

## STUDIES ON GORA RICES OF BIHAR. II. VARIABILITY PATTERN IN AGRO-MORPHOLOGICAL CHARACTERS

P. K. SINHA, K. PRASAD, V. S. CHAUHAN AND J. S. CHAUHAN

*Central Rainfed Upland Rice Research Station, Hazaribag 825301*

(Received: October 7, 1988; accepted: February 24, 1989)

### ABSTRACT

Twenty eight Gora rices of adjoining area of Hazaribag and Giridih districts were studied in situ for their variability pattern in nine agro-morphological characters. Twenty four varieties formed two distinct groups. Four varieties did not fall in any group. Maximum variability was observed for secondary branches per panicle. Grain shape, size, weight and fertility were the least variable characters in Gora rices. In upland varietal improvement programme, Gora rices like HRC 621(5) could be utilized as donors for increasing panicle length and secondary branches/panicle and HRC 625(9) for red kernel.

**Key words:** Variability pattern, morphological character, Gora rices.

The upland rice varieties of Chotanagpur plateau are popularly known as Gora rice. These varieties are characterized by tall plant, broad and drooping leaves, medium to coarse grain with red kernel and are grown on undulating lands on red lateritic soils with low water retention capacity and poor organic matter content (Tanr land). Very little information is available on variability pattern in Gora rices of Chotanagpur. The present study, therefore, is an attempt to understand in situ variability for different morphological characters in Gora rices.

### MATERIALS AND METHODS

Twenty eight Gora rice varieties were taken for the study. These varieties were collected from adjoining fields from three microecological zones along the Ramgarh–Gola–Peterwar–Gomia–Meru, Hazaribag–Chatara, and Koderma–Barhi–Hazaribag, routes of Hazaribag and Giridih districts of Bihar in 1987. Each collection was given a S.No. and an accession number (HRC) for convenience in presentation and to avoid confusion, as different Gora varieties with the same traditional names were collected from different localities. The S.No. of each accession (HRC No.) is given below in parentheses.

Ten representative plants of a variety were taken from farmers' fields to record observations on plant height, panicle length, primary and secondary branches per panicle, grains/panicle, percentage of grain filling per panicle, 1000-grain weight, brown rice length, and length to breadth (L/B) ratio. Kernel colour, length, breadth and L/B ratio were recorded on brown dehulled rice. Kernel length and breadth were recorded on twenty dehulled grains

according to modified method of Adair et al. as described in [1]. Standard Evaluation Systems [2] was adapted to record data on lemma and palea colour. Mean, range, and coefficient of variation (CV) were calculated to express the extent of variation for each character. Pictorialized scattered diagram method of Anderson [3] was followed to analyse the variation pattern. Grains per panicle and number of secondary branches, the two most variable characters,

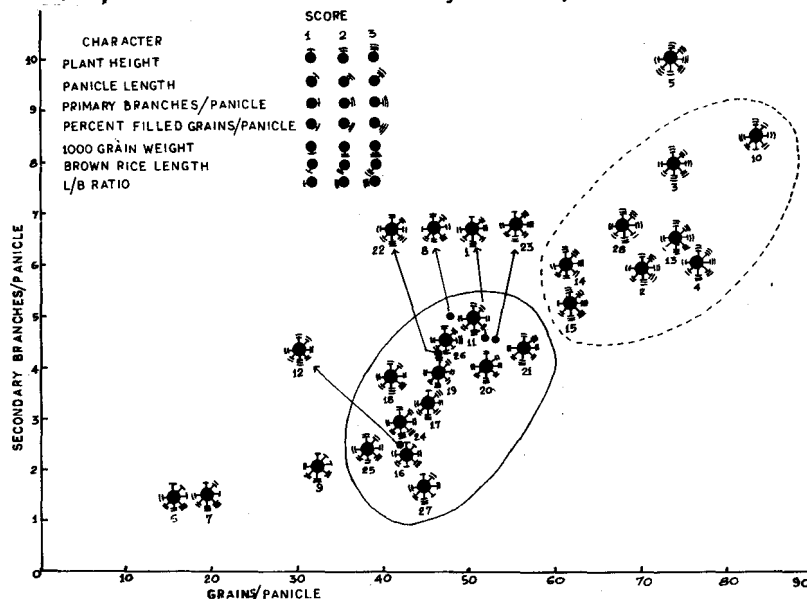


Fig. 1. Metroglyph analysis of Gora rice varieties from Bihar.

were used as abscissa and ordinate, respectively, in the pictorialized scattered diagram. Seven characters of each variety were represented on a glyph array at specific positions with 1, 2 or 3 vertical lines (Fig. 1), representing the degree of expression of a particular character of a variety.

## RESULTS AND DISCUSSION

### VARIABILITY PATTERN IN PLANT CHARACTERS

**Plant height.** Most of the Gora rices had intermediate plant height ( $89.6 \pm 2.5$  cm) in the Tanr lands. Maximum (112 cm) and minimum (76 cm) plant height were recorded in genotypes HRC 643 (27) and HRC 641 (25), respectively. These were collected from village Sakhia of Ramgarh block. Moderate variability (CV 11.7%) was observed for this trait indicating general preference of farmers growing varieties of such height in uplands. Chang et al. [3] have reported suitability of taller varieties in drought-prone areas.

**Panicle length.** Panicle length in Gora rices ranged from 10.6 cm in HRC 622 (6) to 22.2 cm in HRC 621 (5), the mean being 17.3 cm. Moderate CV (15.9%) obtained suggests the stability for this trait in Gora varieties.

**Primary branches per panicle.** The mean number of primary branches per panicle was  $6.67 \pm 0.49$  with moderate variability (CV 20.5 %). The maximum number of primary branches per panicle ( $8.8 \pm 0.42$ ) was recorded in HRC 621 (5) and minimum ( $3.0 \pm 0.22$ ) in HRC 622 (6). Thus, this trait, being a very important component of yield, can be improved by utilizing donors having high number of primary branches as there is very little variability for this character in Gora rices.

Table 1. Range, mean and coefficient of variability (CV) for nine morphological characters in Gora rice

Character	Range	Mean	CV (%)
Plant height (cm)	76.10-112.36	89.62±2.48	11.73
Panicle length (cm)	10.64-22.25	17.31±0.50	15.89
Primary branches/panicle	3.00-8.80	6.67±0.25	20.52
Secondary branches/panicle	1.5-10.00	4.88±0.44	48.82
Grains/panicle	16.00-83.55	54.96±3.68	36.68
Grain filling (%)	49.70-89.50	75.40±1.60	11.66
1000-grain weight(g)	17.91-30.82	26.26±0.59	12.26
Kernel length (mm)	5.50-6.75	6.29±0.05	4.71
Length-to-breadth (L/B) ratio	1.92-2.56	2.21±0.03	6.20

branches per panicle recorded was  $4.88 \pm 0.44$ . Chauhan et al. [4] also reported similar variation in 109 land races of rice.

**Grains per panicle.** In general, Gora varieties are poor yielders. Fewer grains per panicle (mean  $54.96 \pm 63.68$ ) could be one of the reasons for low grain yield in these rice genotypes. However, the presence of sufficient variability (CV 36.7%) for this character offers scope for improvement of this trait through selection or hybridization between Gora varieties. Extreme values of 83.5 and 16.0 grains/panicle were recorded in HRC 626 (10) and HRC 622 (6), respectively.

Table 2. Index score for seven morphological characters in Gora rice

Character	Index score	
	<1	>3
Plant height (cm)	75.0	100.0
Panicle length (cm)	14.6	18.0
Primary branches/panicle	4.9	6.8
Grain filling (%)	50.0	74.0
1000-grain weight(g)	22.2	26.5
Kernel length (mm)	5.5	6.6
Length-to-breadth (L/B) ratio	2.1	3.0

**Secondary branches per panicle.** Secondary branches per panicle were the most variable character in Gora rices (CV 48.8 %). HRC 621 (5) had the maximum mean number of secondary branches per panicle (10), while HRC 622 (6) had the minimum number (1.5). The mean number of secondary

**Grain filling.** Number of filled grains per panicle is an important yield character, as it directly affects grain yield per unit area. In general, the percentage of fertile grains (mean  $75.4 \pm 1.60$ ) was quite high in Gora varieties. The fertility ranged from 49.7% (HRC 643) to 89.5% (HRC 632). Low variation (CV 11.66%) was observed for this trait in Gora varieties. The low variation coupled with a high degree of fertility in Gora rices suggests that in the process of evolution Gora rices got adapted to the agroclimatic conditions of Chota-nagpur plateau.

## VARIABILITY PATTERN IN PHYSICAL COMPONENTS OF RICE GRAIN QUALITY

*Thousand grain weight.* In general, heavier grains (mean 1000-grain weight  $26.3 \pm 0.59$  g) were observed in Gora collections. The heaviest grains (30.8g) were recorded in HRC 624 (8), and lightest (17.9g) in HRC 626 (10). Less variation was observed for this trait also as CV was 12.3%. Thus, preference of the farmers for heavy grain varieties may partly compensate the yield loss caused by the lower number of grains/panicle in Gora varieties.

*Kernel length and length-breadth ratio.* Brown rice length ranged from 5.6 mm in HRC 624 (8) to 6.8mm in HRC 643 (27). Majority of Gora rices (90%) had medium grain length. The L/B ratio varied from 1.92 in HRC 630 (14) to 2.56 in HRC 620 (4). Only 2 out of 28 genotypes were bold and the remaining had medium grain shape. Brown rice length (CV 4.75 %) and shape (CV 6.2%) exhibited very low CV as compared to other traits, indicating lack of inherent variability for this character. Furthermore, it also appears that the local people of Chotanagpur prefer medium grain rice.

*Colour variation in grain.* Most Gora rices (96.4%) have coloured lemma and palea which ranged from black to pale straw. Brown colour was predominant in Gora collections. Thus, predominance of variation having pigmented lemma and palea in the region may be the reason for utilization of this trait for varietal identification such as 'Black Gora', 'Brown Gora' and 'Charka Gora' and maintaining varietal purity.

Except variety HRC 625 (9), where kernel colour was dull white, the remaining collections had red kernel. The dominance of red kernel in Gora varieties has also been reported by Sinha et al. [5] and Srivastava et al. [6].

## METROGLYPH ANALYSIS

The metroglyph analysis based on nine characters revealed two distinct varietal groups (Fig.1). Group I, which is denoted by dotted lines, included eight Gora varieties and is characterized by tall plant stature, long panicle, high number of primary and secondary branches per panicle, high number of grains/panicle, and heavy grains except in HRC 626 (10). Group II, which is demarcated by a continuous line, included 16 genotypes and could be distinguished from Group I by plant height (short to medium), panicle length (medium to long), primary branches/panicle (medium to high), secondary branches per panicle (medium), spikelets fertility (partly sterile to fertile), and grain weight (medium to heavy).

Four genotypes, viz. HRC 621 (5), HRC 622 (6), HRC 623 (7) and HRC 625 (9), did not fall in any group. Genotype HRC 621 (5) was similar to the varieties of group I in most of the characters except in 1000-grain weight, brown rice length, and number of secondary branches/panicle. Genotypes HRC 622 (6), HRC 623 (7) and HRC 625 (9) differ from the genotypes of either of the groups by their poor character expression for plant height, panicle length, primary branches/panicle, and grains/panicle, but were similar to varieties

of both the groups in characters, such as, grains filling per panicle, brown rice length, L/B ratio, and 1000-grain weight. Thus, it appeared that shape, size, weight and fertility are the few basic characters of Gora varieties, which have been retained as a result of stabilized selection, whereas the other desirable characters or their combinations have been selected depending upon the habitat of their growth.

The presence of sufficient variability for important yield components in Gora rices of Hazaribag and Giridih suggests the scope of utilization of the best local types in any upland varietal improvement programme instead of using varieties not so well adapted to the upland conditions, especially of the Chotanagpur plateau. Donors like HRC 621 (5) can be used to increase panicle length and secondary branches per panicle, and HRC 624 (8) for grain weight. Red kernel is the most prevalent characteristic of Gora rices, but such varieties fetch lower price in the market. Improvement in this trait alone could bring better return to farmers for which HRC 625 (9) with dull white pericarp could be used as a donor.

#### REFERENCES

1. J. S. Chauhan and J. S. Nanda. 1983. Genetic variability for physiochemical characters of rice grain in segregating *Oryza sativa* L. *Oryza*, 20: 209-215.
2. Anonymous. 1980. Standard Evaluation Systems for Rice (2nd ed.). The International Rice Research Institute, Los Banos, Laguna, Philippines: 44.
3. E. Anderson. 1957. A semi-graphical method for the analysis of complex problem. *Proc. Natl. Acad. Sci. Wash.*, 43: 923-927.
4. J. S. Chauhan, V. S. Chauhan, P. K. Sinha and K. Prasad. 1989. Analysis of in situ variability for some panicle and grain characters in native rice (*Oryza sativa* L.) germplasm from plateau region of Bihar, India. *Oryza* (unpublished).
5. P. K. Sinha, J. S. Chauhan, V. S. Chauhan and K. Prasad. 1988. Studies on Gora rices of Bihar. Pattern of pigment distribution. *Oryza*, 25: 355-359.
6. D. P. Srivastava, S. C. Prasad and P. N. Sinha. 1977. The Gora rices of Chotanagpur region of South Bihar. *Oryza*, 14: 43-44.