeeling, West Bengal
73.	Malbati	Tarai Research Society, Alipurduar, West Bengal
74.	Malshira	Tarai Research Society, Alipurduar, West Bengal
75.	Mangamuthi	Tarai Research Society, Alipurduar, West Bengal
76.	Marichsal	Tarai Research Society, Alipur Duar, West Bengal
77.	Mohanbhog	BCKV, Mohanpur, West Bengal
78.	Munimahuari	Kalimpong, Darjeeling district, West Bengal
79.	Pahariboichi	Jalpaiguri district, West Bengal
80.	Pahariboichi-Selection	UBKV, Pundibari, Cooch Behar, West Bengal
81.	Panikuthi Shyamlal	Uttar Dinajpur district, West Bengal
82.	Phoolpakari-1	Tarai Research Society, Alipurduar, West Bengal
83.	Phoolpakari-2	Tarai Research Society, Alipurduar, West Bengal
84.	Phoren Mubi	Central Agriculture University, Imphal, Manipur
85.	Radhatilak	PSBSG, Sitalkuchi, Cooch Behar district, West Bengal
86.	Radhatilak-AD	Tarai Research Society, Alipurduar, West Bengal
87.	Radhunipagal	BCKV, Mohanpur, West Bengal
88.	Rampha	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
89.	Ronga Komal	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
90.	Sada Nunia	Cooch Behar district, West Bengal
91.	Sadabhatkalo	PSBSG, Sitalkuchi, Cooch Behar district, West Bengal
92.	Sadamala	Tarai Research Society, Alipurduar, West Bengal
93.	Satia	Tarai Research Society, Alipurduar, West Bengal
94.	Seshphal	Alipurduar district, West Bengal
95.	Sial Bhomra	Tarai Research Society, Alipurduar, West Bengal
96.	Silathia Bora	ICAR-CPCRI- Kahikuchi, Kamrup, Assam
97.	Singara	Alipurduar district, West Bengal
98.	Sitalkuchi-1	UBKV, Pundibari, Coch Behar, West Bengal
99.	Sitalkuchi-2	UBKV, Pundibari, Coch Behar, West Bengal
100.	Sitalkuchi-3	UBKV, Pundibari, Coch Behar, West Bengal
101.	Sitalkuchi-4	UBKV, Pundibari, Coch Behar, West Bengal
102.	Sitalkuchi-5	UBKV, Pundibari, Coch Behar, West Bengal
103.	Sitalkuchi-6	UBKV, Pundibari, Coch Behar, West Bengal
104.	Tarapakari	Tarai Research Society, Alipurduar, West Bengal
105.	Tarapakari-Selection	UBKV, Pundibari, Cooch Behar, West Bengal
106.	Thuri	PSBSG, Sitalkuchi, Cooch Behar district, West Bengal
107.	Tarai Research Society-1	Tarai Research Society, Alipurduar, West Bengal
108.	Tarai Research Society -2	Tarai Research Society, Alipurduar, West Bengal
109.	Tarai Research Society -3	Tarai Research Society, Alipurduar, West Bengal
110.	Tarai Research Society -4	Tarai Research Society, Alipurduar, West Bengal
111.	Tulaipanji	Uttar Dinajpur, West Bengal
112.	Tulaipanji-AD	Alipurduar, West Bengal
113.	Tulsibhog	Alipurduar, West Bengal
114.	Tulsimukul	Tarai Research Society, Alipurduar, West Bengal
115.	Uttar Banga Local -2	Tarai Research Society, Alipurduar, West Bengal
116.	Uttar Banga Local -3	Tarai Research Society, Alipurduar, West Bengal

Sl. No.	Name of farmers' variety	Place of collection/ source of the seed
117.	Uttar Banga Local -3-1	UBKV, Pundibari, Cooch Behar, West Bengal
118.	Uttar Banga Local -5	Tarai Research Society, Alipurduar, West Bengal
119.	Uttar Banga Local -6	Tarai Research Society, Alipurduar, West Bengal
120.	Uttar Banga Local -7	Tarai Research Society, Alipurduar, West Bengal
121.	Uttar Banga Local -8	Tarai Research Society, Alipurduar, West Bengal
122.	Uttar Banga Local -9	Tarai Research Society, Alipurduar, West Bengal
123.	Uttar Banga Local-10	Tarai Research Society, Alipurduar, West Bengal
124.	Uttar Banga Local -11	Tarai Research Society, Alipurduar, West Bengal
125.	Uttar Banga Local -12	Tarai Research Society, Alipurduar, West Bengal
126.	Uttar Banga Local -13	Tarai Research Society, Alipurduar, West Bengal
127.	Uttar Banga Local -14	Tarai Research Society, Alipurduar, West Bengal
128.	Uttar Banga Local -15	Tarai Research Society, Alipurduar West Bengal
129.	Uttar Banga Local -16	Tarai Research Society, Alipurduar, West Bengal
130.	Uttar Banga Local -17	Tarai Research Society, Alipurduar, West Bengal
131.	Uttar Banga Local -18	Tarai Research Society, Alipurduar, West Bengal
132.	Uttar Banga Local -19	Tarai Research Society, Alipurduar, West Bengal

Table 2. Grain types based on decorticated grain length and grain length: breadth ratio

Classes	Parameters
Short-slender	Length less than 6 mm, L:B ration 3 and above
Short-bold	Length less than 6 mm, L:B ratio less than 2.5 mm
Medium-slender	Length less than 6 mm, L:B ratio 2.5 to 3.0 mm
Long-slender	Length 6 mm and above, L:B ratio 3 and above
Long-bold	Length 6 mm and above, L:B ratio less than 3.0 mm
Extr-long slender	Length 7.5 mm and above, L:B ratio 3.0 mm and above

84 were non-aromatic. Details of the genotypes studied are being given in Table 1. The field experiment was carried out at the Instructional Farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, during *Kharif* season of 2013 and 2014. The farm is situated at 26°19′86″ N latitude and 89°23′53″ E longitude, at an elevation of 43 meter above mean sea level.

The FVs were grouped based on colour of basal leaf, days to 50% flowering, length of stem (excluding panicle), length of decorticated grain, shape of decorticated grain, colour of decorticated grain, amylose content of endosperm and aroma (Allidawati and Kustianto, 1989; Sood and Siddiq, 1978) to facilitate the assessment of Distinctiveness as per the Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on Rice (*Oryza sativa* L.) published by Protection of Plant Varieties and Farmers' Rights Authority (2007), Government of India. Characteristics, which are known from experience not to vary, or to vary only slightly within a variety and which in their various states are fairly evenly distributed across all varieties in the collection are suitable for grouping purpose. The experimental design used was randomized blocks design with 132 treatments (genotypes) and two replications.

Results and Discussion

The rice varieties for DUS testing usually are divided into groups to facilitate the assessment of Distinctiveness. Based on guideline of PPV&FRA (2007) FVs of rice were grouped and details are given below.

Basal Leaf Sheath Colour

The leaf sheath colour varied as green, light purple, purple lines and uniform purple. Out of 132 FVs, 110 FVs showed green coloured basal leaf sheath (Fig. 1a). This result also corroborates with the findings of many researchers that most of the FVs possess green coloured basal leaf sheath (Parikh *et al*., 2012; Chakrabarty *et al*., 2012; Chakravorty and Ghosh 2011, 2012, 2013; Tirkey *et al*., 2013; Subba Rao *et al*., 2013; Singh *et al*., 2015).

Seventeen FVs showed light purple coloured leaf sheath, four showed purple lines and one FV showed uniform purple coloured basal leaf sheath. Uniform purple colour of basal leaf sheath was also noted by Parikh *et al*. (2012). However, Chakravorty and Ghosh (2011) found no FV with uniform purple coloured basal leaf sheath among the 51 FVs.

Time of Heading (50% of plants with panicles)

Out of 132 FVs, only one FV (Fig. 1b) was found early time of heading, four were found medium, 39 were found late and 88 were found very late for 50%

heading. Findings of other researchers also showed that the most of the FVs fall under early and medium categories (Subba Rao *et al*., 2013). The early (Bitti) and medium early (Kalturey, Sada Nunia, Bora and Seshphal) may be tested for cultivation in other seasons, like *Boro* and *Aus*.

Stem Length (excluding panicle)

Stem length was categorized into five groups- very short (<91 cm), short (91-110 cm), medium (111-130 cm), long (131-150 cm) and very long (>150 cm). Five FVs were found very short stem length, eight were found to have short stem length (Fig. 1c), 64 were found to have medium stem length, 46 had long stem length, and nine were found to have very long stem length. Stem length is an important character which decides the susceptibility towards the lodging. In general, short to medium plant height is preferred as this makes easy all the intercultural activities. In addition, short height rice varieties are usually considered as lodging resistant. As per the findings of many rice workers the stem length of most of the FVs were medium and long (Chakravorty and Ghosh, 2012, 2013). However, Subba Rao *et al*. (2013) found that nearly all of the FVs they studied fallen under very short, short and medium categories. Only one variety (Kusum Kuntala) belongs to long category. Some other varieties with very long stem length are Muktasal, Jhulur, Manikachan (Chakravorty and Ghosh, 2012, 2013).

Decorticated Grain Length

In the present study, 63 FVs were found to possess short type of decorticated grain (Fig. 1d), 43 FVs were medium, 22 FVs were long type of decorticated grain length and only four FVs were had extra-long type of decorticated grain length. The decorticated grain length varied across the FVs of rice. This result also corroborates the findings of Chakrabarty *et al*. (2012), Subba Rao *et al*. (2013). Decorticated grain length is an important character for deciding grain shape with grain width. In general, longer grains are being preferred by most of the consumers.

Decorticated Grain Shape (in lateral view)

Shape is generally expressed as a ratio, between length and width. Shape of the decorticated grain was classified as short slender, short bold, medium slender, long bold, long slender, long slender (for Basmati type) and extra-long slender. Out of 132 FVs, none of them showed short slender and extra-long slender shape of decorticated grain. 46 FVs showed short bold shape of decorticated grain (Fig. 1e), 18 were medium slender, 54 were long-bold, and 13 showed long slender and one was found to be extra-long slender shape of decorticated grain.

Long grain rice has a low glycemic index than shorter grain rice. It also tends to be fluffier and less sticky than short grain. Medium slender rice is shorter and plumper than long grain and work better for a plant-based risotto or paella. Short grain rice is almost round in shape. The grains become glutinous and sticky when cooked, which is why it is also called 'sticky rice'. This is the best choice for rice puddings, sushi and rice balls. However, short grain rice is higher in glycemic index (https://www.huffingtonpost.com/ornish-living/make-the-switch-why-brown_b_8304558.html). As per the findings of Chakrabarty *et al*. (2012) majority of the FVs have been categorized under long bold and extra-long slender.

Decorticated Grain Colour

In present study out of 132, FVs 47 were found to have white decorticated grain colouration (Fig. 1f; Fig. 2), 34 were found light brown, seven were variegated brown, 13 were dark brown, 17 were light red, eight were red, one was purple and five FVs were found dark purple decorticated grain colouration. One FV was found to have variegated purple coloured decorticated grain.

The most common rice consumed by humans is white rice, followed by brown rice. However, rice genotypes with either red/purple or black bran layer have been cultivated for a long time in Asia (Ahuja *et al*., 2007). Coloured rice is reported to be potent sources of antioxidants and their consumption is encouraged (Yawadio *et al*., 2007, Anggraini *et al*., 2015). Black rice contains relatively high anthocyanin (primarily *cyaniding-3-O-glucoside and peonidin 3-O-glucoside*) in the pericarp layer which gives the dark purple color (Ryu *et al*., 1998; Takashi *et al*., 2001, Kristamtini *et al*., 2012). Anthocyanin is known for their bioactive properties and recognized as health-enhancing substances due to their antioxidant activities, anti-inflammatory, anticancer, anti-atherogenic, and anti-hypoglycemic effects (Wang and Stoner, 2008). Black rice is low in sugar but packed with healthy fibre and plant compounds that combat heart disease and cancer, according to scientists (Sutharut and Sudarat, 2012). Research suggests that the dark plant antioxidants, which mop up harmful molecules, can help

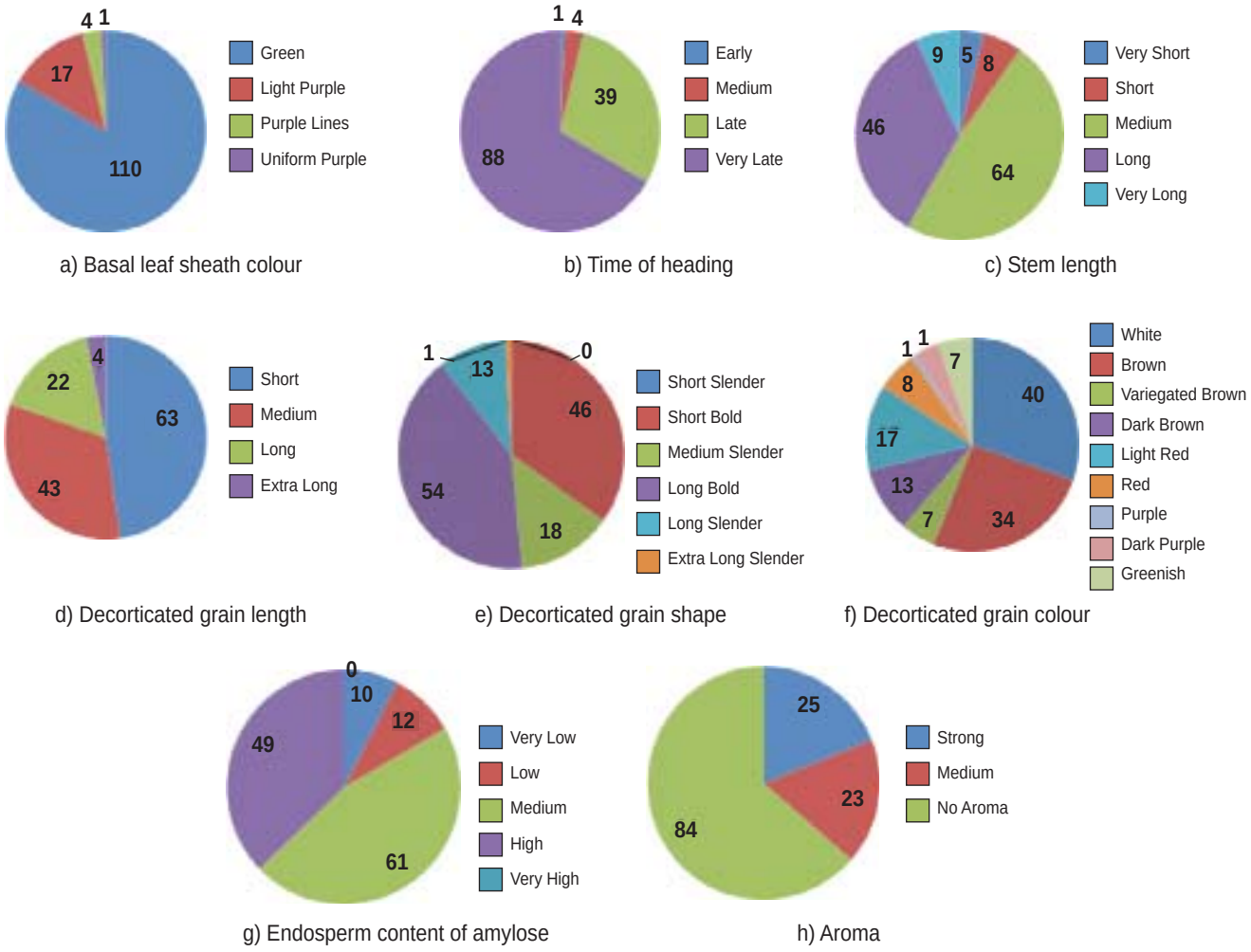

Fig. 1. Classification of the genotypes based on different characters as per PPV & FRA (2007). The numbers depicted in the pie-charts are the number of FVs in repective class.

protect arteries and prevent the DNA damage that leads to cancer. Colored rice have important roles in reducing risk of cancer and other chronic diseases because of their free radicals scavenging capacities (Wang and Stoner, 2008; Shih *et al*., 2007; Elisia *et al*., 2007; Elisia and Kitts, 2008). Black rice also contains higher levels of proteins, vitamins and minerals than common white rice (Suzuki *et al*., 2004).

Endosperm Content of Amylose

It is composed more than 80% starch and at molecular level starch contains amylose (linear chains glucose of α (1-4) linkages) and amylopectin (branched chain glucose with α(1-6) linkage (Henry and Kettlewell, 1996). The extent of amylose content in endosperm was classified into five categories, like very low (<10%), low (10-19%), medium (20-25%), high (26-30%) and very high (>30%). Ten FVs showed very low content of amylose in endosperm (Fig. 1g), 12 showed low amylose content, 61 showed medium and 49 showed high content of amylose in endosperm. None of them was showed very high content of amylose in endosperm. Amylose content is an important rice grain quality parameter in respect of consumer preference. In India, consumers prefer medium (20-25%) amylose content in the endosperm and this is an important parameter for promotion of rice entries during All India Rice Improvement Project (AICRIP) under Indian Council of Agricultural Research, India (Anonymous, 2017). Starch content (amylose) of rice is very important factors in grain yield, processing and palatability.

Decorticated Grain Aroma

Out of 132 FVs, 25 were found strong aromatic (Fig. 1h), 23 were found medium aromatic and remaining 84 were found non-aromatic. The Indian subcontinent has the *Natural Gift* of basmati rice that has been accepted as the best scented, long and slender grain in the national and international markets and gets high price. In addition to Basmati, many local landraces are grown traditionally which excel in aroma, grain quality and cooking quality.

A large number of aromatic FVs are available in our country, particularly in eastern and north-eastern states. Many researchers reported aromatic FVs of rice in their research articles (Chakrabary *et al*., 2012; Das *et al*., 2012; Tirkey *et al*., 2013; Semwal *et al*., 2014). Many FVs have strong aroma, but their other plant characters and/or grain characters may not be *at par* with the modern high yielding genotypes. Most of those aromatic FVs are poor yielders, for examples, Kalonunia, Tulaipanji, Kalojeera, Mohanbhog etc. On the other hand, few aromatic FVs possess high yielding ability, such as Gobindobhog, Badshabhog etc. Those FVs may be brought under cultivation through standardization of modern agronomic practices. In West Bengal, those strongly scented rice are generally used in preparation of *Khir* during special occasions and also offered during different pooja.

With growing demand for aromatic rice in the international market, high emphasis had been given for improvement of Basmati rice alone. The indigenous landraces with small and medium grained aromatic rice, which possesses outstanding aroma, grain quality, cooking quality and taste had been neglected. With introduction of high yielding genotypes of rice, the landraces that include aromatic quality are moving out of cultivation. A large number of aromatic rice has been already been lost and many are at the verge of extinction. Therefore, these local genotypes have to be collected and evaluated for their exploitation of genetic variability for development of suitable non-Basmati type aromatic cultivar. Further, management of the indigenous aromatic rice genetic resources by way of characterization and documentation helps in protection of these unique bio-resources. Improvement of aromatic rice employing the existing bio-resources would not only help farmers produce better-quality grain but would also generate more export income. Rice varieties have been

Fig. 2. Classification based on decorticated grain colour. A) White coloured decorticated grains (e.g., Seshphal, Baigonbuchi, Panikuthi Shyamlal etc.); B) Light brown coloured decorticated grains (e.g., Uttar Banga Local-9, Radhatlak-2, Uttar Banga Local-18 etc.); C) Dark brown coloured decorticated grains (e.g., Chakhao Sempak, Tarai Research Society-2, Uttar Banga Local-3 etc.); D) Red coloured decorticated grains (e.g., Sitalkuchi-2, Bitti, Kalshepa, Kaike etc.); E) Dark purple coloured decorticated grains (e.g., Chakhao Poireiton, Chakhao Angangbi, Sadabhatkalo etc.); F) Greenish coloured* decorticated grains (e.g., Uttar Banga Local-13, Uttar Banga Local-12, Kola Joha-Small etc.).
***This class has not been mentioned in 'Guidelines for the Conduct of test for DUS on rice (Oryza sativa L.). Protection of Plant Varieties and Famrer's Right Authority (PPV & FRA), Government of India, New Delhi. However some varieties showed greenish coloured decorticated grains (Surje Dinesh Tulsiram, 2016).**

developed traditionally by selection, hybridization and backcross selection with locally adopted high yielding genotypes. The numbers of parental lines are very limited which lead narrow genetic base. Genetic uniformity in crop can be undesirable in terms of vulnerability of the crop to epidemics. A new important source for the introduction of new trait or development of new plant type is the existence of genetically diverse gene pool of scented rice in our country.

In nutshell, desirable FVs could be selected for direct cultivation after standardization of modern agronomic practices based on grouping of the FVs in the present study the FVs from desirable groups may be used as donor in rice improvement programmes for different desirable traits.

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