

Morphological and Agronomic Characteristics of Two Unique Rice Landraces from West Bengal

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Selective breeding experiments by farmers over the past few millennia enormously expanded the genetic diversity of domesticated crops [1, 2]. The Indian rice (*Oryza sativa* var. indica) genome is one of the oldest cereals that has been subjected to selective breeding by farmers over generations, resulting in diverse landraces with different morphological and physiological characteristics, and different cultural uses [2, 3]. Here are reports on two unique rice landraces, Jugal and Sateen, collected by volunteers of the Centre for Interdisciplinary Studies (CIS), and maintained in the folk rice seed bank Vrihi (www.ciintdis.org/Vrihi.html). The first morphological description of Jugal [4], and that of Sateen was reported [5].

MATERIALS AND METHODS

Double-grain rice: This variety, named Jugal (Fig. 1), was accessed from Birbhum district in 1999. A number of such double-grain rice varieties were known to many farmers by different names (viz., Lav-Kush, Hara-Gouri, or Kanai-Balai), but are no longer in vogue. The variety named Jugal was rescued from a traditional farm in Birbhum district by K. K. Jana, a CIS volunteer in 1999. Ever since the collection of the type samples, the landrace has not been reported from any other farm. The name literally means "couple" in Bengali.

Triple-grain rice

An evanescent landrace named Sateen (Fig. 2) was accessed from the district of South 24 Parganas in 2003 by CIS volunteers from a

traditional farm margin. The name literally means "co-wives" in Bengali, flanking the two grains, flanking the "husband" grain in the middle.

Both of these landraces are being grown on CIS farm at Binodhati village in the district of Bankura. Selected agronomic and morphological traits of the cultivars were assessed in the years 1999, 2000 and 2004, following INGER system [5].

DESCRIPTION

Both the rice varieties are photoperiod sensitive, and are sown in June. The agronomic and morphological characteristics of Jugal and Sateen rices are given (Tables 1&2). A large proportion of spikelets of Jugal encapsulate two (Sometimes three) grains (Fig. 1), each with a functional endosperm and embryo. The frequency of spikelets with double-grain seeds in Jugal is about 41.4 per cent, whereas, that of three-grain seeds is 1 per cent or less (averaged from 50 panicles examined). The seed on the lemma side is slightly bolder and more curved than that lying on the palea side (Table 3).

Microscopic examination of the florets showed that the ovary is replicated, resulting in two (Sometimes three) grains. This variety has potential for use in functional genomics for organ growth and development and for eventual cloning of homeotic gene(s) that determine the number of reproductive organs or genes that regulate these homeotic genes (T. K. Ghose, Bose Institute, personal comm.). Both the grains within the spikelet are viable and capable of germination (Fig. 3).

Table 1. Agronomic characteristics of Jugal and Sateen rice

Landrace	Accession code	Vrihi district of origin	Land code	30% flowering date	Flowering duration (days)	Total duration (days)	Special agronomic features	Economic and cultural use
Jugal	JUGL-BM	Birbhum	Medium	19-Oct	11	147	Double-grain. BPH resistant	5
Sateen	STIN-ST	South 24 PGS	Medium low	21-Oct	13	148	Triple grain	4

Examination of a sample of 80 panicles shows that each panicle of Sateen has a mean number of 120 grains (With a range between 105 and 280 grains/panicle); each panicle bears a mean of 44.1 per cent of the spikelets containing one grain, 42.3 per cent with two grains, and 13.6 per cent with three grains (Table 3). The relative per cent high frequency of triplet grains, besides other morphological traits, distinguishes this landrace from Jugal [3]. The grain width of the singlet is greater than that in duplets or triplets. The grain on the lemma side is slightly bolder than the other two grains (Table 3).

An examination of the anatomy of the Sateen florets showed that its gynaecium tends to replicate repeatedly, so that two, three or even (Occasionally) four gynaecia with bifid ovaries develop within the same lemma and palea cover. The homeotic genes that govern ovarian development seem to remain functional for an exceptionally longer period than is normal for rice seed development. Panicle density, panicle weight, seed weight and the number of effective tillers per hill of both Jugal and Sateen are considerably high (Table 2A & B).

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Table 2a. Morphological characteristics of Jugal and Satreen: Plants and panicles

Landrace	Basal leaf sheath colour	Internode colour	Culm no./ till	Panicle no./ till	Crop height (cm)	Leaf angle	Flag leaf angle	Leaf length (cm)	Leaf width (cm)	Leaf L/W ratio	Leaf sheath colour	Culm strength	Secondary branching of panicle	Panicle axis length (cm)	Panicle weight (g)	Threshold	
Jugal	Purple	Yellow-Green	12.0	10.0	161.1	Erect	Erect	54.9	1.4	38.3	Green	Inter-mediate	Heavy	Straight	27.1	5.72	Difficult
Satreen	Purple	Yellow-Green	14.0	13.3	146.1	Horizontal	Horizontal	59.1	1.2	50.7	Green	Weak	Heavy	Straight	24.4	4.46	Inter-mediate

Table 2b. Morphological characteristics of Jugal and Satreen: Grains and seeds

Landrace	Awning	Awn colour	Awn length (mm)	Sterility%	Panicle density	Fragrance	Lemma and palea pubes-	Grain length (mm)	Grain width (mm)	Brown rice length (mm)	Brown rice weight (mm)	100-grain weight (g)	Lemma and palea colour	Apical colour	Grain roundness index	Bran colour
Jugal	Partly short and partly long	Straw	2	6.2	186.2	0	Short hairs	8.90	3.81	6.24	1.80	3.06	Gold furrow on straw	Purple	3.53	Light brown
Satreen	Partly short and	Gold	2	11.4	120.0	0	Short hairs	7.84	3.03	5.68	1.83	2.56	Pale yellow	Tawny brown	3.10	Light brown

Table 3. Brown rice length (BL) and width (BW) variations* in Jugal and Sateen

Landrace	No. of seeds	(%) of seeds	Position	BL (mm)	BW (mm)
Jugal	Singlet	59.6	-	6.24	2.80
	Duplets	41.4	Lemna	5.85	2.10
			Palear	5.85	1.60
Sateen	Singlet	44.1	-	6.28	2.70
	Duplets	42.3	Lemna	5.85	1.83
			Palear	5.85	1.72
			Middle	5.72	1.70
	Triplets	13.6			

*Based on a sample of 80 panicles



Fig. 2. Sateen with three kernels



Fig. 1. Jugal with two kernels



Fig. 3. Two seedlings germinating from each seed of Jugal rice