Investigation on the morphological traits of different varieties *Bora-Rice (Oryza sativa L.)* cultivated in Bongaigaon District of Assam, India

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[Received 18.12.2019; Revised 11.06.2020; Accepted 15.06.2020; Published 30.06.2020]

Abstract

Along with the worldwide population explosion the demand for food-grains is increasing steadily and forcing farmers to opt for modern cultivation methods and crops of high yielding varieties, leaving aside the traditional methods and indigenous crop varieties. This has led to the extinction of some important Rice land-races from different localities. But, somehow, the farmers of Bongaigaon district of Assam are yet to given up their traditional rice cultivars from their fields. Major Rice varieties like *Abu*, *Sali* and *Boro* are cultivated in Assam. The farmers of Bongaigaon district prefer to cultivate different varieties of *Bora-rice* which are commonly referred as 'bonni' Rice. Present investigation in the Bongaigaon district during 2014 – 2016 recognized eight *Bora-rice* cultivars, namely *Nalbonni*, *Buribonni*, *Sababonni*, *Sikarabonni*, *Anarashibonni*, *Bhogbonni*, *Kritirajbonni* and *Pakhatibonni*. All these cultivars produce glutinous rice. The study also recognized the morphological differences among these cultivars in some important traits like grains per panicle, shape, size, weight and volume of paddy and rice grains. It was found that though all the eight cultivars of *Bora-rice* showed some unique characteristics, which might be utilized for their identification at cultivar level.

Key words: *Bora-rice*, Grain character, Bongaigaon, Assam

INTRODUCTION

People of North-Eastern region of India, though vastly culturally diverse, depends on rice as their principal crop. The germplasm collection has also unfold the occurrence of large number of rice landraces in the region (Hore 2005; Roy 2018). The indigenous germplasm of North-east India represents a wealth of valuable gene systems (Sharma *et al.* 1971). North east India, including Assam, is recognized as a Centre of Origin of rice and is endowed with exceptionally rich in rice diversity (Sarma & Bahar 2005). Variation in ecological condition, ethnic diversity, diverse cultural practices and different quality preferences contribute to the diversity present in different types of rice, locally known as *Abu*, *Sali*, *Boro*, *Bora*, *Joha*, *Labi* etc. (Pathak 2001). *Bora* is a glutinous rice variety and are gaining prime attention for value-added rice farming. This class of rice is required to prepare a number of food items during any festival, religious occasions and ceremonies. It has an important role in Assamese tradition as many communities here also prepare high class rice-beer using *Bora-rice* (Deka *et al.* 2014). Occasions like *Bihu* is not complete without different dishes made out of *Bora-rice*. It is used in wide variety of *jolpan* (snacks) and *pittha* (rice cake). Soaked and ground *Bora-rice* is used in preparing *pittha*. Boiled *Bora-rice* grain is served as *jolpan* with curd or milk, jaggery or sugar. Some people use *Bora-rice* to make simple cooked-rice or *bhaat*, which is very delicious, but sticky in texture. During the Ahom reign in Assam *Bora-rice* grains with duck-eggs was used in constructing buildings because of its sticky nature of the mixture (<https://en.m.wikipedia.org>).

Figure 1. Location map of the Study Area [paddy fields at: S1. Deohati; S2. Srijangram; S3. Papragaon; S4. Adalaguri; S5. Khagarpur; S6. Shankarghola; S7. Nankargaon; S8. Dangtol; S9. Chitkagaon; S10. Kabaitari; S11. Kayethpar; S12. Dashimapara; S13. Sonakhuli; S14. Tengaigaon; S15. Meshpara; S16. Hatiutra; S17. Saonagaon; S18. Dolaigaon; S19. Kokila; S20. Sukani; S21. Tulungia; S22. Chaparakata; S23. Shakomura; S24. Nimagaon; S25. Talguri; S26. Bidyapur; S27. Jogighopa; S28. Nigamghola; S29. Kasharpara; S30. Kakragaon; S31. Barghola; S32. Panchapur; S33. Lalmati; S34. Shingimari and S35. Kahidoba]

Bongaigaon (26°28'22" N to 26°54'22" N and 89° E to 89°56'22" E) is an agriculturally rich district of Assam (Figure1). Terrain of the major portion of the study area is of running plains that is traversed by two rivers, Tunia and Kujia. The climate of this tropical region is characterized by the highly humid atmosphere with abundant precipitation mainly from the south-west monsoon during the months of June to September resulting in heavy rainfall. 4632.2 mm/ annum (BGR, IOCL 2010). Prevailing favorable climate as well as the conservative and selective attitudes of different ethnic groups helped to select and preserve good number of traditional rice-varieties in the area.

To record and understand how many different types of *Bora*-rice is cultivated in different localities of Bongaigaon district, and how they differ from one another morphologically; a field survey was conducted during November to January (rice harvesting periods) for two consecutive years, 2014 – 2015 and 2015 – 2016 in different localities of Bongaigaon district.

MATERIALS AND METHODS

Thirty five paddy-fields from Bongaigaon district were selected randomly and named as S1, S2, S3, S35 (Figure-1). The survey was conducted for two successive years, during November to January of 2014 – 2015 and 2015 – 2016. This is the harvesting period for *Bora*-rice cultivars. Along with regular field visit farmers of different localities were communicated to avail information regarding the local name and mode of use for each cultivars. Paddy and rice-grains of *Bora* varieties were collected from these localities for the study. The parameters and methods followed were:

- Height of the plant (in meter and centimeter)
- Length of the spike (in centimeter)
- Number of grains per spike
- Length of the awn (in centimeter)
- Weight of 1000 grains of paddy and rice grain (in grams, using electronic balance)
- Volume of 1000 grains of paddy and rice grain (In cubic centimeter, using water replacement method in measuring cylinders)
- Colour of the paddy and rice grains (using standard DULUX colour chart)
- Length and breadth of the paddy and rice grains (Using Vernier calipers)
- And finally, procured data were analyzed statistically using SPSS Ver. 6.0 program (SPSS Inc, 1994)

All the paddy and rice specimens are preserved in the Birjhora college Herbarium.

RESULTS AND DISCUSSION

During the field survey 8 different indigenous cultivars of *Bora*-rice were recognized that are cultivated by the farmers of this region. The overall terminology in use for these cultivars is 'bonni' which is post-fixed to each varietal name. So, names of these cultivars are: *Anarashibonni*, *Bhogbonni*, *Buribonni*, *Kritirajbonni*, *Nalbonni*, *Pakhatibonni*, *Sahabonni* and *Sikarabonni*.

Table 1 shows the height of the plant, length of the spike, number of grain per spike and presence or absence of awn and their length in different varieties of *Bora*-rice. Their average plant-height varies considerably from one another. Tallest plants were recorded for

Pakhatibonni (136.32 ± 10.02 cm) and that was followed by *Anarashibonni*, *Sahabonni*, *Bhogbonni* and *Kritirajbonni*. Shortest plants were recorded for *Buribonni* and *Sikarabonni* (102.51 ± 8.56 and 102.51 ± 12.51 cm) (Figure 2).

Table 1. Height of the plant, length of the spike, number of grain per spike, length of the awn present in different cultivars of *Bora*-rice cultivated in Bongaigaon district (2014 to 2016)

Cultivar	Plant Height (cm)	Spike length (cm)	Grains/ spike	Awn length (cm)
<i>Nalbonni</i>	106.58 ± 13.22	20.38 ± 6.12	67.07 ± 21.05	Absent
<i>Buribonni</i>	102.51 ± 8.56	19.55 ± 6.38	67.94 ± 19.27	Absent
<i>Sahabonni</i>	114.61 ± 8.26	21.32 ± 7.92	73.00 ± 21.26	0.2
<i>Sikarabonni</i>	102.51 ± 12.52	19.88 ± 6.18	70.94 ± 19.33	Rarely present (0.2)
<i>Anarashibonni</i>	121.52 ± 10.66	23.41 ± 7.36	105.61 ± 21.92	Rarely present (0.2)
<i>Bhogbonni</i>	112.31 ± 9.14	21.05 ± 6.61	102.46 ± 23.06	0.5
<i>Kritirajbonni</i>	108.41 ± 11.74	19.02 ± 6.46	70.04 ± 12.32	0.2
<i>Pakhatibonni</i>	136.32 ± 10.02	20.80 ± 6.45	70.10 ± 24.94	Absent

Figure 2: Height of the plant and length of the spike in different cultivars of Bora rice of Bongaigaon district.

In case of spike length of the longest spike was found in *Anarashibonni* (23.41 ± 7.36 cm) with highest number of grains (105.61 ± 21.92) and that was followed by *Sahabonni*, *Bhogbonni*, *Nalbanni*, *Pakhatibonni*, *Kritirajbonni*, *Sikarabonni*. The shortest spike was found in *Buribonni* (19.55 ± 6.38 cm) with 67.94 ± 19.27 number of grain per spike (Figure 2 and Figure 3). Awn in all these cultivars are rudimentary or even missing and varies from 0 – 0.5 cm only. *Nalbonni*, *Buribonni* and *Pakhatibonni* were found without awn.

Table-3 shows weight, volume and colour of paddy and rice grains in different indigenous cultivars of *Bora*-rice cultivated in different localities of Bongaigaon district. Highest weight of 1000 grains of paddy was found in *Nalbonni* and *Sikarabonni* (24.50 g) which was followed by *Bhogbonni*, *Anarashibonni*, *Kritirajbonni*, *Pakhatibonni* and *Sahabonni*. Similarly, highest

Table 2. Length and breadth of paddy and rice grain in different cultivars of *Bora*-rice cultivated in Bongaigaon district during the period of 2014 to 2016.

Cultivar	Paddy grains		Rice grains	
	Length (cm)	Breadth(cm)	Length (cm)	Breadth (cm)
<i>Nalbonni</i>	0.880±0.041	0.292±0.038	0.627±0.046	0.263±0.046
<i>Buribonni</i>	0.895±0.088	0.269±0.031	0.612±0.055	0.224±0.014
<i>Sahabonni</i>	0.822±0.054	0.276±0.031	0.587±0.035	0.250±0.026
<i>Sikarabonni</i>	0.735±0.039	0.287±0.032	0.531±0.016	0.288±0.032
<i>Anarashibonni</i>	0.907±0.029	0.311±0.008	0.640±0.055	0.290±0.008
<i>Bhogbonni</i>	0.915±0.038	0.363±0.025	0.693±0.035	0.334±0.014
<i>Kritirajbonni</i>	0.782±0.054	0.265±0.031	0.563±0.045	0.247±0.026
<i>Pakhatibonni</i>	0.870±0.026	0.265±0.077	0.555±0.044	0.237±0.023

Figure 3. Number of grains per spike in different cultivars of *Bora*-rice of Bongaigaon district

Figure 4. Length and breadth of paddy grains in different cultivars of *Bora*-rice of Bongaigaon district

Table 3. Weight, volume and colour of grains in different cultivars of *Bora*-rice cultivated in Bongaigaon district during the period of 2014 to 2016

Cultivar	1000 grains weight (gm)		1000 grains volume (cc)		Grain colour	
	Paddy	Rice	Paddy	Rice	Paddy	Rice
<i>Nalbonni</i>	24.50	20.00	15.0	11.0	Teak brown	Mushroom
<i>Buribonni</i>	19.60	18.90	20.0	15.0	Pale cream	Summer sprinkle
<i>Sahabonni</i>	22.00	16.52	15.0	12.5	Leaf brown	Corel shell
<i>Sikarabonni</i>	24.50	19.80	22.0	16.0	Leaf brown	Sandal wood
<i>Anarashibonni</i>	22.70	19.60	19.0	12.2	Midbuff	Mushroom
<i>Bhogbonni</i>	23.30	18.50	15.5	10.8	Teak brown	Sandal wood
<i>Kritirajbonni</i>	21.24	19.49	13.90	10.0	Teak brown	Mushroom
<i>Pakhatibonni</i>	22.00	16.50	20.4	11.8	Brown	Mushroom

Figure-5. Length and breadth of rice grains in different cultivars of *Bora*-rice of Bongaigaon district

weight of 1000 grains of rice was found in *Nalbonni* (20.00 g) which was followed by *Sikarabonni*, *Anarashibonni*, *Kritirajbonni*, *Buribonni* and *Pakhatibonni* (16.50 g). Highest volume of 1000 grains of paddy was found in *Sikarabonni* (22.00 cc) and was followed by *Pakhatibonni*, *Buribonni*, *Anarashibonni*, *Bhogbonni*, *Sahabonni*, *Nalbonni* and *Kritirajbonni* (13.90 cc). Highest volume of 1000 grains of rice were observed in *Sikarabonni* (16.0 cc) that was followed by *Buribonni*, *Sahabonni*, *Anarashibonni*, *Pakhatibonni*, *Nalbonni*, *Bhogbonni* and *Kritirajbonni* (10.0 cc).

Regarding the colour of paddy in most of the indigenous cultivars of *Bora*-rice was generally found to be brown which may be teak-brown or leaf-brown in different cultivars. On the other hand, rice-grains in most of the cultivars *Bora*-rice were found to be mushroom and sandal-wood coloured. The rice-grains colour of *Buribonni* and *Sahabonni* are summer sprinkle and coral shell.

Table-2 shows the length and breadth of grain in different indigenous cultivars of *Bora*-rice cultivated in the study area. Length of the paddy grain varies from 0.735 ± 0.039 cm to 0.915 ± 0.038 cm while the breadth varies from 0.265 ± 0.031 cm to 0.363 ± 0.025 cm (Figure 4). The highest length of paddy-grain was observed in *Bhogbonni*. Length of the rice grain varies from 0.531 ± 0.016 cm to 0.693 ± 0.035 cm while the breadth varies from 0.224 ± 0.014 cm to 0.334 ± 0.014 cm (Figure 5). In case of rice grain the highest length and breadth was observed in *Bhogbonni*.

CONCLUSION

Eight different cultivars of *Bora*-rice are being cultivated in the Bongaigaon district of Assam. Although basically all are glutinous, but the varieties studied showed morphological characteristics that are distinct from each other and can be helpful in their easy identification. Though the ethnic people treat these cultivars as their inherent properties but due to their sticky nature normal cooked rice has less demand to the common people. It is used only in preparing *jalpan* (snacks) and *pitba* (traditional rice-cake). Some special dishes are prepared from Bora rice in some ceremonies only. Due to its less popularity among common people farmers might discontinue the practice of cultivating these rice cultivars and can opt for other highly demandable ones. But each of the cultivar has its own importance. If one genotype is lost it is lost forever. Therefore there is an urgent need for characterization for proper recognition and sufficient incentive to encourage the farmers to grow these varieties that could help in the *in situ* on-farm conservation of these important indigenous paddy genotypes of Bongaigaon district.

Acknowledgements

Thanks to UGC (NERO) for providing financial support under Minor Research Project. The author is also thankful to Institutional Biotech Hub and Botany department of Birjhora Mahavidyalaya for extending the basic infrastructure for completion of the research activity. The author is also thankful to all the farmers of the study area and the students of Botany department, Birjhora Mahavidyalaya for their support and continuous help during field study and for sharing their knowledge on indigenous rice varieties.

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