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Some Morphological Characters of the Cultivated Rice Grains Collected in India (IV)

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Introduction

During the period from December in 1978 to January in 1979, the writer was sent to India for collecting of the wild and cultivated rices. In this opportunity, the cultivated rice practically planted not only in Assam but also in West Bengal States were directly collected in the fields and studied in view of the morphological characters found in grains.

Northeastern part of India has been seen as one of the differentiation centers of rice (*Oryza sativa* L.), owing to the several genetical and cytogenetical investigations. However, some questions in these considerations were found and remained unclarified. Sharma *et al.*[5] carried out a systematic collection of current and primitive cultivars in the northeastern part of India in view of breeding program. For phylogenetical studies, as well as for the investigations to clarify and confirm the varietal variations the methodology for these purposes should be promoted as early as possible.

Since 1969, high yielding varieties have been recommended by the governments of a lot of countries in southern and southeastern Asia. It is said that local and domestic varieties have been disappeared in these processes. However, because of several problems in modern agronomical practices using the high yielding varieties, local varieties have been consciously kept in the respective localities. Recently, analyses of the primitive varieties have been put into the limelight in these scientific fields.

Taking into account these items, the present experimental series was made to accomplish the work which is going to clarify the varietal variations and the phylogenetic relationships of cultivated rice in India. In the previous papers, the records on morphological characters of the unhusked and husked grains and some mutual relationships[2], and variation ranges in 18 characters[3,4] were reported.

In the present paper, variation ranges in 6 characters were mainly described following the previous papers, in order to confirm the morphological characters of grains as well as to make clear the strain's specificities. Though the methodology, in which variation ranges were used, was noted to be somewhat in an underdeveloped stage, it was adopted here. The records on the relations between the respective two characters are going to be reported in the separate articles.

Materials and Methods

Twenty-one strains of rice collected in India during the field survey were used in this experimental series. They are listed up in Table 1 of the previous paper[2]. In this table, collection

number, collection date and place, and detailed informations of habitat are mentioned. States included in this paper are Meghalaya, Assam and West Bengal. The strains distributed in the respective localities have different meanings in view of morphological and physiological characters, and should be separately considered. So, they are divided into 2 groups, *i.e.*, Group A ··· strains collected in Meghalaya and Assam States (9 strains), Group B ··· strains collected in West Bengal State (12 strains).

The variation ranges in 6 characters were illustrated by the maximum, the minimum and the pure-range values in the whole grains. Six characters used here were constituted by areas and volumes of the unhusked and husked grains, the area and volume quotients (=ratio of value of husked to value of unhusked grains). The whole data referring to the 6 characters were illustrated by the average value in the whole grains.

In the present paper, the following abbreviations were used, *i.e.*, L (length), W (width), T (thickness), L/W (ratio of length to width), L/T (ratio of length to thickness), W/T (ratio of width to thickness), s.d. (standard deviations), UHG (unhusked grain), HG (husked grain).

Results

1. Area in unhusked grains

Maximum: 1) Group A: The results are given in Table 1. In the table, the maximum, the minimum and their range are shown. The widest (31.76 mm^2) was obtained in No. 5, followed by No. 2 (31.06 mm^2) and No. 1 (30.16 mm^2). The narrowest (25.62 mm^2) was noted in No. 4, which was the same as in cases of the maximum of L/W and of the range of length, followed by No. 3 (25.67 mm^2) and No. 7 (26.40 mm^2). Average and its s.d. through the whole strains were found to be 28.44 ± 2.32.

2) Group B: The widest (32.48 mm^2) was obtained in No. 10, which was the same as in cases of the maximum and of the minimum of L/T, and of the ranges of length and thickness, followed by No. 18 (31.83 mm^2) and No. 21 (31.80 mm^2). The narrowest (18.79 mm^2) was noted in No. 11, which was the same as in cases of the minimum of L/T, and of the range of length, followed by No. 15 (19.80 mm^2) and No. 14 (27.82 mm^2). Average and its s.d. through the whole strains were found to be 28.43 ± 4.79.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 28.44 ± 3.85.

Minimum: 1) Group A: The widest (25.35 mm^2) was obtained in No. 5, which was the same as in case of the maximum of area (UHG), followed by No. 2 (24.48 mm^2) and No. 1 (23.93 mm^2). These orders of strains were found to be the same as in case of the maximum of area (UHG). The narrowest (20.41 mm^2) was noted in No. 6, which was the same as in cases of ranges of width, L/W and W/T, followed by No. 4 (20.50 mm^2) and No. 7 (20.74 mm^2). Average and its s.d. through the whole strains were found to be 22.59 ± 1.88.

2) Group B: The widest (25.11 mm^2) was obtained in No. 21, which was the same as in case of the range of W/T, followed by No. 18 (25.09 mm^2) and No. 19 (24.86 mm^2). The narrowest (15.79 mm^2) was noted in No. 11, which was the same as in cases of the maximum of area (UHG), of the minimum of L/W and of the range of length, followed by No. 15 (16.06 mm^2) and No. 13 (18.60 mm^2). Average and its s.d. through the whole strains were found to be 21.34 ± 3.44.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 21.87 ± 2.89.

Table 1. Ranges of area, volume and quotient in the strain level

Strain No.	Unhusked						Husked						Quotient					
	Area			Volume			Area			Volume			Area			Volume		
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
1	30.16	23.93	6.23	75.40	55.04	20.36	19.77	15.37	4.40	45.47	31.60	13.87	0.70	0.58	0.12	0.65	0.53	0.12
2	31.06	24.48	6.58	76.10	53.66	22.44	19.37	14.84	4.53	51.36	28.96	22.40	0.68	0.55	0.13	0.81	0.46	0.35
3	25.67	23.38	2.29	44.92	34.22	10.70	12.61	8.48	4.13	15.13	7.63	7.50	0.49	0.36	0.13	0.34	0.22	0.12
4	25.62	20.50	5.12	49.96	38.72	11.24	15.48	12.76	2.72	26.89	21.17	5.72	0.64	0.59	0.05	0.59	0.53	0.06
5	31.76	25.35	6.41	75.41	52.20	23.21	19.22	15.25	3.97	42.24	28.31	13.93	0.67	0.55	0.12	0.60	0.48	0.12
6	27.44	20.41	7.03	57.02	41.32	15.70	16.38	11.88	4.50	31.12	21.38	9.74	0.62	0.58	0.04	0.56	0.52	0.04
7	26.40	20.74	5.66	60.72	43.50	17.22	16.00	12.99	3.01	33.60	23.10	10.50	0.70	0.58	0.12	0.66	0.51	0.15
8	29.57	21.30	8.27	63.57	50.06	13.51	16.82	12.60	4.22	34.31	25.20	9.11	0.63	0.54	0.09	0.57	0.49	0.08
9	28.32	23.19	5.13	62.30	46.98	15.32	17.00	13.97	3.03	34.00	25.85	8.15	0.67	0.53	0.14	0.62	0.46	0.16
10	32.48	24.78	7.70	68.74	51.31	17.43	18.49	15.16	3.33	37.76	23.14	14.62	0.65	0.52	0.13	0.59	0.40	0.19
11	18.79	15.79	3.00	36.90	30.00	6.90	11.69	9.27	2.42	21.84	15.30	6.54	0.67	0.58	0.09	0.61	0.51	0.10
12	26.09	21.30	4.79	61.31	46.31	15.00	15.35	11.50	3.85	33.00	24.15	8.85	0.60	0.54	0.06	0.55	0.48	0.07
13	27.30	18.60	8.70	64.16	34.43	29.73	16.25	9.90	6.35	34.13	16.34	17.79	0.66	0.52	0.14	0.61	0.48	0.13
14	27.28	22.00	5.28	60.03	40.90	19.13	15.76	13.02	2.74	31.52	18.03	13.49	0.62	0.54	0.08	0.55	0.44	0.11
15	19.80	16.06	3.74	37.62	28.08	9.54	11.21	9.95	1.26	18.78	15.41	3.37	0.66	0.56	0.10	0.60	0.48	0.12
16	31.32	23.04	8.28	72.24	48.38	23.86	19.39	13.68	5.71	38.54	24.62	13.92	0.65	0.55	0.10	0.60	0.49	0.11
17	30.60	18.46	12.11	68.85	34.21	34.64	17.83	9.69	8.14	37.44	15.99	21.45	0.65	0.50	0.15	0.60	0.44	0.16
18	31.83	25.09	6.74	77.25	56.70	20.55	19.50	15.73	3.77	41.89	30.89	11.00	0.66	0.54	0.12	0.69	0.48	0.21
19	32.19	24.86	7.33	93.35	60.91	32.44	19.68	13.50	6.18	45.54	27.00	18.54	0.65	0.46	0.09	0.58	0.42	0.16
20	31.71	20.90	10.81	72.93	41.80	31.13	18.68	12.58	6.10	37.25	20.13	17.12	0.79	0.52	0.27	0.71	0.45	0.26
21	31.80	25.11	6.69	73.80	55.15	18.65	19.08	15.18	3.90	39.11	29.38	9.73	0.63	0.53	0.10	0.58	0.44	0.14

Range: 1) Group A: The largest (8.27 mm^2) was obtained in No. 8, followed by No. 6 (7.03 mm^2) and No. 2 (6.58 mm^2). The smallest (2.29 mm^2) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width and thickness, followed by No. 4 (5.12 mm^2) and No. 9 (5.13 mm^2). It was noted that the value was particularly small in No. 3. Average and its s.d. through the whole strains were found to be 5.86 ± 1.66.

2) Group B: The largest (12.11 mm^2) was obtained in No. 17, followed by No. 20 (10.81 mm^2) and No. 13 (8.70 mm^2). It was noted that the value was particularly large in No. 17. The smallest (3.00 mm^2) was noted in No. 11, which was the same as in cases of the maximum of area (UHG), of the minima of L/W and area (UHG), and of the range of length, followed by No. 15 (3.74 mm^2) and No. 12 (4.79 mm^2). These combinations of strains were found to be the same as in case of the maximum of L/W. Average and its s.d. through the whole strains were found to be 7.10 ± 2.70.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 6.57 ± 2.35.

2. Volume in unhusked grains

Maximum: 1) Group A: The largest (76.10 mm^3) was obtained in No. 2, which was the same as in case of the maximum of width, followed by No. 5 (75.41 mm^3) and No. 1 (75.40 mm^3). These combinations of strains were found to be the same as in cases of the maximum and of the minimum of area (UHG). The smallest (44.92 mm^3) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width and thickness, and of the range of area (UHG), followed by No. 4 (49.96 mm^3) and No. 6 (57.02 mm^3). These combinations of strains were found to be the same as in case of the range of L/W. Average and its s.d. through the whole strains were found to be 62.82 ± 11.28.

2) Group B: The largest (93.35 mm^3) was obtained in No. 19, which was the same as in case of the range of width, followed by No. 18 (77.25 mm^3) and No. 21 (73.80 mm^3). It was noted that the value was particularly large in No. 19. These combinations of strains were found to be the same as in case of the minimum of area (UHG). The smallest (36.90 mm^3) was noted in No. 11, which was the same as in cases of the maximum of area (UHG), of the minima of L/W and area (UHG), and of the ranges of length and area (UHG), followed by No. 15 (37.62 mm^3) and No. 14 (60.03 mm^3). It was noted that the values were particularly small in Nos. 11 and 15. These orders of strains were found to be the same as in case of the maximum of area (UHG). Average and its s.d. through the whole strains were found to be 65.60 ± 15.81.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 64.41 ± 13.80.

Minimum: 1) Group A: The largest (55.04 mm^3) was obtained in No. 1, followed by No. 2 (53.66 mm^3) and No. 5 (52.20 mm^3). These combinations of strains were found to be the same as in cases of the maxima of area and volume (UHG), and of the minimum of area (UHG). The smallest (34.22 mm^3) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width and thickness, of the maximum of volume (UHG), and of the range of area (UHG), followed by No. 4 (38.72 mm^3) and No. 6 (41.32 mm^3). These combinations of strains were found to be the same as in cases of the maximum of volume (UHG) and of the range of L/W. Moreover, these orders of strains were found to be the same as in case of the maximum of volume (UHG). Average and its s.d. through the whole strains were found to be 46.19 ± 7.21.

2) Group B: The largest (60.91 mm^3) was obtained in No. 19, which was the same as in cases of the maximum of volume (UHG) and of the range of width, followed by No. 18 (56.70 mm^3) and

No. 21 (55.15 mm^3). It was noted that the value was particularly large in No. 19. These combinations of strains were found to be the same as in cases of the maximum of volume (UHG) and of the minimum of area (UHG). Moreover, these orders of strains were found to be the same as in case of the maximum of volume (UHG). The smallest (28.08 mm^3) was noted in No. 15, which was the same as in case of the maximum of thickness, followed by No. 11 (30.00 mm^3) and No. 17 (34.21 mm^3). It was noted that the value was particularly small in No. 15. Average and its s.d. through the whole strains were found to be 44.02 ± 10.88.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 44.95 ± 9.33.

Range: 1) Group A: The largest (23.21 mm^3) was obtained in No. 5, which was the same as in cases of the maximum and of the minimum of area (UHG), followed by No. 2 (22.44 mm^3) and No. 1 (20.36 mm^3). These combinations of strains were found to be the same as in cases of the maxima and of the minima of area and volume (UHG). Moreover, these orders of strains were found to be the same as in cases of the maximum and of the minimum of area (UHG). The smallest (10.70 mm^3) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness and volume (UHG), and of the range of area (UHG), followed by No. 4 (11.24 mm^3) and No. 8 (13.51 mm^3). Average and its s.d. through the whole strains were found to be 16.63 ± 4.58.

2) Group B: The largest (34.64 mm^3) was obtained in No. 17, which was the same as in case of the range of area (UHG), followed by No. 19 (32.44 mm^3) and No. 20 (31.13 mm^3). These combinations of strains were found to be the same as in case of the range of width. The smallest (6.90 mm^3) was noted in No. 11, which was the same as in cases of the maxima of area and volume (UHG), of the minima of L/W and area (UHG), and of the ranges of length and area (UHG), followed by No. 15 (9.54 mm^3) and No. 12 (15.00 mm^3). It was noted that the value was particularly small in No. 11. These combinations of strains were found to be the same as in cases of the maximum of L/W and of the range of area (UHG). Moreover, these orders of strains were found to be the same as in case of the range of area (UHG). Average and its s.d. through the whole strains were found to be 21.58 ± 8.99.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 19.46 ± 7.69.

3. Area in husked grains

Maximum: 1) Group A: The widest (19.77 mm^2) was obtained in No. 1, which was the same as in case of the minimum of volume (UHG), followed by No. 2 (19.37 mm^2) and No. 5 (19.22 mm^2). These combinations of strains were found to be the same as in cases of the maxima and of the minima of area and volume (UHG), and of the range of volume (UHG). These orders of strains were found to be the same as in case of the minimum of volume (UHG). The narrowest (12.61 mm^2) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness and volume (UHG), and of the ranges of area and volume (UHG), followed by No. 4 (15.48 mm^2) and No. 7 (16.00 mm^2). It was noted that the value was particularly small in No. 3. These combinations of strains were found to be the same as in case of the maximum of area (UHG). Average and its s.d. through the whole strains were found to be 16.96 ± 2.27.

2) Group B: The widest (19.68 mm^2) was obtained in No. 19, which was the same as in cases of the maximum and of the minimum of volume (UHG), and of the range of width, followed by No. 18 (19.50 mm^2) and No. 16 (19.39 mm^2). The narrowest (11.21 mm^2) was noted in No. 15,

which was the same as in cases of the maximum of thickness, and of the minimum of volume (UHG), followed by No. 11 (11.69 mm^2) and No. 12 (15.35 mm^2). These combinations of strains were found to be the same as in cases of the maximum of L/W, and of the ranges of area and volume (UHG). Average and its s.d. through the whole strains were found to be 16.91 ± 2.95.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 16.93 ± 2.62.

Minimum: 1) Group A: The widest (15.37 mm^2) was obtained in No. 1, which was the same as in cases of the maximum of area (HG) and of the minimum of volume (UHG), followed by No. 5 (15.25 mm^2) and No. 2 (14.84 mm^2). These combinations of strains were found to be the same as in cases of the maxima of areas (UHG and HG) and volume (UHG), of the minima of area and volume (UHG), and of the range of volume (UHG). The narrowest (8.48 mm^2) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness and volume (UHG), of the maximum of area (HG) and of the ranges of area and volume (UHG), followed by No. 6 (11.88 mm^2) and No. 8 (12.60 mm^2). It was noted that the value was particularly small in No. 3. These combinations of strains were found to be the same as in cases of the maxima of width, thickness and W/T. Average and its s.d. through the whole strains were found to be 13.13 ± 2.14.

2) Group B: The widest (15.73 mm^2) was obtained in No. 18, followed by No. 21 (15.18 mm^2) and No. 10 (15.16 mm^2). These combinations of strains were found to be the same as in case of maximum of area (UHG). The narrowest (9.27 mm^2) was noted in No. 11, which was the same as in cases of the maxima of area and volume (UHG), of the minima of L/W and area (UHG), and of the ranges of length, area and volume (UHG), followed by No. 17 (9.69 mm^2) and No. 13 (9.90 mm^2). Average and its s.d. through the whole strains were found to be 12.43 ± 2.33.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 12.73 ± 2.23.

Range: 1) Group A: The largest (4.53 mm^2) was obtained in No. 2, which was the same as in cases of the maxima of width and volume (UHG), followed by No. 6 (4.50 mm^2) and No. 1 (4.40 mm^2). The smallest (2.72 mm^2) was noted in No. 4, which was the same as in cases of the maxima of L/W and area (UHG), and of the range of length, followed by No. 7 (3.01 mm^2) and No. 9 (3.03 mm^2). It was noted that the value was particularly small in No. 4. Average and its s.d. through the whole strains were found to be 3.83 ± 0.71.

2) Group B: The largest (8.14 mm^2) was obtained in No. 17, which was the same as in cases of the ranges of area and volume (UHG), followed by No. 13 (6.35 mm^2) and No. 19 (6.18 mm^2). It was noted that the value was particularly large in No. 17. The smallest (1.26 mm^2) was noted in No. 15, which was the same as in cases of the maxima of thickness and area (HG), and of the minimum of volume (UHG), followed by No. 11 (2.42 mm^2) and No. 14 (2.74 mm^2). It was noted that the value was particularly small in No. 15. These combinations of strains were found to be the same as in cases of the maxima of area and volume (UHG). Average and its s.d. through the whole strains were found to be 4.48 ± 2.00.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 4.20 ± 1.59.

4. Volume in husked grains

Maximum: 1) Group A: The largest (51.36 mm^3) was obtained in No. 2, which was the same as in cases of the maxima of width and volume (UHG), and of the range of area (HG), followed

by No. 1 (45.47 mm^3) and No. 5 (42.24 mm^3). It was noted that the value was particularly large in No. 2. These combinations of strains were found to be the same as in cases of the maxima and of the minima of areas (UHG and HG) and volume (UHG), and of the range of volume (UHG). The smallest (15.13 mm^3) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness, area (HG) and volume (UHG), and of the ranges of area and volume (UHG), followed by No. 6 (31.12 mm^3) and No. 7 (33.60 mm^3). It was noted that the value was particularly small in No. 3. Average and its s.d. through the whole strains were found to be 34.90 ± 10.66.

2) Group B: The largest (45.54 mm^3) was obtained in No. 19, which was the same as in cases of the maxima of volume (UHG) and area (HG), of the minimum of volume (UHG), and of range of width, followed by No. 18 (41.89 mm^3) and No. 21 (39.11 mm^3). These combinations of strains were found to be the same as in cases of the maximum of volume (UHG), and of the minima of area and volume (UHG). Moreover, these orders of strains were found to be the same as in cases of the maximum and of the minimum of volume (UHG). The smallest (18.78 mm^3) was noted in No. 15, which was the same as in cases of the maxima of thickness and area (HG), of the minimum of volume (UHG), and of the range of area (HG), followed by No. 11 (21.84 mm^3) and No. 14 (31.52 mm^3). These combinations of strains were found to be the same as in cases of the maxima of area and volume (UHG) and of the range of area (HG). Moreover, these orders of strains were found to be the same as in case of the range of area (HG). Average and its s.d. through the whole strains were found to be 34.73 ± 7.74.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 34.81 ± 8.85.

Minimum: 1) Group A: The largest (31.60 mm^3) was obtained in No. 1, which was the same as in cases of the maximum of area (HG), and of the minima of volume (UHG) and area (HG), followed by No. 2 (28.96 mm^3) and No. 5 (28.31 mm^3). These combinations of strains were found to be the same as in cases of the maxima of areas (UHG and HG) and volumes (UHG and HG), of the minima of areas (UHG and HG) and volume (UHG), and of the range of volume (UHG). Moreover, these orders of strains were found to be the same as in cases of the maximum of area (HG) and of the minimum of volume (UHG). The smallest (7.63 mm^3) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness, volume (UHG) and area (HG), of the maximum of volume (HG), and of the ranges of area and volume (UHG), followed by No. 4 (21.17 mm^3) and No. 6 (21.38 mm^3). It was noted that the value was particularly small in No. 3. These combinations of strains were found to be the same as in cases of the range of L/W, and of the maximum and of the minimum of volume (UHG). Moreover, these orders of strains were found to be the same as in cases of the maximum and of the minimum of volume (UHG). Average and its s.d. through the whole strains were found to be 23.69 ± 6.97.

2) Group B: The largest (30.89 mm^3) was obtained in No. 18, which was the same as in case of the minimum of area (HG), followed by No. 21 (29.38 mm^3) and No. 19 (27.00 mm^3). These combinations of strains were found to be the same as in cases of the maxima of volumes (UHG and HG) and of the minima of area (UHG) and volume (UHG). The smallest (15.30 mm^3) was noted in No. 11, which was the same as in cases of the maxima of area and volume (UHG), of the minima of L/W and areas (UHG and HG), and of the ranges of length, area (UHG) and volume (UHG), followed by No. 15 (15.41 mm^3) and No. 17 (15.99 mm^3). These combinations of strains were found to be the same as in case of the minimum of volume (UHG). Average and its s.d. through the whole strains were found to be 21.70 ± 5.61.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 22.55 ± 6.14.

Range: 1) Group A: The largest (22.40 mm^3) was obtained in No. 2, which was the same as in cases of the maxima of width and volumes (UHG and HG), followed by No. 5 (13.93 mm^3) and No. 1 (13.87 mm^3). It was noted that the value was particularly large in No. 2. These combinations of strains were found to be the same as in cases of the maxima and of the minima of areas (UHG and HG) and volumes (UHG and HG), and of the range of volume (UHG). Moreover, these orders of strains were found to be the same as in case of the maximum of volume (UHG). The smallest (5.72 mm^3) was noted in No. 4, which was the same as in cases of the maxima of L/W and area (UHG), and of the ranges of length and area (HG), followed by No. 3 (7.50 mm^3) and No. 9 (8.15 mm^3). These combinations of strains were found to be the same as in case of the range of area (UHG). Average and its s.d. through the whole strains were found to be 11.21 ± 5.00.

2) Group B: The largest (21.45 mm^3) was obtained in No. 17, which was the same as in cases of the ranges of areas (UHG and HG) and volume (UHG), followed by No. 19 (18.54 mm^3) and No. 13 (17.79 mm^3). These combinations of strains were found to be the same as in case of the range of area (HG). The smallest (3.37 mm^3) was noted in No. 15, which was the same as in cases of the maxima of thickness, area (HG) and volume (HG), of the minimum of volume (UHG), and of the range of area (HG), followed by No. 11 (6.54 mm^3) and No. 12 (8.85 mm^3). It was noted that the value was particularly small in No. 15. These combinations of strains were found to be the same as in cases of the maxima of L/W and area (HG), and of the ranges of area and volume (UHG). Moreover, these orders of strains were found to be the same as in case of the maximum of area (HG). Average and its s.d. through the whole strains were found to be 13.04 ± 5.33.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 12.25 ± 5.14.

5. Quotient in areas

Maximum: 1) Group A: The largest (0.70) was obtained in Nos. 1 and 7, followed by No. 2 (0.68). These combinations of strains were found to be the same as in cases of the maxima of length and width, and of the range of length. The smallest (0.49) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness, area (HG) and volumes (UHG and HG), and of the ranges of area (UHG) and volume (UHG), followed by No. 6 (0.62) and No. 8 (0.63). It was noted that the value was particularly small in No. 3. These combinations of strains were found to be the same as in cases of the maxima of width, thickness and W/T, and of the minimum of area (HG). Moreover, the orders of strains were found to be the same as in case of the minimum of area (HG). Average and its s.d. through the whole strains were found to be 0.64 ± 0.07.

2) Group B: The largest (0.79) was obtained in No. 20, which was the same as in cases of the ranges of L/W and L/T, followed by No. 11 (0.67). It was noted that the value was particularly large in No. 20. The smallest (0.60) was noted in No. 12, which was the same as in cases of the maxima of length, L/T and W/T, and of the ranges of width, thickness, L/W, L/T and W/T, followed by No. 14 (0.62) and No. 21 (0.63). Average and its s.d. through the whole strains were found to be 0.66 ± 0.05.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.65 ± 0.05.

Minimum: 1) Group A: The largest (0.59) was obtained in No. 4, which was the same as in cases of the minima of width and W/T, followed by Nos. 1, 6 and 7 (0.58). These orders of strains

were found to be the same as in case of the minimum of width. The smallest (0.36) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness, area (HG) and volumes (UHG and HG), of the maximum of quotient of area, and of the ranges of area and volume (UHG), followed by No. 9 (0.53) and No. 8 (0.54). It was noted that the value was particularly small in No. 3. These combinations of strains were found to be the same as in case of the minimum of W/T. Average and its s.d. through the whole strains were found to be 0.54 ± 0.07.

2) Group B: The largest (0.58) was obtained in No. 11, followed by No. 15 (0.56) and No. 16 (0.55). The smallest (0.46) was noted in No. 19, which was the same as in case of the minimum of width, followed by No. 17 (0.50). It was noted that the value was particularly small in No. 19. Average and its s.d. through the whole strains were found to be 0.53 ± 0.03.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.53 ± 0.05.

Range: 1) Group A: The largest (0.14) was obtained in No. 9, which was the same as in cases of the maximum and of the range of W/T, followed by Nos. 2 and 3 (0.13). These combinations of strains were found to be the same as in case of the maximum of L/T. The smallest (0.04) was noted in No. 6, which was the same as in cases of the minimum of area (UHG), and of the ranges of width, L/W and W/T, followed by No. 4 (0.05) and No. 8 (0.09). These combinations of strains were found to be the same as in cases of the maximum of L/T, and of the ranges of thickness, L/T and W/T. Moreover, these orders of strains were found to be the same as in case of the range of W/T. Average and its s.d. through the whole strains were found to be 0.10 ± 0.04.

2) Group B: The largest (0.27) was obtained in No. 20, which was the same as in cases of the maximum of quotient of area, and of the ranges of L/W and L/T, followed by No. 17 (0.15) and No. 13 (0.14). It was noted that the value was particularly large in No. 20. These combinations of strains were found to be the same as in case of the range of area (UHG). The smallest (0.06) was noted in No. 12, which was the same as in cases of the maxima of length, L/W, L/T and quotient of area, and of the ranges of width, thickness, L/W, L/T and W/T, followed by No. 14 (0.08) and Nos. 11 and 19 (0.09). These combinations of strains were found to be the same as in case of the range of length. Average and its s.d. through the whole strains were found to be 0.12 ± 0.05.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.11 ± 0.05.

6. Quotient in volumes

Maximum: 1) Group A: The largest (0.81) was obtained in No. 2, which was the same as in cases of the maxima of width and volume (HG), and of the ranges of area and volume (HG), followed by No. 7 (0.66) and No. 1 (0.65). It was noted that the value was particularly large in No. 2. These combinations of strains were found to be the same as in cases of the maxima of length, width and quotient of area. The smallest (0.34) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness, area (HG), volumes (UHG and HG) and quotient of area, and of the ranges of area and volume (UHG), followed by No. 6 (0.56) and No. 8 (0.57). It was noted that the value was particularly small in No. 3. These combinations of strains were found to be the same as in cases of the maxima of width, thickness, W/T and quotient of area, and of the minimum of area (HG). Moreover, these orders of strains were found to be the same as in cases of the maximum of quotient of area, and of the minimum of area (HG). Average and its s.d. through the whole strains were found to be 0.60 ± 0.12.

2) Group B: The largest (0.71) was obtained in No. 20, which was the same as in cases of the maximum of quotient of area, of the ranges of L/W, L/T and quotient of area, followed by No. 18 (0.69) and Nos. 11 and 13 (0.61). The smallest (0.55) was noted in Nos. 12 and 14, followed by No. 19 (0.58). These combinations of strains were found to be the same as in case of the range of quotient of area. Average and its s.d. through the whole strains were found to be 0.61 ± 0.05.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.60 ± 0.09.

Minimum: 1) Group A: The largest (0.53) was obtained in Nos. 1 and 4, followed by No. 6 (0.52). These combinations of strains were found to be the same as in cases of the minima of width and quotient of area. The smallest (0.22) was noted in No. 3, which was the same as in cases of the maxima and of the minima of length, width, thickness, area (HG), volumes (UHG and HG) and quotient of area, of the maximum of quotient of volume, and of the ranges of area and volume (UHG), followed by Nos. 2 and 9 (0.46). It was noted that the value was particularly small in No. 3. Average and its s.d. through the whole strains were found to be 0.47 ± 0.10.

2) Group B: The largest (0.51) was obtained in No. 11, which was the same as in case of the minimum of quotient of area, followed by No. 16 (0.49). The smallest (0.40) was noted in No. 10, followed by No. 19 (0.42). Average and its s.d. through the whole strains were found to be 0.46 ± 0.03.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.46 ± 0.07.

Range: 1) Group A: The largest (0.35) was obtained in No. 2, which was the same as in cases of the maxima of width, volumes (UHG and HG) and quotient of volume and of the range of volume (HG), followed by No. 9 (0.16) and No. 7 (0.15). It was noted that the value was particularly large in No. 2. These combinations of strains were found to be the same as in cases of the maxima of width and W/T, and of the range of W/T. The smallest (0.04) was noted in No. 6, which was the same as in cases of the minimum of the area (UHG), of the ranges of width, L/W, W/T and quotient of area, followed by No. 4 (0.06) and No. 8 (0.08). These combinations of strains were found to be the same as in cases of the maximum of L/T, and of the ranges of thickness, L/T, W/T and quotient of area. Moreover, these orders of strains were found to be the same as in cases of the ranges of W/T and quotient of area. Average and its s.d. through the whole strains were found to be 0.13 ± 0.09.

2) Group B: The largest (0.26) was obtained in No. 20, which was the same as in cases of the maxima of quotients of area and volume, and of the ranges of L/W, L/T and quotient of area, followed by No. 18 (0.21) and No. 10 (0.19). The smallest (0.07) was noted in No. 12, which was the same as in cases of the maxima of length, L/T, W/T and quotient of area, and of the ranges of width, thickness, L/W, L/T, W/T and quotient of area, followed by No. 11 (0.10) and Nos. 14 and 16 (0.11). It was noted that the value was particularly small in No. 12. Average and its s.d. through the whole strains were found to be 0.15 ± 0.05.

3) Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.14 ± 0.07.

Discussion

Basing on the results obtained in the present experiments, the following problems are to be discussed here.

1. Although the values were particularly large or small in some characters, the values were found to be the standard level in other characters in view of the same strains. For example, No. 5 showed the largest value (31.76 mm^2) in the maximum of length (UHG), but showed the middle value (6.41 mm^2) in the range of length (UHG). In another case, No. 7 showed nearly the smallest value (26.40 mm^2) in the maximum of length (UHG), but showed the middle value (5.66 mm^2) in the range of length (UHG).

On the other hand, although the values were particularly large in some characters, the values were found to be peculiarly small in other characters in view of the same strains, and *vice versa*. For example, No. 17 showed nearly the smallest value (9.69 mm^2) in the minimum of area (HG), but showed peculiarly large value (8.14 mm^2) in the range of area (HG). In another case, No. 4 showed the largest value (0.53) in the minimum of quotient of volume, but showed nearly the smallest value (0.06) in the range of quotient of volume. These phenomena were found in several combinations.

2. In comparison with type A, type B and type C in accordance with the tripartite classification, the following facts were ascertained. Type A showed the general features as follows; 4 characters, *i.e.*, the minima of volumes (UHG and HG), quotients of area and volume, showed the larger values than that of the average of the whole strains, the remaining 14 characters, *i.e.*, the maxima, the minima and the ranges of areas (UHG and HG), the maxima and the ranges of volumes (UHG and HG) and of quotients of areas and volumes, showed the smaller values than that of the average of the whole strains. It was a remarkable fact that the larger values of type A were found only in the minimum columns.

In type B, the pattern was fixed to be the one consisting of reversed results in type A. In view of the average values through the whole strains belonging to the type B in comparison with the average values through the whole strains, 14 characters, *i.e.*, the maxima, the minima and the ranges of areas (UHG and HG) and volumes (UHG and HG), and the maximum and the minimum of quotient of volume, showed the larger values than that of the average of the whole strains. Three characters, *i.e.*, the minima of quotients of area and volume, and the range of quotient of area, showed the same values as the average of the whole strains. One character, *i.e.*, the maximum of quotient of area, showed the smaller value than that of the average of the whole strains. It was noteworthy that the whole characters of area and volume showed the larger values than that of the whole strains.

In type C, the pattern was fixed to be nearly the same as that in type A and to be reversed one observed in type B, respectively. In view of the average values through type C in comparison with the average values through the whole strains, 3 characters, *i.e.*, the minimum of area (UHG), the minimum and the range of quotient of area, showed the larger values than that of the average of the whole strains. Two characters, *i.e.*, the maximum of quotient of area, and the minimum of quotient of volume, showed the same values as the average of the whole strains. The remaining 13 characters, *i.e.*, the maxima of areas (UHG and HG), volumes (UHG and HG) and quotient of volume, the minima of areas (UHG and HG) and volumes (UHG and HG), the ranges of area (HG), volumes (UHG and HG) and quotient of volume, showed the smaller values than that of the average of the whole strains.

3. In comparisons made on the Groups A and B in view of group-averages, the following facts were ascertained. Nine characters, *i.e.*, the maxima of areas (UHG and HG) and volume (HG), the minima of areas (UHG and HG), volumes (UHG and HG), quotients of area and volume, showed the larger values in Group A than that in Group B. The remaining 9 characters, *i.e.*, the maxima

of volume (UHG) and quotients of area and volume, the ranges of areas (UHG and HG), volumes (UHG and HG) and quotients of area and volume, showed the smaller values in Group A than that in Group B. It was noticeable that the minima and ranges of the whole columns showed the larger and the smaller values in Group A than that in Group B, respectively. These phenomena may be looked upon as geographical specificities.

4. In the larger set of area (UHG) in view of the maximum-column, the widest (31.76 mm^2) was obtained in No. 5, followed by No. 2 (31.06 mm^2) and No. 1 (30.16 mm^2). In also the larger set of area (UHG) in view of the minimum-column, the widest (25.35 mm^2) was obtained in No. 5, followed by No. 2 (24.48 mm^2) and No. 1 (23.93 mm^2). Addition to this, in the larger set of volume (UHG) in view of the range-column, the largest (23.21 mm^3) was obtained in No. 5, followed by No. 2 (22.44 mm^3) and No. 1 (20.36 mm^3). These orders of strains were finally illustrated in 3 characters as 5>2>1, and were fixed to be the same as 3 characters. These phenomena were found in other 11 cases, *i.e.*, ① 1>2>5···No. 1 (55.04 mm^3, 19.77 mm^2 and 31.60 mm^3), No. 2 (53.66 mm^3, 19.37 mm^2 and 28.96 mm^3) and No. 5 (52.20 mm^3, 19.22 mm^2 and 28.31 mm^3) in the larger sets of the minimum of volume (UHG), the maximum of area (HG) and the minimum of volume (HG); ② 2>5>1···No. 2 (76.10 mm^3 and 22.40 mm^3), No. 5 (75.41 mm^3 and 13.93 mm^3) and No. 1 (75.40 mm^3 and 13.87 mm^3) in the larger sets of the maximum of volume (UHG) and the range of volume (HG); ③ 3<4<6···No. 3 (44.92 mm^3, 34.22 mm^3 and 7.63 mm^3), No. 4 (49.96 mm^3, 38.72 mm^3 and 21.17 mm^3) and No. 6 (57.02 mm^3, 41.32 mm^3 and 21.38 mm^3) in the smaller sets of the maximum of volume (UHG), the minimum of volume (UHG) and the minimum of volume (HG); ④ 3<6<8···No. 3 (8.48 mm^2, 0.49 and 0.34), No. 6 (11.88 mm^2, 0.62 and 0.56) and No. 8 (12.60 mm^2, 0.63 and 0.57) in the smaller sets of the minimum of area (HG), the maximum of quotient of area and the maximum of quotient of volume; ⑤ 6<4<8···No. 6 (0.04 and 0.04), No. 4 (0.05 and 0.06) and No. 8 (0.09 and 0.08) in the smaller sets of the ranges of quotients of area and volume; ⑥ 19>18>21···No. 19 (93.35 mm^3, 60.91 mm^3 and 45.54 mm^3), No. 18 (77.25 mm^3, 56.70 mm^3 and 41.89 mm^3) and No. 21 (73.80 mm^3, 55.15 mm^3 and 39.11 mm^3) in the larger sets of the maximum and the minimum of volumes (UHG) and the maximum of volume (HG); ⑦ 11<15<12··· No. 11 (3.00 mm^2 and 6.90 mm^3), No. 15 (3.74 mm^2 and 9.54 mm^3) and No. 12 (4.79 mm^2 and 15.00 mm^3) in the smaller sets of the ranges of area (UHG) and volume (UHG); ⑧ 11<15<14··· No. 11 (18.79 mm^2 and 36.90 mm^3), No. 15 (19.80 mm^2 and 37.62 mm^3) and No. 14 (27.28 mm^2 and 60.03 mm^3) in the smaller sets of the maxima of area (UHG) and volume (UHG); ⑨ 12<14<21··· No. 12 (0.60 and 0.55), No. 14 (0.62 and 0.55) and No. 21 (0.63 and 0.58) in the smaller sets of the maxima of quotients of area and volume; ⑩ 15<11<12···No. 15 (11.21 mm^2 and 3.37 mm^3), No. 11 (11.69 mm^2 and 6.54 mm^3) and No. 12 (15.35 mm^2 and 8.85 mm^3) in the smaller sets of the maximum of area (HG) and the range of volume (HG); ⑪ 15<11<14···No. 15 (1.26 mm^2 and 18.78 mm^3), No. 11 (2.42 mm^2 and 21.84 mm^3) and No. 14 (2.74 mm^2 and 31.52 mm^3) in the smaller sets of the range of area (HG) and the maximum of volume (HG). It was noticed that 5 of the whole combinations (=12) were found in the smaller sets in Group B.

In view of the tripartite classifications, the following sets were constituted by the same types, *i.e.*, only type B···⑥, only type C···③, ④, ⑤, ⑧ and ⑪.

On the other hand, some sets of strains did not show the same orders, but showed the same combinations, which meant the same strain numbers regardless of orders. Twelve cases were ascertained, *i.e.*, ① 1·2·5 in the larger sets···the maximum of area (HG) and the minima of volumes (UHG and HG) (1>2>5), the minimum of area (HG) (1>5>2), the maximum of volume (HG) (2>1>5), the maximum of volume (UHG) and the range of volume (HG) (2>5>1), the maximum

and the minimum of area (UHG) and the range of volume (UHG) (5>2>1); ② 1·2·7 in the larger sets···the maxima of quotients of area (1=7>2) and volume (2>7>1); ③ 1·4·6 in the larger sets··· the minima of quotients of area (4>1=6) and of volume (1=4>6); ④ 3·4·7 in the smaller sets··· the maxima of areas in UHG (4<3<7) and in HG (3<4<7); ⑤ 3·4·9 in the smaller sets···the ranges of area (UHG) (3<4<9) and of volume (HG) (4<3<9); ⑥ 10·18·21 in the larger sets··· the maximum (UHG) (10>18>21) and the minimum (HG) (18>21>10) of areas; ⑦ 13·17·19 in the larger sets···the ranges of area (HG) (17>13>19) and volume (HG) (17>19>13); ⑧ 13·17·20 in the larger sets···the ranges of area (UHG) (17>20>13) and of quotient of area (20>17>13); ⑨ 18·19·21 in the larger sets···the minimum of volume (HG) (18>21>19), the maxima of volumes (UHG and HG) and the minimum of volume (UHG) (19>18>21), the minimum of area (UHG) (21>18>19); ⑩ 11·12·15 in the smaller sets···the ranges of area and volume (UHG) (11<15<12), the maximum of area (HG) and the range of volume (HG) (15<11<12); ⑪ 11·14·15 in the smaller sets···the maxima of area and volume (UHG) (11<15<14), the range of area (HG) and the maximum of volume (HG) (15<11<14); ⑫ 11·15·17 in the smaller sets···the minima of volume in UHG (15<11<17) and HG (11<15<17).

It was noteworthy that 10 combinations were ascertained in ① set, *i.e.*, 1·2·5 combinations. It meant that these combinations of strains were fixed to be genetically stable state.

In view of the tripartite classification, the following sets were constituted by the same types, *i.e.*, only type B···⑨, only type C···③, ④, ⑤, ⑧, ⑪ and ⑫.

5. From the data obtained in the previous papers[3,4] and the present experiment, varietal variations were summed-up in view of the pure-ranges, and are shown in Table 2. In this table, strains showing the relatively large (roman figure in the table) and relatively small (*italic figure* in the table) values were illustrated by No. 1, No. 2 and No. 3 in 24 characters. The arrangements were separately made in Group A and Group B. In view of the relatively large values, strains showed No. 1, No. 2 and No. 3 values in the respective strains from the strain Nos. 1 to 21 as follows; 7, 3, 4; 4, 6, 4; 3, 2, 1; 0, 0, 0; 4, 4, 1; 0, 3, 4; 5, 3, 7; 1, 3, 1; 2, 4, 0; 3, 3, 5; 0, 1, 2; 0, 0, 1; 0, 4, 4; 2, 4, 2; 0, 0, 0; 0, 1, 3; 5, 7, 0; 0, 1, 0; 3, 4, 2; 10, 3, 3; 1, 0, 0, respectively. In view of the relatively small values, these values were ascertained in the same order as 0, 0, 1; 0, 1, 1; 8, 5, 0; 6, 13, 2; 1, 2, 2; 5, 5, 1; 1, 0, 0; 2, 0, 4; 4, 4, 5; 0, 0, 0; 4, 5, 3; 10, 3, 4; 0, 0, 2; 0, 3, 3; 10, 5, 2; 0, 1, 3; 0, 1, 1; 0, 1, 2; 0, 1, 2; 0, 0, 0; 1, 4, 2, respectively. In view of the both values, these values were ascertained in the same order as 7, 3, 5; 4, 7, 5; 11, 7, 1; 6, 13, 2; 5, 6, 3; 5, 8, 5; 6, 3, 7; 3, 3, 5; 6, 8, 5; 3, 3, 5; 4, 6, 5; 10, 3, 5; 0, 4, 6; 2, 7, 5; 10, 5, 2; 0, 2, 6; 5, 8, 1; 0, 2, 2; 3, 5, 4; 10, 3, 3; 2, 4, 2, respectively.

In the larger ranges, the highest frequency (=16) was found in strain No. 20, followed by No. 7 (=15) and Nos. 1 and 2 (=14). The lowest frequency (=0) was noted in Nos. 4 and 15, followed by Nos. 12, 18 and 21 (=1). In the smaller ranges, the highest frequency (=21) was found in No. 4, followed by Nos. 12 and 15 (=17). The lowest frequency (=0) was noted in Nos. 10 and 20, followed by Nos. 1 and 7 (=1). It was reasonably found that the results found in the larger ranges were fixed to be of the reversed status from that of the smaller ranges. In the whole ranges, the highest frequency (=21) was found in No. 4, followed by Nos. 3 and 9 (=19). The lowest frequency (=4) was noted in No. 18, followed by Nos. 16 and 21 (=8).

In view of the tripartite classification, type A (1 strain), B (5 strains) and C (15 strains) showed their average values in the order of the larger, the smaller and the total values as 1.0, 17.0, 18.0; 6.8, 4.0, 10.8; 7.7, 7.3, 14.9, respectively. It was ascertained that type A was remarkably found in the smaller ranges.

Table 2. Strains showing the relatively large values (roman figure) and the small values (*italic* figure) in 24 characters, cited from the pure-ranges; 1-the largest or the smallest, 2-the second, 3- the third values in the respective characters

Strain No.	Character numbers: Unhusked						Husked						Comparison						Area and Volume						Total		
	1	2	3	4	5	6	11	12	13	14	15	16	21	22	23	24	25	26	31	32	33	34	35	36	L	S	T
1	*3*	1	2	1	1	1		1		1	3	1	2				2			3	3	3			14	*1*	15
2	3		3			*3*	2			*2*			2	2	1		2	3	3	2	1	1	2	1	14	*2*	16
3	*1*	*1*	*2*	*1*	*1*		*1*		*2*	2	1	*1*	*2*	1		*2*	1	3	*1*	*1*		*2*	2		6	*13*	19
4		*2*	*2*	*2*	*3*	*2*		*1*	*2*	*1*	*3*		*1*	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*1*	*1*	*2*	*2*	0	*21*	21
5	*2*	2	1	3	2	*3*	*2*	2	1			*1*	*3*		1					1		2			9	*5*	14
6	2		*2*		3	3	3	3	*2*	*3*	*2*			*1*	*2*	*1*	*2*	*1*	2		2		*1*	*1*	7	*11*	18
7	1		3	2		3	1		1	3	2	3	1	3	3	1		2			*1*			3	15	*1*	16
8		3				2						2			*1*	2	*1*	*3*	1	*3*			*3*	*3*	5	*6*	11
9		*2*	*1*	*3*	*2*	*1*		*2*	*1*		*1*	*3*	2	*2*		2	2	1	*3*		*3*	*3*	1	2	6	*13*	19
10	3	3			2	1	3		2	3		2	1		1									3	11	*0*	11
11	*2*	*1*		*3*	3		*3*	*2*			3		*1*			2			*1*	*1*	*2*	*2*	*3*	*2*	3	*12*	15
12	*1*			*1*	*1*		*2*			*3*	*2*	3	*2*	*1*	*1*	*1*	*1*	*1*	*3*	*3*		*3*	*1*	*1*	1	*17*	18
13		2	2			*3*		2	3			*3*							3		2	3	3		8	*2*	10
14			3			3		*2*	1		2	1	*3*		2	*2*	2	2			*3*		*2*	*3*	8	*6*	14
15	*3*	*2*	*1*			*1*	*1*	*1*	*1*	*1*	*1*	*1*			*2*		*3*	*2*	*2*	*2*	*1*	*1*			0	*17*	17
16			*2*	3	*3*		3		*3*	2						3								*3*	4	*4*	8
17	2	1		2	*2*		2	2					2	2		*3*			1	1	1	1	2		12	*2*	14
18															*3*		*2*	*3*						2	1	*3*	4
19			1	*2*				1			*3*		2	1			2	3		2	3	2	*3*		9	*3*	12
20	1	3		1	1	2	1			1	1			2	3	1	1		2	3			1	1	16	*0*	16
21		*3*	*3*			*2*			*1*	*2*		*2*		*2*				1							1	*7*	8

Character numbers; 1, 11, 21–length, 2, 12, 22–width, 3, 13, 23–thickness, 4, 14, 24–L/W, 5, 15, 25–L/T, 6, 16, 26–W/T, 1–6–unhusked grain, 11–16–husked grain, 21–26–comparative value (=husked/unhusked), 31–area (UHG), 32–volume (UHG), 33–area (HG), 34–volume (HG), 35–quotient of area (=33/31), 36–quotient of volume (=34/32)

Total; L–relatively large values, S–relatively small values, T–both of L and S

This analysing method was firstly used in the present paper. New methodology for these purposes should be promoted by the further analyses using other materials, which have been distributed all over the world.

Summary

In order to confirm the varietal variations of cultivated rice collected in India, variation ranges of 6 characters were investigated following the previous papers. Those were geographically divided into 2 groups, *i.e.*, Group A — northeastern India, Group B — West Bengal State. The results obtained here were summarized as follows:

1. The maxima, the minima and the pure-ranges of area (UHG), volume (UHG), area (HG), volume (HG), quotient of area and quotient of volume in Group A were ascertained as 28.44 mm^2, 22.59 mm^2, 5.86 mm^2; 62.82 mm^3, 46.19 mm^3, 16.63 mm^3; 16.96 mm^2, 13.13 mm^2, 3.83 mm^2; 34.90 mm^3, 23.69 mm^3, 11.21 mm^3; 0.64, 0.54, 0.10; 0.60, 0.47, 0.13 in average values, respectively. Those in Group B were ascertained in the same order as 28.43 mm^2, 21.34 mm^2, 7.10 mm^2; 65.60 mm^3, 44.02 mm^3, 21.58 mm^3; 16.91 mm^2, 12.43 mm^2, 4.48 mm^2; 34.73 mm^3, 21.70 mm^3, 13.04 mm^3; 0.66, 0.53, 0.12; 0.61, 0.46, 0.15 in average values, respectively. Those in the whole strains of both of the groups were ascertained in the same order as 28.44 mm^2, 21.87 mm^2, 6.57 mm^2; 64.41 mm^3, 44.95 mm^3, 19.46 mm^3; 16.93 mm^2, 12.73 mm^2, 4.20 mm^2; 34.81 mm^3, 22.55 mm^3, 12.25 mm^3; 0.65, 0.53, 0.11; 0.60, 0.46, 0.14 in average values, respectively. Nine and other 9 characters showed the larger and the smaller values in Group A than that in Group B, respectively.

2. Basing on the data obtained in these characters, several patterns and strain specificities were ascertained. Strain showing relatively large or small values in the respective characters were picked-up and grouped as "order" or "combination". These techniques were confirmed to be useful for testing strain or geographical differentiations of rice varieties.

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