

Genetic Diversity and Biochemical Characterization of Assam's Joha Rice: Implications for Breeding Programs

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Received: 17 Feb., 2024

Accepted: 17 Mar., 2024

Published: 27 Mar., 2024

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Preferred citation for this article:

Li J.Q., 2024, Genetic diversity and biochemical characterization of Assam's Joha rice: implications for breeding programs, Rice Genomics and Genetics, 15(2): 80-82 (doi: [10.5376/rgg.2024.15.0009](https://doi.org/10.5376/rgg.2024.15.0009))

The paper titled "Morpho-Molecular and Nutritional Analysis of Indigenous Aromatic Joha Rice of Assam for Yield Improvement and Value Addition" was published on February 12, 2024, in the open-access journal Scientific Reports under the Nature Publishing Group. The authors, Dibosh Bordoloi, Debojit Sarma, Nagendra Sarma Barua, Ranjan Das, and Bikram Kishore Das, are from the Department of Plant Breeding and Genetics at Assam Agricultural University, India. This study conducted a detailed analysis of the morphological, molecular, and nutritional components of the indigenous aromatic Joha rice of Assam to enhance yield and increase its value. The research team systematically characterized 20 Joha rice varieties in multiple aspects, discovering significant differences in their morphology and nutritional content, thus providing essential foundational data for breeding programs. This study not only revealed the nutritional richness of Joha rice but also demonstrated the significant potential for yield improvement through crossbreeding.

1 Interpretation of Experimental Data

The study comprehensively examines the diversity of Joha rice varieties. Figure 1 highlights significant morphological traits such as split ligules, variations in basal leaf sheath color, internodes, stigma color, panicle morphology, awns, and grain color. These traits are crucial for identifying and classifying Joha rice varieties. Based on 37 polymorphic DUS characteristics by unweighted neighbor-joining (UNJ) cluster analysis, reveals genetic relationships among 20 Joha rice varieties. Multi-genotypic clusters (G1 and G2) exhibit high genetic diversity, providing broad breeding options, while the mono-genotypic cluster (G3-Kon Joha-2) holds unique breeding value. The study's findings underscore the rich genetic diversity of Joha rice, which is essential for developing breeding strategies that enhance yield, maintain unique aroma, and improve nutritional value, thereby ensuring the sustainability and economic viability of Joha rice cultivation in Assam.

2 Insights of Research Results

The study on Assam's indigenous Joha rice cultivars highlights a significant step forward in utilizing the inherent variability of this unique rice category to address its traditionally low yield potential. By analyzing the morphological, molecular, and biochemical characteristics of these cultivars, the research elucidates the rich diversity present in the yield and quality traits of Joha rice varieties. This diversity is crucial for breeding programs aimed at increasing yield while preserving the distinctive aromatic quality of Joha rice. Identifying specific genotypes with desirable traits provides a solid genetic foundation for recombination breeding. This strategic breeding approach can facilitate the development of superior aromatic rice varieties that combine high yield and quality traits, thereby enhancing the economic viability of Joha rice cultivation. The study also emphasizes the high molecular-level diversity among Joha rice cultivars, as evidenced by the varying degrees of differences between germplasm. This molecular diversity is a valuable resource for breeding programs, aiding in the creation of new elite varieties through marker-assisted selection. The unique alleles identified in 13 Joha cultivars provide a rich source of genetic diversity, which can be used for the precise identification and differentiation of aromatic rice cultivars, maintaining the integrity of this high-quality product, and benefiting both farmers and consumers.

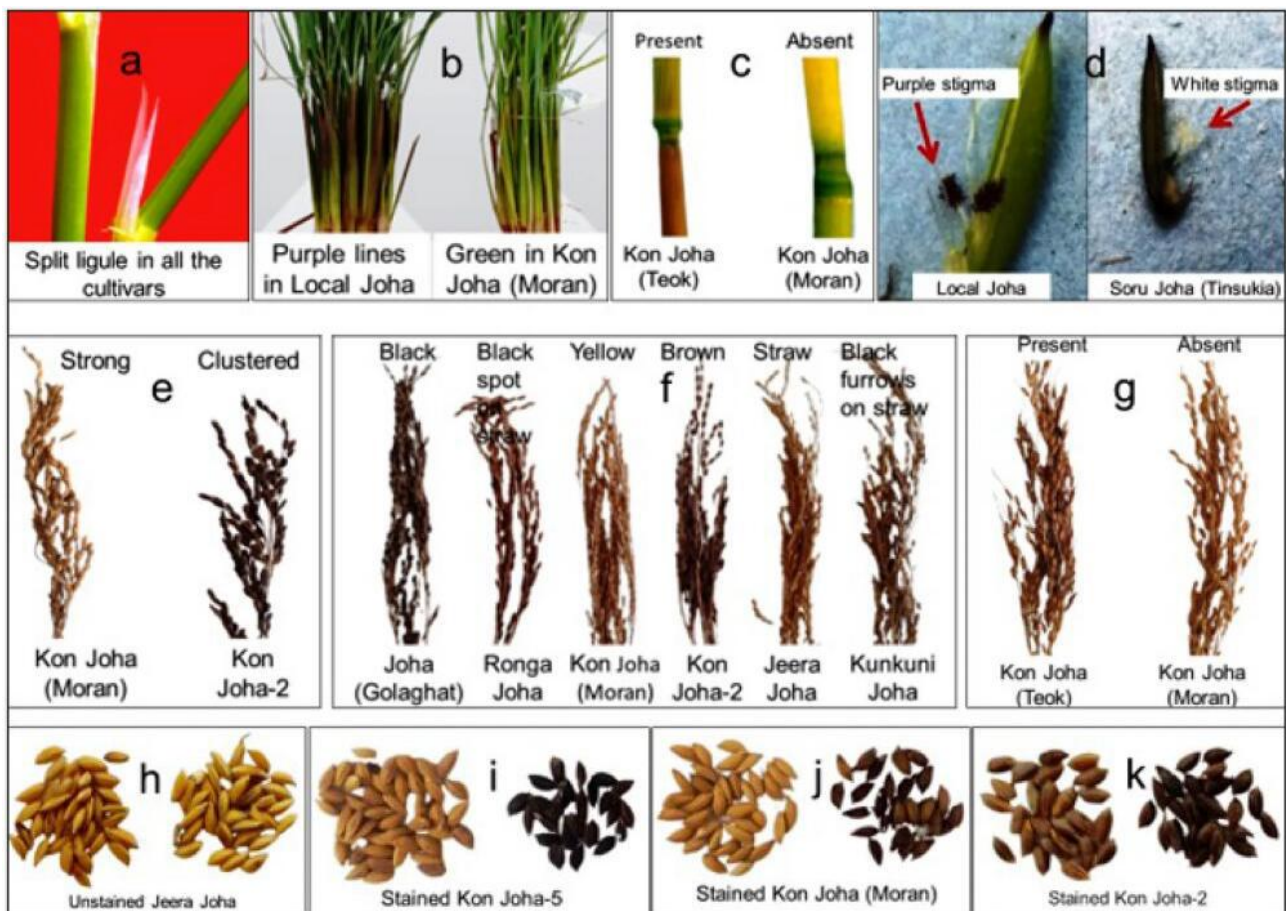


Figure 1 illustrates the morphological diversity of Joha rice in Assam

Image caption: Figure a shows that all varieties have split ligules, Figures b and c display the differences in basal leaf sheath color and the presence of internodes among different varieties, respectively, Figure d shows the differences in stigma color among the varieties, Figures e and f illustrate the variations in panicle morphology and color among different varieties, including black spots, yellow, straw color, and black stripes on straw, Figure g shows the presence or absence of awns, Figures h to k show the rice grains before and after staining, revealing color differences among the varieties, These morphological characteristics provide important criteria for distinguishing and identifying Joha rice varieties

3 Research Evaluation

This study comprehensively revealed the diversity and superior characteristics of Joha rice varieties in Assam through detailed morphological, nutritional, and molecular characterization, providing a solid foundation for their breeding and improvement. The results showed that Joha rice not only has significant advantages in nutritional content but also demonstrated potential for application in breeding programs through genetic diversity. However, the inherent low yield of Joha rice remains a challenge that requires further research and improvement.

4 Research Findings Review

This study systematically conducted a detailed analysis of the morphological, molecular, and biochemical characteristics of twenty indigenous aromatic Joha rice varieties from Assam, India, with the aim of improving yield and increasing their value. The research demonstrated significant diversity in the morphological traits of these varieties, providing unique resources for breeding programs. Through cluster analysis, these rice varieties were classified into three major groups, indicating notable differences in their morphological markers. Additionally, the study found that Joha rice is nutritionally rich, particularly in high levels of polyunsaturated fatty acids, iron, and zinc, which is significant for enhancing its value. This research provides a solid foundation for the breeding and improvement of aromatic rice and holds considerable application prospects.

5 Access the Full Text

Bordoloi D., Sarma D., Sarma Barua N., Das R., and Das B.K., 2024, Morpho-molecular and nutritional profiling for yield improvement and value addition of indigenous aromatic Joha rice of Assam, Sci. Rep., 14, 3509. <https://doi.org/10.1038/s41598-023-42874-9>

Acknowledgement

The author expresses gratitude to the journal Scientific Reports for its open access policy, which allows scientific peers to freely share this valuable research. The author also thanks the research team at Assam Agricultural University for their outstanding work, providing new breeding resources for rice breeding colleagues. The author apologizes if the interpretation and evaluation of the research data and results differ from the original intent due to the reviewers' different perspectives.

Author Introduction

Dr. Jianquan Li, a researcher at the Hainan Institute of Tropical Agricultural Resources, is a senior breeder who has long been engaged in the discovery, screening, and utilization of rice genetic resources.



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