



# MORPHOLOGICAL CHARACTERIZATION AND COMPARISON OF DIFFERENT ACCESSIONS OF TRADITIONAL AROMATIC RICE VARIETIES BISNI, DUBRAJ, VISHNUBHOG AND CHINNOR

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## Abstract

The present studies were carried out to characterize four aromatic rice genotypes, prominent in different districts of Raipur. Each genotype has some unique characteristics and grain quality due to which these are very much popular among the consumers. No systematic study has been done on these genotypes and no marker traits are yet known for individual genotype. These genotypes were characterized for 45 stable diagnostic morphological traits. Variability for morphological traits was recorded for all stable diagnostic traits and genotypes; passport information of all traits for all individuals was recorded. All considered morphological descriptors showed markable differences in their distribution and amount of variations within them.

**Key words :** Aromatic rice, Dubraj, Bisni, medium slender and short slender grain types.

## Introduction

Chhattisgarh is well known for its biodiversity of rice including aromatic rice (Bisne and Sarawgi, 2008). More than 100 of traditional landraces of aromatic rice with pleasant aroma are grown in different parts of the state and their diversity and quality traits were studied (Das, 2009 and Das *et al.*, 2003). The rice in this state is grown twice or sometimes thrice in a year. Most of the landraces or varieties grown by the farmers are maintained by them since ancestry, simply by keeping the seed of previous year crop. These landraces are very famous in the state and outside among the consumers since having specific aroma and cooking quality. Most of these traditional aromatic rice varieties belong to medium to short slender grain type. Every district of Chhattisgarh has its own famous aromatic traditional rice variety. The varieties are maintained by different farmers of different villages with the same traditional name showed variability, for some of the traits since the seed is maintained by farmers without any scientific approach. Since, consumers prefer aromatic rice for daily consumption and ready to purchase at any market price, there is need to purify and improve these rice varieties for yield contributing traits.

There is need to purify traditional aromatic rice varieties maintained by the farmers, and characterized them for important diagnostic traits. Dubraj is a prominent traditional aromatic late maturing rice of C.G., with medium slender grain type with lot of aroma, mainly grown in Dhamtari district of C.G. and having very high market value. Similarly, Bisni is famous in Sarguja region, particularly in Surajpur, Bagicha and Ambikapur districts of C.G. It is medium maturing rice with small slender grain type, with aroma.

## Materials and Methods

In this study, accessions of Bisni from Surajpur and Ambikapur districts of C.G., Dubraj from Sinhwa, Nagri, Dhamtari districts of C.G., Vishnubhog from Pendra Road and Chinnor from Rajnandgaon and Dongargar district were collected from different farmer's field as single panicles in year 2011-12. These were evaluated for different traits and their improved lines were multiplied. These varieties were evaluated for DUS traits in order to identify genetic diversity present among them. Five hundred single panicle progenies for each accessions collected were grown and evaluated in rows. The best promising progenies were identified, characterised and multiplied. These best progeny rows identified from each farmers field is characterised for DUS as the descriptors

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proposed by Standard evaluation system (SES) IRRI (2002) in table 1. Observations were recorded on five randomly selected plants for 45 morphological and quality descriptors *viz.*, 1. Coleoptile color with classes colorless (1), green (2), purple (3), 2. Basal leaf sheath color with classes green(1), light purple(2), purple lines(3), purple(4), 3. Intensity of green color on leaf with classes Light(3), medium(5), dark(7), 4. Anthocyanin coloration of leaf with classes Absent(1), present(9), 5. Distribution of anthocyanin coloration on leaf with classes on tips only(1), on margins only(2), in blotches only(3), uniform(4), 6. Anthocyanin coloration on leaf sheath with classes Absent(1), present(9), 7. Intensity of anthocyanin coloration on leaf sheath with classes very weak(1), weak(3), medium(5), strong(7), very strong(9), 8. Presence of pubescence on leaf blade surface with classes Absent(1), weak(3), medium(5), strong(7), very strong(9), 9. Presence of auricles with classes with classes Absent(1), present(9), 10. Anthocyanin coloration of auricles with classes Colourless(1), light purple(2), purple(3), 11. Presence of collar on leaves with classes Absent(1), present(9), 12. Anthocyanin coloration of collar with classes Absent(1), present(9), 13. Presence of ligule on leaf with classes Absent(1), present(9), 14. Shape of ligule with classes Truncate(1), acute(2), split(3), 15. Color of ligule with classes Green(1), light purple(2), purple(3), 16. Length of leaf blade with classes Short(3), medium(5), long (7), 17. Width of leaf blade with classes Narrow(3), medium(5), broad(7), 18. Culm: attitude with classes erect(1), semierect(3), open(5), spreading(7), 19. Attitude of flag leaf blade with classes Erect(1), semierect(3), horizontal(5), deflexed(7), 20. Density of pubescence of lemma with classes Absent(1), weak(3), medium(5), strong(7), very strong(9), 21. Color of stigma with classes White(1), light green(2), yellow(3), light purple(4), purple(5), 22. Anthocyanin coloration of nodes with classes Absent(1), present(9), 23. Intensity of anthocyanin coloration of nodes with classes weak(3), medium(5), strong(7), 24. Anthocyanin coloration of internodes with classes Absent(1), present(9), 25. Attitude of flag leaf blade at late stage with classes Erect(1), semi-erect(3), horizontal(5), deflexed(7), 26. Curvature of main axis of panicle with classes Straight(1), semi-straight(3), drooping(5), deflexed(7), 27. Color of tip of lemma at ripening with classes White(1), yellowish(2), brown(3), red(4), purple(5), black(6), 28. Color of lemma and palea with classes Straw(1), gold and gold furrows on straw background(2), brown spots on straw(3), brown furrows on straw(4), brown (tawny)(5), reddish to light purple(6), purple spots on straw(7), purple furrows on straw(8), purple(9), black(10), 29. Presence of awns on panicles

with classes Absent(1), present(9), 30. Color of awns with classes yellowish white(1), yellowish brown(2), brown(3), reddish brown(4), light red(5), red(6), light purple(7), purple(8), black(9), 31. Distribution of awns with classes tip only(1), upper half only(3), whole length(5), 32. Presence of secondary branching on panicles with classes Absent(1), present(9), 33. Density of secondary branching on panicles with classes Weak(1), strong(2), clustered(3), 34. Attitude of branches with classes Erect(1), erect to semi-erect(3), semi-erect(5), semi-erect to spreading(7), spreading(9), 35. Exertion of panicle with classes partly exerted(3), exerted(5), well exerted(7), 36. Leaf senescence with classes Early(3), medium(5), late(7), 37. Days to 50 percent flowering with classes very early (<71 days)(1), early (71-90 days)(3), medium (91-110 days) (5), late (111-130 days)(7), 38. Stem/culm length (cm) with classes very short (<91 cm)(1), short (91-110 cm)(3), medium (111-130 cm)(5), long (131-150 cm)(7), very long (>150 cm)(9), 39. Panicle length (cm) with classes very short (<16 cm)(1), short (16-20 cm)(3), medium (21-25 cm)(5), long (26-30 cm)(7), very long (>30 cm)(9), 40. Thousand seed weight(g) with classes very low(1), low(3), medium(5), high(7), very high(9), 41. Kernel length with classes very short(1), short(3), medium(5), long(7), very long(9), 42. Kernel breadth with classes very narrow(1), narrow(3), medium(5), broad(7), very broad(9), 43. Amylose content with classes very low (<10%)(1), low(10-19%) (3), medium (20-25%) (5), high (26-30%) (7), very high (>30%)(9), 44. Alkali spreading value with classes Low (1), medium (3), high medium(5), high (7) and 45. Aroma with classes Absent (1), present (9).

## Results and Discussion

Any variety can be identifying through its distinguished stable morphological traits. These traits may be monogenic or polygenic. The stable morphological traits can be used as reliable morphological markers, for identification of a variety since they are govern by major gene and less influenced by environment. Each variety must have certain novel diagnostic features which will distinguish a variety from others. Such diagnostic characters should uniformly present in the population and should be inherited in next generation than only the character is supposed to be stable and can be used as morphological marker traits to diagnose that variety.

Out of numbers of progenies evaluated two accessions of Bisni, three accessions of Dubraj, two accessions of Vishnubhog and two accessions of Chinnor were identified promising. These accessions were purified, multiplied and their progenies were critically evaluated

**Table 1** : Descriptors and their codes of 45 morphological traits examined.

S. no.	Characteristics	Description	Growth stage
1.	Coleoptile color	Colourless (1), green(2), purple(3)	First leaf stage
2.	Basal leaf sheath color	Green (1), light purple (2), purple lines (3), purple (4)	Early boot stage
3.	Intensity of green color on leaf	Light(3),medium(5), dark(7)	Early boot stage
4.	Anthocyanin coloration of leaf	Absent(1), present(9)	Early boot stage
5.	Distribution of anthocyanin coloration on leaf	On tips only (1), on margins only (2), in blotches only (3), uniform (4)	Early boot stage
6.	Anthocyanin coloration on leaf sheath	Absent(1), present(9)	Early boot stage
7.	Intensity of anthocyanin coloration on leaf sheath	Very weak(1), weak(3), medium(5), strong(7), very strong(9)	Early boot stage
8.	Presence of pubescence on leaf blade surface	Absent(1), weak(3), medium(5), strong(7), very strong(9)	Early boot stage
9.	Presence of auricles	Absent(1), present(9)	Early boot stage
10.	Anthocyanin coloration of auricles	Colourless(1), light purple(2), purple(3)	Early boot stage
11.	Presence of collar on leaves	Absent(1), present(9)	Early boot stage
12.	Anthocyanin coloration of collar	Absent(1), present(9)	Early boot stage
13.	Presence of ligule on leaf	Absent(1),present(9)	Early boot stage
14.	14. Shape of ligule	Truncate(1), acute(2), split(3)	Early boot stage
15.	15. Color of ligule	Green(1), light purple(2), purple(3)	Early boot stage
16.	16. Length of leaf blade	Short(3), medium(5),long (7)	Early boot stage
17.	17. Width of leaf blade	Narrow(3), medium(5), broad(7)	Early boot stage
18.	18. Culm: attitude	Erect(1),semierect(3),open(5),spreading(7)	Early boot stage
19.	Attitude of flag leaf blade	Erect (1), semi erect (3), horizontal (5), deflexed (7)	Beginning of anthesis
20.	Density of pubescence of lemma very strong (9)	Absent (1),weak (3), medium (5), strong (7),	Beginning of anthesis to dough development
21.	Color of stigma	White(1), light green(2),yellow(3), light purple(4), purple(5)	Anthesis half-way
22.	Anthocyanin coloration of nodes	Absent(1), present(9)	Milk development
23.	Intensity of anthocyanin coloration of nodes	Weak(3), medium(5), strong(7)	Milk development
24.	Anthocyanin coloration of internodes	Absent(1), present(9)	Milk development
25.	Attitude of flag leaf blade at late stage	Erect(1), semi-erect(3), horizontal(5), deflexed(7)	Ripening stage
26.	Curvature of main axis of panicle	Straight(1), semi-straight(3), drooping(5), deflexed(7)	Ripening stage
27.	Color of tip of lemma at ripening	White(1), yellowish(2), brown(3), red(4), purple(5), black(6)	Dough development to ripening
28.	Color of lemma and palea	Straw(1), gold and gold furrows on straw background(2), brown spots on straw(3), brown furrows on straw(4),brown (tawny)(5), reddish to	Dough development to ripening

*Table 1 continued....*

Table 1 continued....

		light purple(6), purple spots on straw(7), purple furrows on straw(8), purple(9), black(10)	
29.	Presence of awns on panicles	Absent(1), present(9)	Ripening stage
30.	Color of awns	Yellowish white (1), yellowish brown (2), brown (3), reddish brown (4), light red (5), red (6), light purple (7), purple (8), black (9)	Ripening stage
31.	Distribution of awns	Tip only(1), upper half only(3), whole length(5)	Ripening stage
32.	Presence of secondary branching on panicles	Absent(1), present(9)	Ripening stage
33.	Density of secondary branching on panicles	Weak(1), strong(2), clustered(3)	Ripening stage
34.	Attitude of branches	Erect (1), erect to semi-erect (3), semi-erect (5), semi-erect to spreading(7), spreading (9)	Ripening stage
35.	Exertion of panicle	Partly exerted (3), exerted (5), well exerted (7)	Ripening stage
36.	Leaf senescence	Early(3), medium(5), late(7)	Caryopsis hard
37.	Days to 50 percent flowering	Very early (<71 days) (1), early (71-90 days) (3), medium (91-110 days)(5), late (111-130 days)(7), very late (>130 days)(9)	Ripening stage
38.	Stem/culm length (cm)	Very short (<91 cm) (1), short (91-110 cm) (3), medium (111-130 cm) (5), long (131-150 cm) (7), very long (>150 cm) (9)	Milk development
39.	Panicle length (cm)	Very short (<16 cm)(1), short (16-20 cm)(3), medium (21-25 cm)(5), long (26-30 cm)(7), very long (>30 cm)(9)	Milk development to Ripening stage
40.	Thousand seed weight(g)	Very low(1), low(3), medium(5), high(7), very high(9)	Caryopsis hard
41.	Kernel length	Very short(1), short(3), medium(5), long(7), very long(9)	Caryopsis hard
42.	Kernel breadth	Very narrow(1), narrow(3), medium(5), broad(7), very broad(9)	Caryopsis hard
43.	Amylose content	Very low (<10%) (1), low(10-19%) (3), medium (20-25%) (5), high(26-30%) (7), very high (>30%) (9)	Caryopsis hard
44.	Alkali spreading value	Low(1), medium(3), high medium(5), high(7)	Caryopsis hard
45.	Aroma	Absent(1), present(9)	Caryopsis hard

for 45 diagnostic DUS descriptors and compared individually for the variability exists among them in table 2.

**Bisni** : Bisni was collected from Surajpur and Bagicha distt. of Sarguja. This is a medium maturing (120 days) genotype, medium heighted, spreading type plant characters with strong aroma since seedling stage to grain stage. Two accessions of Bisni were compared for 45 DUS descriptors and it was observed that they were different only for one trait of apiculus color. Bisni-1 had white apiculus color whereas Bisni-II had purple tip. For rest of the traits both accessions were similar.

**Chinnor** : Chinnor collected from Rajnandgaon Distt. has two major accessions. The major morphological variations recorded among two accessions of Chinnor were anthocyanin colorations of auricles which was colorless in Chinnor-I, but purple in Chinnor-II. In Chinnor-I the shape of ligule was short whereas in Chinnor-II, it was long. The attitude of flag leaf blade was horizontal in case of Chinnor-I, but in Chinnor-II, it was erect. The thickness of stem in Chinnor-I was thin whereas in Chinnor-II, it was thick. Awns were present in Chinnor-II, but absent in Chinnor-I. Color of awns was yellowish white in Chinnor-II. Secondary branching was strong in Chinnor-I, but in Chinnor-II, it was clustered. In

**Table 2 :** Morphological traits of thirty eight aromatic rice germplasm.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Bisni-1	2	1	5	1	-	1	-	5	9	1	9	1	9	3	1	5	7	7	3	3	3	1	-	1	3
Bisni-2	2	1	5	1	-	1	-	5	9	1	9	1	9	3	1	5	7	7	3	3	3	1	-	1	3
Chinnor –I	2	1	3	1	-	1	-	3	9	1*	9	1	9	3	1	3*	7	1	5*	5*	1	1	-	1	5*
Chinnor-II	2	1	3	1	-	1	-	3	1	3*	9	1	9	3	1	7*	7	1	1*	7*	1	1	-	1	1*
Dubraj-I	2	1	5	1	-	1	-	3	9	1*	9	1	9	3	1	7	7	1	1	7	1	1	-	1	1
Dubraj-II	2	1	5	1	-	1	-	3	9	2*	9	1	9	3	1	7	7	1	1	7	1	1	-	1	1
Dubraj-III	2	1	5	1	-	1	-	3	9	2*	9	1	9	3	1	7	7	1	1	7	1	1	-	1	1
Vishnubhog-I	2	1	5	1	-	1	-	1	9	1	9	1	9	3*	1	3*	7	1	3	7*	1*	1	-	1	3
Vishnubhog-II	2	1	5	1	-	1	-	1	9	1	9	1	9	2*	1	5*	7	1	3	5*	3*	1	-	1	3

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Bisni-1	1	1*	1	1	-	-	9	3	1	7	3	3	3	-	3	5	5	9	1	9
Bisni-2	1	5*	1	1	-	-	9	3	1	7	3	3	3	-	3	5	5	9	1	9
Chinnor –I	3	1	1	1*	.*	.*	9	2*	3	7	7	5	3	.*	3*	5*	5	9	5*	9
Chinnor-II	3	1	1	9*	1*	5*	9	3*	3	7	7	5	3	7*	5*	9*	5	9	1*	9
Dubraj-I	1	1	1	9	1	5	9	3	3	7*	3	5	3*	7	5	9	5	9	1	9
Dubraj-II	1	1	1	9	1	5	9	3	3	7*	3	5	1*	7	5	9	5	9	1	9
Dubraj-III	1	1	1	9	1	5	9	3	3	5*	3	5	1*	7	5	9	5	9	1	9
Vishnubhog-I	3	1	1	1	-	-	9	3	3*	7	5	5	3	-	3	5	5*	3	3*	9
Vishnubhog-II	3	1	1	1	-	-	9	3	5*	7	5	5	3	-	3	5	3*	3	5*	9

Character(s) with \* marks showed variability.

Chinnor-I the length of decorticated grain was short but medium in Chinnor-II. The width of decorticated grain was medium in Chinnor-I whereas in Chinnor-II, it was narrow. The shape of decorticated grain in Chinnor-I was medium slender whereas in Chinnor-II, it was short slender. Similarly, the color of decorticated grain was white in Chinnor-I, but light brown in Chinnor-II. In Chinnor-I the alkali speding value is medium, but in Chinnor-II this was low.

**Dubraj :** Three accessions of Dubraj were critically studied for DUS descriptors and it was observed that all three accessions of Dubraj were of same maturity group, with similar plant height (110 cm), all were late (140 days) to very late (145 days) maturing, seeds of all the accessions have aroma. The major morphological differences as per 47 DUS descriptors were for length of main axis of panicle, for Dubraj-1, it was long, for Dubraj-II and Dubraj-III the length of main axis were medium. Number of panicles per plant in Dubraj-1 were few but in Dubraj-II and Dubraj-III, these were medium in numbers. Length of leaf blade also varied, in Dubraj – I, it was medium, whereas in Dubraj-II and Dubraj-III length of leaves were long. Maturity duration in Dubraj-I was late (140 days), but in Dubraj-II and Dubraj-III the maturity time was very late (145 days). In Dubraj-I and Dubraj-II the panicles were well exerted, but in Dubraj – III panicles were normal exerted. In the post harvest

observations decorticated grain length was short for Dubraj-1, Medium for Dubraj-II and Dubraj-III, whereas decorticated grain width was narrow for Dubraj-I and Dubraj-III, whereas medium for Dubraj-II. The decorticated grain shape was short slender for Dubraj-I, medium bold for Dubraj-II and medium slender for Dubraj-III. In Dubraj-I and Dubraj- III amylase content of endosperm was very high, but in Dubraj-II it was medium.

**Vishnubhog :** Out of number of progenies evaluated two promising accessions of Vishnubhog, *i.e.* Vishnubhog-I and Vishnubhog –II for different morphological descriptors. The density of pubescence in lemma were medium in Vishnubhog-I but strong in Vishnubhog-II. The length of leafblade was short in Vishnubhog-I, but in Vishnubhog-II, it was medium. Color of stigma of Vishnubhog-I was white whereas in Vishnubhog-II, it was yellow. Distribution of awns on panicles were absent in Vishnubhog-I, but few in Vishnubhog-II. Vishnubhog-I matures very late (145 days) but Vishnubhog-II matures late (140 days). The decorticated grain length of Vishnubhog-I was very short, whereas in Vishnubhog-II, it was short. Similarly, the width of decorticated grain was medium in Vishnubhog-I, but narrow in Vishnubhog-II. In Vishnubhog-I the decorticated grain color was white, but light brown in case of Vishnubhog-II.

Chhattisgarh is rich for its biodiversity in rice landraces, cultivated varieties and wild types. More than 273 aromatic landraces are reported by Richharia (1979). Although, these landraces does not have long grain type like Basmati but medium to small seeds with aroma have its economic importance. This aromatic landraces are highly preferred by local people individual's diets and have 2-3 times more market cost than the any other high yielding rice varieties. Hence, there is need to purify, evaluate these landraces and to identify the market to export them in international market. Although, these varieties having market value and also preferred by people, but no improvement programme has been taken yet.

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