

Morphological Characters of the Cultivated Rice Grains Delivered from Rice Research Station, Chinsurah, West Bengal, India (III)

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Introduction

During the period from December in 1978 to January in 1979, the writer was sent to India for collection of the wild and cultivated rices under the project, designated "The Distribution of Wild Rice and the Ecotypic Differentiation of Cultivated Rice in Burma and Assam", supported by the Grant from the Ministry of Education, Japan. In this opportunity, 100 strains of cultivated rice stocked in Rice Research Station, Chinsurah, West Bengal, India, were delivered to him through the kindness of Dr. S. Biswas of the station. The grains of these strains were used for the morphological studies.

In the station, many strains of the cultivated rice, *Oryza sativa* L., were collected and studied in view of the breeding program. While they were not used for morphological characters. For genetic and breeding purposes, however, varietal variations and methodology of those should be ascertained as promptly as possible.

Since 1969, high yielding varieties have been recommended by the governments of a lot of countries in south and southeast Asia. It is said that local and domestic varieties have been disappeared in these processes^{1,2)}. 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 limelight in these scientific fields.

Taking these factors into account, the author tried to accomplish the work, the aim of which was a clarification the varietal variation and of the phylogenetic relationships of cultivated-rice-strains (=cultivars), using the relatively primitive and un-advanced ones in India in the previous experimental series. The present experimental series was made to search the varietal variations, using the relatively advanced cultivars in India, taking these facts into considerations. In the previous papers^{4,5)}, the records of morphological characters of the unhusked and husked grains⁴⁾, comparative values, area and volume columns and 6 characters of ranges⁵⁾, were reported.

In the present paper, variation ranges in the other 12 characters were mainly described, in order to confirm the morphological characters of grains which were to make the strain's specificities clear.

Materials and Methods

One hundred strains of rice cultivars were used in this experiment. They are listed up in Table 1 of the previous paper⁴⁾. In this table, collection number, original place are mentioned. They have different meanings in view of physiological characters, *i. e.*, *aman* and *aus*, and should be considered separately also in morphological studies. Accordingly, they are divided into two groups in the present experiment, *i. e.*, Group A-*aman* varieties (=strain Nos. 1~50), Group B-*aus* varieties (=strain Nos. 51~100).

Thirty grains were used for measurement of each strain. The variation ranges in 12 characters (Tables 1 and 2) were illustrated by the maximum, the minimum and the pure-range value in the whole grains. Comparative values for 6 characters (Table 2) were illustrated by the ratios of values in the husked grains to values in the unhusked grains in the respective characters. The whole data referring 12 characters were illustrated by the average value through 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. Lengths in HG

Maximum : *Group A:* The results are given in Table 1. In this table, the maximum, the minimum and their ranges are shown. The longest (8.00 mm) was obtained in No. 6, which was the same as in cases of the maxima of L/W and W/T, and of the minima of L and L/T and of the ranges of L/W and L/T (UHG), followed by No. 25 (7.90 mm) and Nos. 8, 28 and 42 (7.60 mm). These combinations of strains were found to be the same as in cases of the minima of L and L/W (UHG). The shortest (4.60 mm) was noted in No. 29, which was the same as in cases of the maxima of L, W, T, L/T and W/T, and of the minima of L, W and L/T (UHG), followed by No. 50 (5.70 mm) and No. 20 (5.75 mm). Average and its s. d. through the whole strains were found to be 6.71 ± 0.63 .

Group B: The longest (7.45 mm) was obtained in No. 89, followed by No. 97 (7.30 mm) and No. 92 (7.15 mm). The shortest (5.30 mm) was noted in No. 87, which was the same as in case of the maximum of L (UHG), followed by No. 94 (5.65 mm) and Nos. 56 and 79 (5.80 mm). These orders of strains were found to be the same as in case of the maximum of L (UHG). Average and its s. d. through the whole strains were found to be 6.35 ± 0.40 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 6.53 ± 0.56 .

Minimum : *Group A:* The longest (7.15 mm) was obtained in No. 6, which was the same as in cases of the maxima of L (HG), and L/W and L/T (UHG), of the minima of L and L/T (UHG), and the ranges of L/W and L/T (UHG), followed by No. 28 (7.00 mm) and No. 25 (6.90 mm). These combinations of strains were found to be the same as in cases of the minima of L and L/W (UHG) and of the maximum of L (HG). The shortest (4.00 mm) was noted in No. 29, which was the same as in cases of the maxima of L (UHG and HG), W, T, L/T and W/T (UHG), of the minima of L, W and L/T (UHG), followed by

Table 1. Ranges of husked grains in the strain level; length (mm), width (mm), thickness (mm), ratio of length to width (%), ratio of length to thickness (%) and ratio of width to thickness (%)

Strain No.	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness		
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
1	6.80	6.10	0.70	2.45	2.00	0.25	2.00	1.85	0.15	3.35	2.57	0.78	3.68	3.13	0.55	1.27	1.05	0.22
2	6.70	6.05	0.65	2.65	2.20	0.45	2.10	1.85	0.25	2.91	2.33	0.58	3.46	2.93	0.53	1.43	1.10	0.33
3	7.25	6.70	0.55	2.60	2.20	0.40	2.00	1.80	0.20	3.34	2.58	0.76	3.92	3.49	0.43	1.44	1.13	0.31
4	7.00	6.40	0.60	2.40	2.00	0.40	2.05	1.70	0.35	3.43	2.79	0.64	3.88	3.27	0.61	1.37	0.98	0.39
5	6.35	5.80	0.55	2.15	1.80	0.35	1.85	1.60	0.25	3.30	2.74	0.56	3.76	3.27	0.49	1.30	1.03	0.27
6	8.00	7.15	0.85	2.20	1.85	0.35	1.80	1.30	0.50	4.00	3.45	0.55	5.58	4.11	1.47	1.56	1.06	0.50
7	6.80	6.05	0.75	2.55	2.00	0.55	1.95	1.65	0.30	3.35	2.48	0.87	3.94	3.26	0.68	1.50	1.05	0.45
8	7.60	6.45	1.15	2.50	2.10	0.40	2.05	1.45	0.60	3.50	2.58	0.92	4.45	3.58	0.87	1.72	1.02	0.70
9	6.70	6.20	0.50	2.40	2.00	0.40	1.95	1.70	0.25	3.30	2.67	0.63	3.91	3.35	0.56	1.38	1.05	0.33
10	7.50	6.80	0.70	2.50	2.20	0.30	2.00	1.70	0.30	3.29	2.80	0.49	4.12	3.60	0.52	1.43	1.18	0.25
11	6.45	5.95	0.50	2.35	2.10	0.25	1.95	1.55	0.40	3.07	2.61	0.46	4.10	3.28	0.82	1.48	1.08	0.40
12	6.80	6.00	0.80	2.45	2.10	0.35	2.00	1.70	0.30	3.05	2.60	0.45	3.78	3.15	0.63	1.41	1.08	0.33
13	7.50	6.70	0.80	2.55	2.20	0.35	2.00	1.80	0.20	3.36	2.68	0.68	4.05	3.58	0.47	1.39	1.10	0.29
14	6.70	6.10	0.60	2.50	2.00	0.50	2.00	1.80	0.20	3.20	2.53	0.67	3.69	3.05	0.64	1.33	1.05	0.28
15	6.40	5.90	0.50	2.45	2.00	0.45	1.95	1.50	0.35	3.08	2.55	0.53	4.17	3.15	1.02	1.57	1.03	0.54
16	6.90	6.00	0.90	2.15	2.00	0.15	1.90	1.70	0.20	3.40	2.95	0.45	4.06	3.33	0.73	1.27	1.05	0.22
17	6.75	6.10	0.65	2.15	1.90	0.25	1.90	1.45	0.45	3.30	2.93	0.37	4.28	3.21	1.07	1.31	1.05	0.26
18	6.40	5.70	0.70	2.60	2.35	0.25	2.10	1.70	0.40	2.72	2.27	0.45	3.47	2.83	0.64	1.47	1.14	0.33
19	6.40	5.80	0.60	2.60	2.25	0.35	2.20	1.80	0.40	2.74	2.39	0.35	3.38	2.98	0.40	1.37	1.09	0.28
20	5.75	5.10	0.65	2.70	2.30	0.40	1.90	1.55	0.35	2.40	2.16	0.24	3.55	2.83	0.72	1.48	1.27	0.21
21	6.40	5.90	0.50	2.95	2.60	0.35	2.20	1.95	0.25	2.42	2.10	0.32	3.23	2.74	0.59	1.45	1.21	0.24
22	5.80	5.00	0.80	2.80	2.40	0.40	2.00	1.70	0.30	2.29	1.79	0.50	3.12	2.65	0.47	1.62	1.27	0.35
23	6.15	5.65	0.50	2.60	2.30	0.30	2.00	1.70	0.30	2.61	2.31	0.30	3.44	2.97	0.47	1.46	1.23	0.23
24	6.85	5.70	1.15	2.60	2.25	0.35	2.05	1.80	0.25	2.98	2.38	0.60	3.44	3.00	0.44	1.33	1.10	0.23
25	7.90	6.90	1.00	2.25	2.00	0.25	2.00	1.70	0.30	3.69	3.18	0.51	4.12	3.59	0.53	1.29	1.05	0.24

(Continued)

Table 1. (Continued)

Strain	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness			
	No.	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
26	26	6.00	5.60	0.40	2.50	2.20	0.30	2.00	1.30	0.70	2.67	2.30	0.37	4.39	2.85	1.54	1.85	1.13	0.72
27	27	6.00	5.50	0.50	2.60	2.30	0.30	2.00	1.80	0.20	2.54	2.12	0.42	3.28	2.85	0.43	1.44	1.15	0.29
28	28	7.60	7.00	0.60	2.10	1.90	0.20	1.95	1.75	0.20	3.95	3.41	0.54	4.20	3.64	0.56	1.17	1.05	0.12
29	29	4.60	4.00	0.60	1.85	1.70	0.15	1.70	1.50	0.20	2.68	2.28	0.40	3.00	2.47	0.53	1.23	1.03	0.20
30	30	6.45	5.80	0.65	2.30	1.95	0.35	1.90	1.60	0.30	3.15	2.67	0.48	3.75	3.22	0.53	1.30	1.05	0.25
31	31	6.60	6.00	0.60	2.40	2.00	0.40	1.95	1.70	0.25	3.15	2.52	0.63	3.82	3.18	0.64	1.37	1.11	0.26
32	32	6.35	5.40	0.95	2.45	2.10	0.35	1.95	1.70	0.25	2.98	2.30	0.68	3.89	3.08	0.81	1.40	1.13	0.27
33	33	6.70	5.90	0.80	2.20	1.90	0.30	1.90	1.75	0.15	3.42	2.86	0.56	3.66	3.24	0.42	1.20	1.05	0.15
34	34	6.45	5.70	0.75	2.15	2.00	0.15	1.90	1.75	0.15	3.23	2.76	0.47	3.42	3.05	0.37	1.17	1.05	0.12
35	35	7.45	6.70	0.75	2.40	2.00	0.40	1.90	1.60	0.30	3.68	2.91	0.77	4.47	3.39	1.08	1.47	1.11	0.36
36	36	7.40	6.70	0.70	2.35	2.05	0.30	1.95	1.70	0.25	3.46	3.00	0.46	4.24	3.58	0.66	1.35	1.10	0.25
37	37	6.60	6.10	0.50	2.40	2.10	0.30	2.05	1.75	0.30	3.00	2.63	0.37	3.60	3.15	0.45	1.31	1.07	0.24
38	38	7.55	6.85	0.70	2.40	2.10	0.30	2.05	1.75	0.30	3.57	2.92	0.65	4.11	3.45	0.66	1.34	1.02	0.32
39	39	6.70	6.05	0.65	2.30	2.00	0.30	1.95	1.75	0.20	3.30	2.75	0.55	3.64	3.18	0.46	1.28	1.03	0.25
40	40	6.20	5.70	0.50	2.00	1.80	0.20	1.80	1.60	0.20	3.39	2.93	0.46	3.69	3.26	0.43	1.25	1.03	0.22
41	41	6.90	6.40	0.50	2.40	2.10	0.30	1.95	1.80	0.15	3.21	2.79	0.42	3.72	3.31	0.41	1.33	1.10	0.23
42	42	7.60	6.50	1.10	2.30	2.10	0.20	2.00	1.75	0.25	3.54	2.89	0.65	3.95	3.42	0.53	1.31	1.08	0.23
43	43	6.15	5.70	0.45	2.60	2.15	0.45	2.10	1.80	0.30	2.77	2.25	0.52	3.22	2.85	0.37	1.33	1.08	0.25
44	44	6.25	5.70	0.55	2.50	2.20	0.30	2.00	1.80	0.20	2.65	2.41	0.25	3.26	2.92	0.34	1.31	1.13	0.18
45	45	6.95	6.05	0.90	2.30	2.00	0.30	1.95	1.75	0.20	3.43	2.72	0.71	3.83	3.18	0.65	1.22	1.05	0.17
46	46	6.95	6.40	0.55	2.15	2.00	0.15	1.95	1.80	0.15	3.39	3.07	0.32	3.83	3.42	0.41	1.19	1.05	0.14
47	47	6.75	6.15	0.60	2.25	2.00	0.25	1.95	1.70	0.25	3.29	2.86	0.43	3.77	3.21	0.56	1.24	1.03	0.21
48	48	6.60	5.95	0.65	3.05	2.40	0.65	2.10	1.80	0.30	2.65	2.10	0.55	3.46	2.90	0.56	1.65	1.19	0.46
49	49	7.10	6.30	0.80	2.30	2.00	0.30	2.10	1.70	0.40	3.55	2.74	0.81	3.97	3.36	0.61	1.31	0.98	0.33
50	50	5.70	5.00	0.70	2.45	2.20	0.25	2.00	1.75	0.25	2.55	2.19	0.36	3.17	2.72	0.45	1.37	1.16	0.21

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Table 1. (Continued)

Strain No.	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness		
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
51	6.25	5.50	0.75	3.30	2.90	0.40	2.30	2.00	0.30	2.16	1.72	0.44	3.08	2.50	0.58	1.61	1.29	0.32
52	6.30	5.70	0.60	3.10	2.70	0.40	2.20	2.00	0.20	2.26	1.87	0.39	3.10	2.65	0.45	1.55	1.28	0.27
53	6.50	5.90	0.60	2.95	2.55	0.40	2.10	1.80	0.30	2.43	2.10	0.43	3.36	2.88	0.48	1.50	1.26	0.24
54	6.55	6.00	0.55	2.85	2.50	0.35	2.10	2.00	0.10	2.53	2.22	0.31	3.25	2.91	0.34	1.43	1.25	0.18
55	6.55	5.90	0.65	3.30	2.90	0.40	2.40	2.00	0.40	2.17	1.82	0.35	3.10	2.57	0.53	1.60	1.25	0.35
56	5.80	5.00	0.80	3.15	2.60	0.55	2.25	1.95	0.30	2.00	1.66	0.34	2.85	2.34	0.51	1.55	1.24	0.31
57	6.70	5.95	0.75	2.75	2.40	0.35	2.10	1.85	0.25	2.60	2.28	0.32	3.62	2.93	0.69	1.43	1.17	0.26
58	6.30	5.60	0.70	3.45	2.70	0.75	2.30	2.00	0.30	2.32	1.67	0.65	3.00	2.54	0.46	1.62	1.17	0.35
59	6.60	6.10	0.50	3.15	2.60	0.55	2.20	1.90	0.30	2.43	1.97	0.46	3.32	2.86	0.46	1.58	1.24	0.34
60	6.40	5.90	0.50	3.15	2.45	0.75	2.20	1.95	0.25	2.49	2.00	0.49	3.23	2.81	0.42	1.62	1.14	0.38
61	6.80	6.30	0.50	2.75	2.40	0.35	2.00	1.90	0.10	2.71	2.39	0.32	3.47	3.18	0.29	1.42	1.20	0.22
62	6.30	5.80	0.50	2.85	2.45	0.40	2.05	1.80	0.25	2.49	2.16	0.33	3.33	2.85	0.48	1.50	1.24	0.26
63	6.15	5.70	0.45	2.85	2.50	0.35	2.10	1.85	0.25	2.40	2.13	0.27	3.16	2.76	0.40	1.47	1.19	0.28
64	6.25	5.75	0.50	3.15	2.75	0.40	2.15	1.90	0.25	2.18	1.94	0.24	3.21	2.76	0.45	1.61	1.31	0.30
65	6.50	5.80	0.70	2.80	2.30	0.50	2.15	1.90	0.25	2.80	2.18	0.62	3.31	2.76	0.55	1.38	1.17	0.21
66	6.45	5.75	0.70	2.40	2.20	0.20	1.90	1.70	0.20	2.87	2.50	0.37	3.51	3.11	0.40	1.35	1.16	0.19
67	6.10	5.30	0.80	3.15	2.80	0.35	2.20	1.90	0.30	2.07	1.83	0.24	3.50	2.59	0.91	1.68	1.34	0.34
68	6.30	5.80	0.50	2.85	2.45	0.40	2.15	1.90	0.25	2.44	2.04	0.40	3.16	2.70	0.46	1.47	1.14	0.33
69	6.30	5.80	0.50	3.30	2.90	0.40	2.30	2.00	0.30	2.04	1.84	0.20	3.03	2.69	0.34	1.60	1.37	0.23
70	6.10	5.30	0.80	2.55	2.40	0.15	2.00	1.75	0.25	2.54	2.12	0.42	3.39	2.87	0.52	1.40	1.25	0.15
71	6.70	6.05	0.65	2.60	2.30	0.30	1.95	1.70	0.25	2.79	2.46	0.33	3.72	3.26	0.46	1.47	1.23	0.24
72	6.15	5.70	0.45	2.65	2.40	0.25	2.00	1.70	0.30	2.56	2.26	0.30	3.47	3.00	0.47	1.50	1.20	0.30
73	6.55	5.95	0.60	3.00	2.70	0.30	2.20	1.95	0.25	2.39	2.03	0.36	3.20	2.93	0.27	1.50	1.27	0.23
74	5.95	5.30	0.65	3.10	2.60	0.50	2.20	2.00	0.20	2.13	1.71	0.42	2.95	2.52	0.43	1.51	1.24	0.27
75	6.30	5.70	0.60	2.70	2.30	0.40	2.05	1.85	0.20	2.58	2.17	0.41	3.22	2.90	0.32	1.46	1.12	0.34

(Continued)

Table 1. (Continued)

Strain No.	Length			Width			Thickness			Length Width			Length Thickness			Width Thickness		
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
76	6.60	6.00	0.60	2.95	2.50	0.45	2.10	1.90	0.20	2.40	2.07	0.33	3.26	2.91	0.35	1.45	1.25	0.20
77	6.05	5.60	0.45	2.50	2.25	0.25	1.90	1.65	0.25	2.63	2.33	0.30	3.55	3.03	0.52	1.47	1.21	0.26
78	6.20	5.50	0.70	2.80	2.50	0.30	2.00	1.70	0.30	2.43	2.08	0.35	3.47	3.00	0.47	1.59	1.30	0.29
79	5.80	5.30	0.50	3.10	2.55	0.55	2.25	1.90	0.35	2.15	1.82	0.33	3.05	2.40	0.65	1.55	1.23	0.32
80	6.40	5.50	0.90	2.80	2.20	0.60	2.20	1.80	0.40	2.73	2.11	0.62	3.24	2.80	0.44	1.44	1.05	0.39
81	5.95	5.30	0.65	3.20	2.65	0.55	2.20	1.90	0.30	2.20	1.74	0.46	3.00	2.52	0.48	1.58	1.23	0.35
82	6.40	6.00	0.40	2.85	2.45	0.40	2.00	1.90	0.10	2.57	2.14	0.43	3.32	3.08	0.24	1.47	1.23	0.24
83	6.15	5.50	0.65	3.00	2.40	0.60	2.10	1.70	0.40	2.38	1.83	0.55	3.44	2.71	0.73	1.68	1.20	0.48
84	6.05	5.40	0.65	3.15	2.40	0.75	2.30	1.90	0.40	2.52	1.77	0.75	2.90	2.44	0.46	1.55	1.07	0.48
85	6.90	6.00	0.90	2.95	2.50	0.45	2.10	1.90	0.20	2.64	2.10	0.54	3.45	2.95	0.50	1.45	1.24	0.21
86	5.90	5.10	0.80	2.50	2.10	0.40	1.95	1.60	0.35	2.68	2.20	0.48	3.44	2.91	0.53	1.47	1.16	0.31
87	5.30	4.90	0.40	2.75	2.40	0.35	2.00	1.75	0.25	2.15	1.85	0.30	2.94	2.51	0.43	1.57	1.23	0.34
88	6.10	5.15	0.95	2.75	2.40	0.35	1.95	1.70	0.25	2.38	2.00	0.38	3.50	2.82	0.68	1.50	1.23	0.27
89	7.45	6.45	1.00	2.50	2.10	0.40	2.00	1.80	0.20	3.37	2.75	0.62	4.00	3.31	0.69	1.39	1.08	0.31
90	6.25	5.65	0.60	3.30	2.70	0.60	2.25	1.80	0.45	2.22	1.76	0.46	3.16	2.51	0.65	1.78	1.29	0.49
91	6.05	5.20	0.85	3.10	2.80	0.30	2.20	1.80	0.40	2.05	1.73	0.32	3.03	2.48	0.55	1.67	1.33	0.34
92	7.15	6.20	0.95	2.95	2.60	0.35	2.15	2.00	0.15	2.61	2.31	0.30	3.50	2.95	0.55	1.45	1.23	0.22
93	6.60	6.00	0.60	2.70	2.10	0.60	2.05	1.75	0.30	2.93	2.32	0.61	3.60	2.95	0.65	1.43	1.15	0.28
94	5.65	4.90	0.75	2.75	2.30	0.45	2.00	1.80	0.20	2.41	1.82	0.59	2.97	2.50	0.47	1.50	1.21	0.29
95	6.25	5.60	0.65	2.40	2.10	0.35	1.95	1.70	0.25	2.91	2.30	0.61	3.54	3.11	0.43	1.35	1.10	0.25
96	6.15	5.55	0.60	2.60	2.20	0.40	2.00	1.70	0.30	2.64	2.21	0.43	3.44	2.95	0.49	1.50	1.15	0.35
97	7.30	6.40	0.90	2.50	2.20	0.30	1.90	1.70	0.20	3.16	2.71	0.45	4.06	3.46	0.60	1.41	1.18	0.23
98	6.30	5.80	0.50	3.20	2.80	0.40	2.30	1.95	0.35	2.19	1.86	0.33	3.13	2.61	0.52	1.58	1.22	0.36
99	6.65	5.70	0.95	3.20	2.70	0.50	2.25	2.05	0.20	2.27	1.91	0.36	3.09	2.69	0.40	1.51	1.28	0.23
100	7.05	6.40	0.65	2.90	2.50	0.40	2.10	1.80	0.30	2.64	2.28	0.36	3.73	3.12	0.61	1.56	1.19	0.37

Nos. 22 and 50 (5.00 mm). These combinations of strains were found to be the same as in cases of the maxima and of the minima of L and L/T (UHG). Average and its s. d. through the whole strains were found to be 6.03 ± 0.57 .

Group B: The longest (6.45 mm) was obtained in No. 89, which was the same as in case of the maximum of L (HG), followed by Nos. 97 and 100 (6.40 mm). These combinations of strains were found to be the same as in case of the maximum of L/T (UHG). The shortest (4.90 mm) was noted in Nos. 87 and 94, followed by No. 86 (5.10 mm). These combinations of strains were found to be the same as in case of the minimum of L (UHG). Average and its s. d. through the whole strains were found to be 5.69 ± 0.38 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 5.86 ± 0.51 .

Range : Group A: The largest (1.15 mm) was obtained in Nos. 8 and 24, followed by No. 42 (1.10 mm). The smallest (0.40 mm) was noted in No. 26, followed by No. 43 (0.45 mm). Average and its s. d. through the whole strains were found to be 0.68 ± 0.18 .

Group B: The largest (1.00 mm) was obtained in No. 89, which was the same as in cases of the maximum and of the minimum of L (HG), followed by Nos. 88, 92 and 99 (0.95 mm). These combinations of strains were found to be the same as in case of the range of L (UHG). The smallest (0.40 mm) was noted in Nos. 82 and 87, followed by Nos. 63, 72 and 77 (0.45 mm). Average and its s. d. through the whole strains were found to be 0.66 ± 0.16 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 0.67 ± 0.17 .

2. Widths in HG

Maximum : Group A: The widest (3.05 mm) was obtained in No. 48, followed by No. 21 (2.95 mm) and No. 22 (2.80 mm). These combinations of strains were found to be the same as in case of the range of W (UHG). The narrowest (1.85 mm) was noted in No. 29, which was the same as in cases of the maxima of L (UHG and HG), W, T, L/T and W/T (UHG), and of the minima of L (UHG and HG), W and L/T (UHG), followed by No. 40 (2.00 mm) and No. 28 (2.10 mm). Average and its s. d. through the whole strains were found to be 2.42 ± 0.22 .

Group B: The widest (3.45 mm) was obtained in No. 58, followed by Nos. 51, 55, 69 and 90 (3.30 mm). These combinations of strains were found to be the same as in case of the maximum of T (UHG). The narrowest (2.40 mm) was noted in Nos. 66 and 95, which were the same as in case of the maximum of W (UHG), followed by Nos. 77, 86, 89 and 97 (2.50 mm). These orders of strains were found to be the same as in case of the maximum of W (UHG). Average and its s. d. through the whole strains were found to be 2.91 ± 0.27 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 2.66 ± 0.35 .

Minimum : Group A: The widest (2.60 mm) was obtained in No. 21, which was the same as in cases of the maximum and of the minimum of W (UHG), and of the maximum of T (UHG), followed by Nos. 22 and 48 (2.40 mm). These combinations of strains were found to be the same as in case of the range of W (UHG). The narrowest (1.70 mm) was noted in No. 29, which was the same as in cases of the maxima of L (UHG and HG), W (UHG and HG), L/T and W/T (UHG), and of the minima of L (UHG and HG), W and

L/T (UHG), followed by Nos. 5 and 40 (1.80 mm). These combinations of strains were found to be the same as in case of the maximum of T (UHG). Average and its s.d. through the whole strains were found to be 2.09 ± 0.17 .

Group B : The widest (2.90 mm) was obtained in Nos. 51, 55 and 69. These combinations of strains were found to be the same as in case of the maximum of W (UHG). The narrowest (2.10 mm) was noted in Nos. 86, 89, 93 and 95. Average and its s.d. through the whole strains were found to be 2.48 ± 0.22 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 2.29 ± 0.28 .

Range : Group A : The largest (0.65 mm) was obtained in No. 48, which was the same as in case of the maximum of W (HG), followed by No. 7 (0.55 mm) and No. 14 (0.50 mm). The smallest (0.15 mm) was noted in Nos. 16, 29, 34 and 46. Average and its s.d. through the whole strains were found to be 0.33 ± 0.10 .

Group B : The largest (0.75 mm) was obtained in Nos. 58, 60 and 84. The smallest (0.15 mm) was noted in No. 70, followed by No. 66 (0.20 mm) and Nos. 72 and 77 (0.25 mm). Average and its s.d. through the whole strains were found to be 0.42 ± 0.13 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.38 ± 0.13 .

3. Thicknesses in HG

Maximum : Group A : The thickest (2.20 mm) was obtained in Nos. 19 and 21, followed by Nos. 2, 18, 43, 48 and 49 (2.10 mm). The thinnest (1.70 mm) was noted in No. 29, which was the same as in cases of the maxima of L (UHG and HG), W (UHG and HG), T, L/T and W/T (UHG), and of the minima of L (UHG and HG), W (UHG and HG) and L/T (UHG), followed by Nos. 6 and 40 (1.80 mm). These orders of strains were found to be the same as in case of the minimum of W (UHG). Average and its s.d. through the whole strains were found to be 1.98 ± 0.09 .

Group B : The thickest (2.40 mm) was obtained in No. 55, which was the same as in cases of the range of W and of the minimum of T (UHG), followed by Nos. 51, 58, 69, 84 and 98 (2.30 mm). These combinations of strains were found to be the same as in case of the maximum of T (UHG). The thinnest (1.90 mm) was noted in Nos. 66, 77 and 97. Average and its s.d. through the whole strains were found to be 2.12 ± 0.13 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 2.05 ± 0.13 .

Minimum : Group A : The thickest (1.95 mm) was obtained in No. 21, which was the same as in cases of the maximum (UHG) and the minima (UHG and HG) of W, and the maximum of T (UHG), followed by Nos. 1 and 2 (1.85 mm). The thinnest (1.30 mm) was noted in Nos. 6 and 26, which were the same as in case of the minimum of T (UHG), followed by Nos. 8 and 17 (1.45 mm). These orders of strains were found to be the same as in case of the minimum of T (UHG). Average and its s.d. through the whole strains were found to be 1.69 ± 0.13 .

Group B : The thickest (2.05 mm) was obtained in No. 99, followed by Nos. 51, 52, 54, 55, 58, 69, 74 and 92 (2.00 mm). The thinnest (1.60 mm) was noted in No. 86, which was the same as in case of the minimum of W (UHG), followed by No. 77 (1.65 mm) and Nos.

66, 71, 72, 78, 83, 88, 95, 96 and 97 (1.70 mm). Average and its s.d. through the whole strains were found to be 1.84 ± 0.11 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 1.77 ± 0.15 .

Range : Group A : The largest (0.70 mm) was obtained in No. 26, which was the same as in case of the range of T (UHG), followed by No. 8 (0.60 mm) and No. 6 (0.50 mm). These combinations of strains were found to be the same as in cases of the ranges of T and L/T (UHG). Moreover, these orders of strains were found to be the same as in case of the range of T (UHG). The smallest (0.15 mm) was noted in Nos. 1, 33, 34, 41 and 46. Average and its s.d. through the whole strains were found to be 0.28 ± 0.11 .

Group B : The largest (0.45 mm) was obtained in No. 90, followed by Nos. 55, 80, 83, 84 and 91 (0.40 mm). The smallest (0.10 mm) was noted in Nos. 54, 61 and 82. Average and its s.d. through the whole strains were found to be 0.27 ± 0.08 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.28 ± 0.10 .

4. Ratios of length to width (L/W) in HG

Maximum : Group A : The largest (4.00) was obtained in No. 6, which was the same as in cases of the maxima of L/W, L/T (UHG) and L (HG), of the minima of L (UHG and HG) and L/T (UHG), and of the ranges of L/W and L/T (UHG), followed by No. 28 (3.95) and No. 25 (3.69). These combinations of strains were found to be the same as in cases of the maximum (UHG) and of the minima of L (UHG and HG), and of the minimum of L/W (UHG). Moreover, these orders of strains were found to be the same as in case of the minimum of L (HG). The smallest (2.28) was noted in No. 22, which was the same as in cases of the maximum and of the minimum of L/W (UHG), followed by No. 20 (2.40) and No. 21 (2.42). These combinations of the strains were found to be the same as in cases of the maximum and of the minimum of L/W (UHG). Moreover, these orders of strains were found to be the same as in case of the maximum of L/W (UHG). Average and its s.d. through the whole strains were found to be 3.15 ± 0.40 .

Group B : The largest (3.37) was obtained in No. 89, which was the same as in cases of the maximum, of the minimum and of the range of L (HG), followed by No. 97 (3.16) and No. 93 (2.93). The smallest (2.00) was noted in No. 56, which was the same as in cases of the maximum and of the range of L/W (UHG), followed by No. 69 (2.04) and No. 91 (2.05). Average and its s.d. through the whole strains were found to be 2.47 ± 0.29 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 2.81 ± 0.49 .

Minimum : Group A : The largest (3.45) was obtained in No. 6, which was the same as in cases of the maxima of L (HG), L/W (UHG and HG) and L/T (UHG), of the minima of L (UHG and HG) and L/T (UHG) and of the ranges of L/W and L/T (UHG), followed by No. 28 (3.41) and No. 25 (3.18). These combinations of strains were found to be the same as in cases of the maximum (UHG) and of the minima (UHG and HG) of L, of the maximum (HG) and of the minimum (UHG) of L/W. Moreover, these orders of strains were found to be the same as in cases of the minimum of L and of the maximum of L/W (HG). The smallest (1.79) was noted in No. 22, which was the same as in cases of the maxima (UHG

and HG) and of the minimum (UHG) of L/W, followed by Nos. 21 and 48 (2.10). Average and its s. d. through the whole strains were found to be 2.62 ± 0.34 .

Group B: The largest (2.75) was obtained in No. 89, which was the same as in cases of the maxima (L and L/W), of the minimum (L) and of the range (L) in HG, followed by No. 97 (2.71) and No. 66 (2.50). These combinations of strains were found to be the same as in case of the maximum of L/W (UHG). The smallest (1.67) was noted in No. 58, followed by No. 74 (1.71) and No. 51 (1.72). Average and its s. d. through the whole strains were found to be 2.06 ± 0.26 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 2.34 ± 0.41 .

Range: Group A: The largest (0.92) was obtained in No. 8, which was the same as in cases of the maximum of W/T, of the ranges of L and W/T (UHG), followed by No. 7 (0.87) and No. 49 (0.81). The smallest (0.24) was noted in No. 20, followed by No. 25 (0.25) and No. 23 (0.30). Average and its s. d. through the whole strains were found to be 0.53 ± 0.16 .

Group B: The largest (0.75) was obtained in No. 84, which was the same as in case of the range of W/T (UHG), followed by No. 58 (0.65) and Nos. 65, 80 and 89 (0.62). The smallest (0.20) was noted in No. 69, followed by Nos. 64 and 67 (0.24). Average and its s. d. through the whole strains were found to be 0.41 ± 0.12 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 0.47 ± 0.15 .

5. Ratios of length to thickness (L/T) in HG

Maximum: Group A: The largest (5.58) was obtained in No. 6, which was the same as in cases of the maxima of L (HG), L/W (UHG and HG) and L/T (UHG), of the minima of L (UHG and HG), L/W (HG) and L/T (UHG), and of the ranges of L/W and L/T (UHG), followed by No. 35 (4.47) and No. 8 (4.45). These combinations of strains were found to be the same as in case of the maximum of L/T (UHG). The smallest (3.00) was noted in No. 29, which was the same as in cases of the maxima of L, W and T (UHG and HG), L/T and W/T (UHG), of the minima of L and W (UHG and HG) and L/T (UHG), followed by No. 22 (3.12) and No. 50 (3.17). These combinations of strains were found to be the same as in cases of the maxima and of the minima of L and L/T (UHG) and that of the minimum of L (HG). Moreover, these orders of strains were found to be the same as in cases of the maxima of L and L/T and of the minimum of L/T (UHG). Average and its s. d. through the whole strains were found to be 3.80 ± 0.44 .

Group B: The largest (4.06) was obtained in No. 97, which was the same as in cases of the maximum and of the minimum of L/T (UHG), followed by No. 89 (4.00) and No. 100 (3.73). These combinations of strains were found to be the same as in cases of the maximum of L/T (UHG) and of the minimum of L (HG). Moreover, these orders of strains were found to be the same as in case of the maximum of L/T (UHG). The smallest (2.85) was noted in No. 56, which was the same as in cases of the maxima of L/W (UHG and HG) and of the range of L/W (UHG), followed by No. 84 (2.90) and No. 87 (2.94). Average and its s. d. through the whole strains were found to be 3.31 ± 0.27 .

Whole: Average and its s. d. through the whole strains of both of the groups were found to be 3.55 ± 0.44 .

Minimum : *Group A :* The largest (4.11) was obtained in No. 6, which was the same as in cases of the maxima of L/W and L/T (UHG and HG) and L (HG), of the minima of L (UHG and HG), L/W (HG) and L/T (UHG), and of the ranges of L/W and L/T (UHG), followed by No. 28 (3.64) and No. 25 (3.59). These combinations of strains were found to be the same as in cases of the maxima of L and L/W (HG), of the minima of L and L/W (UHG and HG). Moreover, these orders of strains were found to be the same as in cases of the maximum of L/W, of the minima of L and L/W (HG). The smallest (2.47) was noted in No. 29, which was the same as in cases of the maxima of L, W, T, L/T (UHG and HG) and W/T (UHG), of the minima of L, W (UHG and HG) and L/T (UHG), followed by No. 22 (2.65) and No. 50 (2.72). These combinations of strains were found to be the same as in cases of the maxima of L (UHG) and L/T (UHG and HG), of the minima of L (UHG and HG) and L/T (UHG). Moreover, these orders of strains were found to be the same as in cases of the maxima of L (UHG) and L/T (UHG and HG) and of the minimum of L/T (UHG). Average and its s. d. through the whole strains were found to be 3.18 ± 0.30 .

Group B : The largest (3.46) was obtained in No. 97, which was the same as in cases of the maxima of L/T (UHG and HG) and of the minimum of L/T (UHG), followed by No. 89 (3.31) and No. 71 (3.26). These combinations of strains were found to be the same as in cases of the minima of L/W and L/T (UHG). Moreover, these orders of strains were found to be the same as in case of the minimum of L/T (UHG). The smallest (2.34) was noted in No. 56, which was the same as in cases of the maxima of L/W (UHG and HG) and L/T (HG), of the range of L/W (UHG), followed by No. 79 (2.40) and No. 84 (2.44). Average and its s. d. through the whole strains were found to be 2.81 ± 0.25 .

Whole : Average and its s. d. through the whole strains of both of the groups were found to be 3.00 ± 0.34 .

Range : *Group A :* The largest (1.54) was obtained in No. 26, which was the same as in cases of the ranges of T (UHG and HG), followed by No. 6 (1.47) and No. 35 (1.08). It was noticeable that the values were particularly large in Nos. 6 and 26. The smallest (0.34) was noted in No. 44, followed by Nos. 34 and 43 (0.37). Average and its s. d. through the whole strains were found to be 0.62 ± 0.25 .

Group B : The largest (0.91) was obtained in No. 67, which was the same as in case of the minimum of W/T (UHG), followed by No. 83 (0.73) and No. 57 (0.69). The smallest (0.24) was noted in No. 82, followed by No. 73 (0.27) and No. 61 (0.29). Average and its s. d. through the whole strains were found to be 0.50 ± 0.13 .

Whole : Average and its s. d. through the whole strains of both of the groups were found to be 0.56 ± 0.21 .

6. Ratios of width to thickness (W/T) in HG

Maximum : *Group A :* The largest (1.85) was obtained in No. 26, which was the same as in cases of the ranges of T (UHG and HG) and L/T (HG), followed by No. 8 (1.72) and No. 48 (1.65). The smallest (1.17) was noted in Nos. 28 and 34, followed by No. 46 (1.19). Average and its s. d. through the whole strains were found to be 1.38 ± 0.14 .

Group B : The largest (1.78) was obtained in No. 90, which was the same as in case of the range of T (HG), followed by Nos. 67 and 83 (1.68). The smallest (1.35) was noted in Nos. 66 and 95, which were the same as in cases of the maxima of W (UHG and HG),

followed by No. 65 (1.38). Average and its s. d. through the whole strains were found to be 1.51 ± 0.09 .

Whole : Average and its s. d. through the whole strains of both of the groups were found to be 1.45 ± 0.14 .

Minimum : *Group A* : The largest (1.27) was obtained in Nos. 20 and 22, followed by No. 23 (1.23). These combinations of strains were found to be the same as in case of the maximum of W/T (UHG). The smallest (0.98) was noted in Nos. 4 and 49, followed by Nos. 8 and 38 (1.02). Average and its s. d. through the whole strains were found to be 1.09 ± 0.07 .

Group B : The largest (1.37) was obtained in No. 69, which was the same as in case of the maximum of W (UHG), followed by No. 67 (1.34) and No. 91 (1.33). The smallest (1.05) was noted in No. 80, followed by No. 84 (1.07) and No. 89 (1.08). Average and its s. d. through the whole strains were found to be 1.22 ± 0.07 .

Whole : Average and its s. d. through the whole strains of both of the groups were found to be 1.15 ± 0.09 .

Range : *Group A* : The largest (0.72) was obtained in No. 26, which was the same as in cases of the maximum of W/T (HG), of the ranges of T (UHG and HG) and L/T (HG), followed by No. 8 (0.70) and No. 15 (0.54). These combinations of strains were found to be the same as in case of the range of W/T (UHG). The smallest (0.12) was noted in Nos. 28 and 34, which were the same as in case of the maximum of W/T (HG), followed by No. 46 (0.14). These orders of strains were found to be the same as in case of the maximum of W/T (HG). Average and its s. d. through the whole strains were found to be 0.29 ± 0.12 .

Group B : The largest (0.49) was obtained in No. 90, which was the same as in cases of the range of T and of the maximum of W/T (HG), followed by Nos. 83 and 84 (0.48). These orders of strains were found to be the same as in case of the range of T (HG). The smallest (0.15) was noted in No. 70, which was the same as in case of the range of W (HG), followed by No. 54 (0.18) and No. 66 (0.19). Average and its s. d. through the whole strains were found to be 0.30 ± 0.08 .

Whole : Average and its s. d. through the whole strains of both of the groups were found to be 0.29 ± 0.10 .

7. Quotients in L

Maximum : *Group A* : The results are given in Table 2. In this table, the maximum, the minimum and their ranges are shown. The largest (0.76) was obtained in Nos. 13, 31, 34, 38 and 39. The smallest (0.71) was noted in No. 11, followed by Nos. 2, 9, 19, 20, 23, 24 and 27 (0.72). Average and its s. d. through the whole strains were found to be 0.74 ± 0.01 .

Group B : The largest (0.78) was obtained in No. 56, followed by Nos. 61, 79 and 80 (0.75). The smallest (0.70) was noted in No. 69, followed by Nos. 64, 75 and 98 (0.71). Average and its s. d. through the whole strains were found to be 0.73 ± 0.01 .

Whole : Average and its s. d. through the whole strains of both of the groups were found to be 0.73 ± 0.01 .

Minimum : *Group A* : The largest (0.72) was obtained in Nos. 38 and 39, followed by Nos. 13, 34 and 46 (0.71). The smallest (0.62) was noted in No. 24, followed by No. 5

Table 2. Ranges of comparative values in the strain level

Strain	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness			
	No.	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
1	1	0.74	0.70	0.04	0.91	0.78	0.13	0.93	0.84	0.09	0.91	0.79	0.12	0.88	0.76	0.12	1.03	0.88	0.15
2	2	0.72	0.66	0.06	0.90	0.80	0.10	0.95	0.88	0.07	0.87	0.78	0.09	0.83	0.73	0.10	0.96	0.87	0.09
3	3	0.75	0.70	0.05	0.96	0.80	0.16	0.95	0.84	0.09	0.94	0.74	0.20	0.84	0.73	0.11	1.07	0.88	0.19
4	4	0.75	0.68	0.07	0.91	0.77	0.14	0.95	0.83	0.12	0.94	0.78	0.16	0.86	0.75	0.11	1.06	0.86	0.20
5	5	0.73	0.64	0.09	0.93	0.81	0.12	0.97	0.82	0.15	0.91	0.74	0.17	0.86	0.70	0.16	1.04	0.88	0.16
6	6	0.75	0.67	0.08	0.93	0.78	0.15	0.95	0.81	0.14	0.93	0.76	0.17	0.88	0.75	0.13	1.07	0.87	0.20
7	7	0.75	0.68	0.07	0.91	0.79	0.12	0.98	0.84	0.14	0.88	0.73	0.14	0.82	0.73	0.09	1.02	0.88	0.14
8	8	0.73	0.68	0.05	0.94	0.79	0.15	0.95	0.86	0.09	0.89	0.75	0.14	0.83	0.75	0.08	1.08	0.88	0.20
9	9	0.72	0.67	0.05	0.92	0.82	0.10	0.95	0.86	0.09	0.86	0.76	0.10	0.83	0.73	0.10	1.02	0.88	0.14
10	10	0.74	0.69	0.05	0.92	0.82	0.10	0.95	0.87	0.08	0.87	0.79	0.08	0.85	0.72	0.13	1.05	0.89	0.16
11	11	0.71	0.67	0.04	0.92	0.75	0.17	0.95	0.87	0.08	0.93	0.74	0.19	0.81	0.71	0.10	1.04	0.83	0.21
12	12	0.73	0.67	0.06	0.92	0.82	0.10	0.95	0.87	0.08	0.86	0.77	0.09	0.81	0.71	0.10	1.05	0.86	0.19
13	13	0.76	0.71	0.05	0.93	0.80	0.13	0.95	0.86	0.09	0.90	0.79	0.11	0.84	0.76	0.08	1.05	0.88	0.17
14	14	0.73	0.67	0.06	0.91	0.76	0.15	0.95	0.86	0.09	0.94	0.76	0.18	0.80	0.73	0.07	1.02	0.83	0.19
15	15	0.73	0.66	0.07	0.94	0.78	0.16	0.95	0.85	0.10	0.93	0.75	0.18	0.85	0.74	0.11	1.06	0.88	0.18
16	16	0.74	0.69	0.05	0.93	0.87	0.06	0.95	0.85	0.10	0.85	0.77	0.08	0.84	0.75	0.09	1.05	0.94	0.11
17	17	0.74	0.70	0.04	0.92	0.80	0.12	0.95	0.85	0.10	0.89	0.77	0.12	0.84	0.74	0.10	1.05	0.89	0.16
18	18	0.73	0.68	0.05	0.89	0.78	0.11	0.96	0.85	0.11	0.91	0.79	0.12	0.85	0.74	0.11	1.01	0.86	0.15
19	19	0.72	0.66	0.06	0.90	0.78	0.12	1.00	0.84	0.16	0.89	0.77	0.12	0.80	0.68	0.12	0.99	0.84	0.15
20	20	0.72	0.67	0.05	0.87	0.77	0.10	0.95	0.87	0.08	0.90	0.77	0.13	0.81	0.74	0.07	0.98	0.85	0.13
21	21	0.73	0.68	0.05	0.88	0.78	0.10	0.98	0.89	0.09	0.89	0.80	0.09	0.80	0.70	0.10	0.97	0.82	0.15
22	22	0.74	0.66	0.08	0.91	0.77	0.14	0.95	0.84	0.11	0.94	0.78	0.16	0.87	0.71	0.16	1.02	0.83	0.19
23	23	0.72	0.67	0.05	0.88	0.78	0.10	0.95	0.86	0.09	0.90	0.77	0.13	0.84	0.73	0.11	0.97	0.87	0.10
24	24	0.72	0.62	0.10	0.91	0.80	0.11	0.95	0.86	0.09	0.85	0.75	0.10	0.84	0.67	0.17	1.03	0.89	0.14
25	25	0.75	0.69	0.06	0.90	0.81	0.09	0.95	0.86	0.09	0.90	0.79	0.11	0.85	0.74	0.11	0.99	0.87	0.12

(Continued)

Table 2. (Continued)

Strain No.	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness		
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
26	0.74	0.69	0.05	0.91	0.80	0.11	0.95	0.81	0.14	0.89	0.78	0.11	0.86	0.74	0.12	1.06	0.87	0.19
27	0.72	0.68	0.04	0.91	0.83	0.08	0.95	0.89	0.06	0.86	0.77	0.09	0.80	0.71	0.09	1.01	0.87	0.14
28	0.75	0.69	0.06	0.91	0.82	0.09	0.95	0.85	0.10	0.87	0.79	0.08	0.86	0.75	0.11	1.02	0.89	0.13
29	0.73	0.68	0.05	0.97	0.87	0.10	0.97	0.86	0.11	0.81	0.73	0.08	0.84	0.73	0.11	1.07	0.93	0.14
30	0.75	0.70	0.05	0.94	0.80	0.14	0.95	0.83	0.12	0.97	0.78	0.19	0.85	0.77	0.08	1.10	0.84	0.16
31	0.76	0.70	0.06	0.92	0.74	0.08	0.95	0.86	0.09	1.00	0.79	0.21	0.86	0.74	0.12	1.03	0.84	0.19
32	0.73	0.68	0.05	0.91	0.81	0.10	0.95	0.85	0.10	0.89	0.71	0.18	0.88	0.74	0.14	1.03	0.88	0.15
33	0.74	0.69	0.05	0.92	0.74	0.18	0.95	0.88	0.07	0.96	0.77	0.19	0.82	0.75	0.07	1.02	0.82	0.20
34	0.76	0.71	0.05	0.93	0.83	0.10	0.95	0.88	0.07	0.89	0.77	0.12	0.85	0.76	0.09	1.05	0.89	0.16
35	0.73	0.66	0.07	0.89	0.79	0.10	0.95	0.85	0.10	0.91	0.80	0.11	0.84	0.65	0.09	1.02	0.83	0.19
36	0.74	0.68	0.06	0.88	0.81	0.07	0.95	0.83	0.12	0.91	0.80	0.11	0.88	0.72	0.16	1.00	0.88	0.12
37	0.75	0.70	0.05	0.92	0.78	0.14	0.95	0.88	0.07	0.91	0.79	0.12	0.84	0.75	0.09	1.02	0.84	0.18
38	0.76	0.72	0.04	0.92	0.83	0.09	0.96	0.84	0.12	0.89	0.80	0.09	0.87	0.77	0.10	1.02	0.88	0.14
39	0.76	0.72	0.04	0.92	0.84	0.08	0.95	0.88	0.07	0.90	0.77	0.13	0.81	0.74	0.07	1.05	0.87	0.18
40	0.75	0.69	0.06	0.95	0.84	0.11	0.95	0.85	0.10	0.89	0.75	0.14	0.82	0.73	0.09	1.07	0.89	0.18
41	0.75	0.69	0.06	0.90	0.79	0.11	0.95	0.88	0.07	0.93	0.81	0.12	0.83	0.74	0.09	0.99	0.87	0.12
42	0.75	0.70	0.05	0.92	0.82	0.10	0.95	0.85	0.10	0.90	0.78	0.12	0.84	0.75	0.09	1.07	0.89	0.18
43	0.73	0.69	0.04	0.91	0.79	0.12	0.96	0.86	0.10	0.90	0.78	0.12	0.81	0.73	0.08	1.00	0.87	0.13
44	0.74	0.68	0.06	0.91	0.79	0.12	0.95	0.87	0.08	0.88	0.78	0.10	0.82	0.73	0.09	1.00	0.83	0.17
45	0.73	0.70	0.03	0.93	0.82	0.11	0.95	0.88	0.07	0.87	0.76	0.11	0.84	0.74	0.10	1.02	0.88	0.14
46	0.74	0.71	0.03	0.91	0.82	0.09	0.93	0.86	0.07	0.91	0.80	0.11	0.85	0.76	0.09	1.03	0.86	0.17
47	0.74	0.69	0.05	0.94	0.84	0.10	0.95	0.88	0.07	0.85	0.76	0.09	0.86	0.73	0.13	1.02	0.92	0.10
48	0.73	0.69	0.04	0.92	0.82	0.10	0.96	0.88	0.08	0.87	0.77	0.10	0.83	0.73	0.10	1.03	0.87	0.16
49	0.74	0.69	0.05	0.92	0.80	0.12	0.98	0.88	0.10	0.90	0.76	0.14	0.83	0.71	0.12	1.00	0.88	0.12
50	0.74	0.67	0.07	0.94	0.80	0.14	0.95	0.88	0.07	0.88	0.71	0.17	0.80	0.73	0.07	1.00	0.87	0.13

(Continued)

Table 2. (Continued)

Strain	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness			
	No.	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
51	51	0.72	0.67	0.05	0.91	0.78	0.13	0.94	0.84	0.10	0.88	0.75	0.13	0.85	0.71	0.14	1.05	0.88	0.17
52	52	0.72	0.67	0.05	0.91	0.77	0.14	0.94	0.83	0.11	0.93	0.77	0.16	0.83	0.76	0.07	1.02	0.85	0.17
53	53	0.73	0.67	0.06	0.91	0.80	0.11	0.95	0.88	0.07	0.89	0.75	0.14	0.82	0.73	0.09	1.03	0.83	0.20
54	54	0.74	0.67	0.07	0.87	0.77	0.10	0.96	0.87	0.09	0.91	0.80	0.11	0.82	0.73	0.09	0.97	0.86	0.11
55	55	0.72	0.66	0.06	0.90	0.80	0.10	0.94	0.82	0.12	0.87	0.75	0.12	0.85	0.71	0.14	1.06	0.88	0.18
56	56	0.78	0.68	0.10	0.91	0.79	0.12	0.96	0.86	0.10	0.92	0.77	0.15	0.84	0.73	0.11	1.02	0.89	0.13
57	57	0.74	0.66	0.08	0.87	0.79	0.08	0.93	0.87	0.06	0.87	0.81	0.06	0.82	0.74	0.08	0.97	0.87	0.10
58	58	0.73	0.65	0.08	0.91	0.76	0.15	0.94	0.83	0.11	0.95	0.73	0.22	0.84	0.74	0.10	1.02	0.85	0.17
59	59	0.72	0.68	0.04	0.89	0.79	0.10	0.94	0.84	0.10	0.91	0.78	0.13	0.85	0.74	0.11	1.05	0.87	0.18
60	60	0.72	0.66	0.06	0.85	0.78	0.07	0.91	0.86	0.05	0.93	0.78	0.15	0.82	0.72	0.10	1.06	0.88	0.18
61	61	0.75	0.72	0.03	0.90	0.80	0.10	0.95	0.89	0.06	0.93	0.82	0.11	0.84	0.79	0.05	0.99	0.88	0.11
62	62	0.72	0.68	0.04	0.90	0.82	0.08	0.93	0.88	0.05	0.86	0.75	0.11	0.79	0.73	0.06	0.99	0.90	0.09
63	63	0.73	0.68	0.05	0.88	0.83	0.05	0.93	0.88	0.05	0.87	0.73	0.14	0.81	0.75	0.06	0.99	0.90	0.09
64	64	0.71	0.68	0.03	0.88	0.80	0.08	0.96	0.89	0.07	0.89	0.80	0.09	0.80	0.73	0.07	0.97	0.86	0.11
65	65	0.74	0.70	0.04	0.90	0.81	0.09	0.96	0.87	0.09	0.88	0.79	0.09	0.83	0.74	0.09	0.95	0.81	0.14
66	66	0.74	0.70	0.04	0.88	0.81	0.07	0.95	0.87	0.08	0.89	0.80	0.09	0.82	0.75	0.07	0.99	0.87	0.12
67	67	0.73	0.69	0.04	0.94	0.78	0.16	0.94	0.86	0.08	0.92	0.78	0.14	0.93	0.75	0.18	1.04	0.86	0.18
68	68	0.73	0.69	0.04	0.89	0.80	0.09	0.94	0.88	0.06	0.87	0.79	0.08	0.81	0.75	0.06	0.99	0.86	0.13
69	69	0.70	0.66	0.04	0.86	0.77	0.09	0.95	0.85	0.10	0.89	0.80	0.09	0.81	0.71	0.10	0.98	0.84	0.14
70	70	0.72	0.69	0.03	0.91	0.82	0.09	0.95	0.88	0.07	0.88	0.79	0.09	0.82	0.74	0.08	1.03	0.88	0.15
71	71	0.74	0.69	0.05	0.91	0.84	0.07	0.95	0.86	0.09	0.89	0.78	0.11	0.93	0.75	0.18	1.03	0.93	0.10
72	72	0.73	0.68	0.05	0.89	0.81	0.08	0.93	0.86	0.07	0.87	0.78	0.09	0.83	0.70	0.13	1.01	0.89	0.12
73	73	0.72	0.66	0.06	0.91	0.82	0.09	0.93	0.87	0.06	0.84	0.74	0.10	0.79	0.73	0.06	1.04	0.90	0.14
74	74	0.73	0.67	0.06	0.83	0.76	0.07	0.95	0.85	0.10	0.96	0.82	0.14	0.84	0.72	0.12	0.97	0.83	0.14
75	75	0.71	0.68	0.03	0.91	0.85	0.06	0.95	0.85	0.10	0.82	0.76	0.06	0.93	0.73	0.10	1.02	0.93	0.09

(Continued)

Table 2. (Continued)

Strain	Length			Width			Thickness			Length/Width			Length/Thickness			Width/Thickness			
	No.	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
76	76	0.74	0.67	0.07	0.89	0.81	0.08	0.95	0.88	0.07	0.87	0.76	0.11	0.81	0.73	0.08	0.98	0.87	0.11
77	77	0.74	0.69	0.05	0.89	0.82	0.07	0.93	0.87	0.06	0.91	0.80	0.11	0.84	0.77	0.07	0.99	0.89	0.10
78	78	0.73	0.65	0.08	0.90	0.82	0.08	0.95	0.86	0.09	0.86	0.76	0.10	0.83	0.74	0.09	1.06	0.88	0.18
79	79	0.75	0.70	0.05	0.85	0.74	0.11	0.93	0.86	0.07	0.98	0.83	0.15	0.85	0.76	0.09	0.93	0.82	0.11
80	80	0.75	0.67	0.08	0.80	0.65	0.15	0.92	0.85	0.07	1.07	0.85	0.22	0.85	0.74	0.11	0.89	0.71	0.18
81	81	0.73	0.70	0.03	0.85	0.76	0.09	0.94	0.87	0.07	0.96	0.84	0.12	0.83	0.77	0.06	0.96	0.84	0.12
82	82	0.72	0.67	0.05	0.88	0.74	0.14	0.93	0.86	0.07	0.93	0.77	0.16	0.82	0.74	0.08	1.01	0.82	0.19
83	83	0.74	0.67	0.07	0.91	0.82	0.09	0.93	0.85	0.08	0.88	0.77	0.11	0.85	0.66	0.19	1.03	0.91	0.12
84	84	0.73	0.70	0.03	0.88	0.76	0.12	0.94	0.88	0.06	0.94	0.81	0.13	0.82	0.77	0.05	0.98	0.82	0.16
85	85	0.74	0.67	0.07	0.88	0.78	0.10	0.93	0.89	0.04	0.91	0.79	0.12	0.83	0.74	0.09	0.96	0.85	0.11
86	86	0.74	0.68	0.06	0.89	0.79	0.10	0.95	0.85	0.10	0.92	0.81	0.11	0.86	0.76	0.10	0.99	0.85	0.14
87	87	0.72	0.66	0.06	0.87	0.81	0.06	0.95	0.88	0.07	0.92	0.75	0.17	0.81	0.72	0.09	0.99	0.87	0.12
88	88	0.72	0.67	0.05	0.86	0.78	0.08	0.95	0.87	0.08	0.90	0.79	0.11	0.91	0.72	0.19	0.96	0.84	0.12
89	89	0.74	0.70	0.04	0.86	0.78	0.08	0.95	0.84	0.11	0.93	0.82	0.11	0.85	0.76	0.09	0.98	0.86	0.12
90	90	0.72	0.67	0.05	0.88	0.71	0.17	0.91	0.80	0.11	0.97	0.81	0.16	0.87	0.74	0.13	1.02	0.84	0.18
91	91	0.73	0.66	0.07	0.92	0.79	0.13	0.94	0.83	0.11	0.89	0.74	0.15	0.83	0.74	0.09	1.04	0.89	0.15
92	92	0.72	0.69	0.03	0.87	0.80	0.07	0.94	0.85	0.09	0.89	0.80	0.09	0.82	0.74	0.08	1.00	0.86	0.14
93	93	0.73	0.66	0.07	0.89	0.79	0.10	0.95	0.88	0.07	0.91	0.77	0.14	0.82	0.67	0.15	0.99	0.85	0.14
94	94	0.74	0.67	0.07	0.89	0.82	0.07	0.95	0.88	0.07	1.00	0.78	0.22	0.84	0.73	0.11	0.99	0.90	0.09
95	95	0.74	0.68	0.06	0.90	0.82	0.08	0.93	0.88	0.05	0.88	0.80	0.08	0.83	0.75	0.08	0.99	0.91	0.08
96	96	0.74	0.70	0.04	0.89	0.82	0.07	0.95	0.87	0.08	0.88	0.81	0.07	0.83	0.74	0.09	1.01	0.88	0.13
97	97	0.74	0.70	0.04	0.89	0.77	0.12	0.93	0.86	0.07	0.91	0.80	0.11	0.86	0.76	0.10	1.01	0.83	0.18
98	98	0.71	0.63	0.08	0.89	0.80	0.09	0.93	0.87	0.06	0.86	0.75	0.11	0.82	0.68	0.14	0.97	0.88	0.09
99	99	0.72	0.65	0.07	0.86	0.78	0.08	0.94	0.86	0.08	0.89	0.79	0.10	0.80	0.73	0.07	0.99	0.87	0.12
100	100	0.72	0.68	0.04	0.85	0.77	0.08	0.91	0.85	0.06	0.90	0.81	0.09	0.82	0.73	0.09	0.97	0.85	0.08

(0.64) and Nos. 2, 15, 19, 22 and 35 (0.66). Average and its s.d. through the whole strains were found to be 0.68 ± 0.02 .

Group B: The largest (0.72) was obtained in No. 61, followed by Nos. 65, 66, 79, 81, 84, 89, 96 and 97 (0.70). The smallest (0.63) was noted in No. 98, followed by Nos. 58, 78 and 99 (0.65). Average and its s.d. through the whole strains were found to be 0.68 ± 0.02 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.68 ± 0.02 .

Range: *Group A*: The largest (0.10) was obtained in No. 24, followed by No. 5 (0.09) and Nos. 6 and 22 (0.08). The smallest (0.03) was noted in Nos. 45 and 46. Average and its s.d. through the whole strains were found to be 0.06 ± 0.01 .

Group B: The largest (0.10) was obtained in No. 56, which was the same as in case of the maximum of L, followed by Nos. 57, 58, 78, 80 and 98 (0.08). The smallest (0.03) was noted in Nos. 61, 64, 70, 75, 81, 84 and 92. Average and its s.d. through the whole strains were found to be 0.05 ± 0.02 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.05 ± 0.02 .

8. Quotients in W

Maximum: *Group A*: The largest (0.97) was obtained in No. 29, followed by No. 3 (0.96) and No. 40 (0.95). The smallest (0.87) was noted in No. 20, followed by Nos. 21, 23 and 36 (0.88). Average and its s.d. through the whole strains were found to be 0.92 ± 0.02 .

Group B: The largest (0.94) was obtained in No. 67, followed by No. 91 (0.92). These 2 strains belong to type B. The smallest (0.80) was noted in No. 80, followed by No. 74 (0.83) and Nos. 60, 79, 81 and 100 (0.85). These 6 strains belong to type B. Average and its s.d. through the whole strains were found to be 0.89 ± 0.03 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.90 ± 0.03 .

Minimum: *Group A*: The largest (0.87) was obtained in Nos. 16 and 29, followed by Nos. 39, 40 and 47 (0.84). The smallest (0.74) was noted in Nos. 31 and 33, followed by No. 11 (0.75). Average and its s.d. through the whole strains were found to be 0.80 ± 0.03 .

Group B: The largest (0.85) was obtained in No. 75, followed by No. 71 (0.84) and No. 63 (0.83). These 3 strains belong to type C, which was the reversed result of the maximum of W. The smallest (0.65) was noted in No. 80, which was the same as in case of the maximum of W, followed by No. 90 (0.71) and Nos. 79 and 82 (0.74). It was noticeable that the value was particularly small in No. 80. These 4 strains belong to type B, which was the same as in case of the maximum of W. Average and its s.d. through the whole strains were found to be 0.79 ± 0.03 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.80 ± 0.03 .

Range: *Group A*: The largest (0.18) was obtained in No. 33, followed by No. 11 (0.17) and Nos. 3 and 15 (0.16). The smallest (0.06) was noted in No. 16, followed by No. 36 (0.07) and Nos. 27, 31 and 39 (0.08). Average and its s.d. through the whole strains were found to be 0.11 ± 0.03 .

Group B: The largest (0.17) was obtained in No. 90, followed by Nos. 58 and 80 (0.15).

These 3 strains belong to type B, which was the same as in case of the maximum of W. The smallest (0.05) was noted in No. 63, followed by Nos. 75 and 87 (0.06). These 3 strains belong to type C, which was the reversed result of the maximum and of the minimum of W. Average and its s.d. through the whole strains were found to be 0.10 ± 0.03 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.11 ± 0.03 .

9. Quotients in T

Maximum : Group A : The largest (1.00) was obtained in No. 19, followed by Nos. 21 and 49 (0.98). The smallest (0.93) was noted in Nos. 1 and 46. Average and its s.d. through the whole strains were found to be 0.95 ± 0.01 .

Group B : The largest (0.96) was obtained in Nos. 54, 64 and 65. The smallest (0.91) was noted in Nos. 60, 90 and 100. These 3 strains belong to type B, which was the same as in cases of the maximum and of the minimum of W. Average and its s.d. through the whole strains were found to be 0.94 ± 0.01 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.95 ± 0.01 .

Minimum : Group A : The largest (0.89) was obtained in Nos. 21 and 27. The smallest (0.81) was noted in Nos. 6 and 26, followed by No. 5 (0.82). Average and its s.d. through the whole strains were found to be 0.86 ± 0.02 .

Group B : The largest (0.89) was obtained in Nos. 61, 64 and 85. The smallest (0.80) was noted in No. 90, followed by No. 55 (0.82) and Nos. 52, 58 and 91 (0.83). These 5 strains belong to type B, which was the same as in cases of the maxima of W and T, and of the minimum of W. Average and its s.d. through the whole strains were found to be 0.86 ± 0.02 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.86 ± 0.02 .

Range : Group A : The largest (0.16) was obtained in No. 19, which was the same as in case of the maximum of T, followed by No. 5 (0.15) and Nos. 6 and 7 (0.14). The smallest (0.06) was noted in No. 27. Average and its s.d. through the whole strains were found to be 0.10 ± 0.02 .

Group B : The largest (0.12) was obtained in No. 55, followed by Nos. 52, 58, 89, 90 and 91 (0.11). The smallest (0.04) was noted in No. 85, followed by Nos. 60, 62, 63 and 95 (0.05). Average and its s.d. through the whole strains were found to be 0.08 ± 0.02 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.09 ± 0.02 .

10. Quotients in L/W

Maximum : Group A : The largest (1.00) was obtained in No. 31, followed by No. 30 (0.97) and No. 33 (0.96). The smallest (0.81) was noted in No. 29, followed by Nos. 16, 24 and 47 (0.85). Average and its s.d. through the whole strains were found to be 0.90 ± 0.03 .

Group B : The largest (1.07) was obtained in No. 80, followed by No. 94 (1.00) and No. 79 (0.98). The smallest (0.82) was obtained in No. 75, followed by No. 73 (0.84) and Nos. 62, 78 and 98 (0.86). Average and its s.d. through the whole strains were found to be

0.91 ± 0.04 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.90 ± 0.04 .

Minimum : *Group A* : The largest (0.81) was obtained in No. 41, followed by Nos. 21, 35, 36, 38 and 46 (0.80). The smallest (0.71) was noted in Nos. 32 and 50, followed by Nos. 7 and 29 (0.73). Average and its s.d. through the whole strains were found to be 0.77 ± 0.02 .

Group B : The largest (0.85) was obtained in No. 80, which was the same as in case of the maximum of L/W, followed by No. 81 (0.84) and No. 79 (0.83). These 3 strains belong to type B, which was the same as in cases of the maximum and of the range of W. The smallest (0.73) was noted in Nos. 58 and 63, followed by Nos. 73 and 91 (0.74). Average and its s.d. through the whole strains were found to be 0.79 ± 0.03 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.78 ± 0.03 .

Range : *Group A* : The largest (0.21) was obtained in No. 31, which was the same as in case of the maximum of L/W, followed by No. 3 (0.20) and Nos. 11, 30 and 33 (0.19). The smallest (0.08) was noted in Nos. 10, 16, 28 and 29. Average and its s.d. through the whole strains were found to be 0.13 ± 0.04 .

Group B : The largest (0.22) was obtained in Nos. 58, 80 and 94. The smallest (0.06) was noted in Nos. 57 and 75, followed by No. 96 (0.07). Average and its s.d. through the whole strains were found to be 0.12 ± 0.04 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.13 ± 0.04 .

11. Quotients in L/T

Maximum : *Group A* : The largest (0.88) was obtained in Nos. 1, 6, 32 and 36. The smallest (0.80) was noted in Nos. 14, 19, 21, 27 and 50. Average and its s.d. through the whole strains were found to be 0.84 ± 0.02 .

Group B : The largest (0.93) was obtained in Nos. 67, 71 and 75. The smallest (0.79) was noted in Nos. 62 and 73, followed by No. 64 (0.80). Average and its s.d. through the whole strains were found to be 0.84 ± 0.03 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.84 ± 0.03 .

Minimum : *Group A* : The largest (0.77) was obtained in Nos. 30 and 38, followed by Nos. 1, 13, 34 and 46 (0.76). The smallest (0.65) was noted in No. 35, followed by No. 24 (0.67) and No. 19 (0.68). These combinations of strains were found to be the same as in case of the minimum of L. Average and its s.d. through the whole strains were found to be 0.73 ± 0.02 .

Group B : The largest (0.79) was obtained in No. 61, which was the same as in case of the minimum of L, followed by Nos. 77, 81 and 84 (0.77). These orders of strains were found to be the same as in case of the minimum of L. The narrowest (0.66) was noted in No. 83, followed by No. 93 (0.67) and No. 98 (0.68). Average and its s.d. through the whole strains were found to be 0.74 ± 0.02 .

Whole : Average and its s.d. through the whole strains of both of the groups were found

to be 0.73 ± 0.02 .

Range : Group A : The largest (0.17) was obtained in No. 24, which was the same as in case of the range of L, followed by Nos. 5, 22 and 36 (0.16). These combinations of strains were found to be the same as in case of the range of L. The smallest (0.07) was noted in Nos. 14, 20, 33, 39 and 50. Average and its s.d. through the whole strains were found to be 0.10 ± 0.02 .

Group B : The largest (0.19) was obtained in Nos. 83 and 88, followed by Nos. 67 and 71 (0.18). The smallest (0.05) was noted in Nos. 61 and 84, followed by Nos. 62, 63, 68, 73 and 81 (0.06). These combinations of strains were found to be the same as in case of the range of L. Average and its s.d. through the whole strains were found to be 0.09 ± 0.04 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.10 ± 0.03 .

12. Quotients in W/T

Maximum : Group A : The largest (1.08) was obtained in No. 8, followed by Nos. 3, 6, 29, 40 and 42 (1.07). The smallest (0.97) was noted in Nos. 21 and 23, followed by No. 20 (0.98). Average and its s.d. through the whole strains were found to be 1.03 ± 0.03 .

Group B : The largest (1.06) was obtained in Nos. 55, 60 and 78. The smallest (0.89) was noted in No. 80, which was the same as in cases of the maximum and of the minimum of W, followed by No. 79 (0.93) and No. 65 (0.95). Average and its s.d. through the whole strains were found to be 1.00 ± 0.04 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 1.01 ± 0.04 .

Minimum : Group A : The largest (0.94) was obtained in No. 16, followed by No. 29 (0.93) and No. 47 (0.92). These combinations of strains were found to be the same as in case of the minimum of W. The smallest (0.82) was noted in Nos. 21 and 33, followed by Nos. 11, 14, 22, 35 and 44 (0.83). Average and its s.d. through the whole strains were found to be 0.87 ± 0.03 .

Group B : The largest (0.93) was obtained in Nos. 71 and 75, followed by Nos. 83 and 95 (0.91). These 4 strains belong to type C, which was the same as in case of the minimum of W. The smallest (0.71) was noted in No. 80, which was the same as in cases of the maxima of W and W/T and of the minimum of W, followed by No. 65 (0.81) and Nos. 79, 82 and 84 (0.82). It was noticeable that the value was particularly small in No. 80. These combinations of strains were found to be the same as in case of the maximum of W/T. Average and its s.d. through the whole strains were found to be 0.86 ± 0.04 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.87 ± 0.03 .

Range : Group A : The largest (0.21) was obtained in No. 11, followed by Nos. 4, 6, 8 and 33 (0.20). The smallest (0.09) was noted in No. 2, followed by Nos. 23 and 47 (0.10). Average and its s.d. through the whole strains were found to be 0.16 ± 0.03 .

Group B : The largest (0.20) was obtained in No. 53, followed by No. 82 (0.19). These 2 strains belong to type B, which was the same as in cases of the maximum of L, of the minimum of L/W and of the range of W. The smallest (0.08) was noted in Nos. 95 and 100, followed by Nos. 62, 63, 75, 94 and 98 (0.09). Average and its s.d. through the whole

strains were found to be 0.13 ± 0.03 .

Whole : Average and its s.d. through the whole strains of both of the groups were found to be 0.15 ± 0.03 .

Discussion

Basing on the results obtained in the previous^{4,5)} and the present experiments, the following problems are discussed here.

1. Although the values were particularly large or small in some characters, the values were found to be of the standard level in other characters in view of the same strains. For example, No. 6 showed the largest value (8.00 mm) in the maximum of L, but showed the middle value (2.20 mm) in the maximum of T. In another case, No. 50 showed nearly the smallest value (5.70 mm) in the maximum of L, but showed the middle value (2.45 mm) in the maximum of W.

On the other hand, although the values were particularly large in some characters, the values were found to be particularly small in other characters in view of the same strains, and *vice versa*. For example, No. 87 showed the largest value (7.45 mm) in the maximum of L, but showed nearly the smallest (2.50 mm) in the maximum of W. These phenomena were found in several combinations. In ratios of 3 combinations, these facts were not ascertained in the present experiments. These differences were attributable to the genetic backgrounds.

2. In the comparisons of the three types of A, B and C carried out in accordance with the tripartite classifications, the following facts were ascertained. In this chapter, considerations were made using only values of the HG (Table 1) without making use of the comparative values (Table 2), because no clear tendency was found in the latter. Type A showed the general features as follows; 10 characters, *i.e.*, the maxima, the minima and the ranges of W, T and W/T, and the range of L, showed the larger values than that of the average of the whole strains. The remaining 8 characters, *i.e.*, the maxima, the minima and the ranges of L/W and L/T, and the maximum and the minimum of L, showed the smaller values than that of the average of the whole strains. It was a remarkable fact that the maxima of L/W and L/T and the minimum of L/T, the maximum of L, showed the lowest and nearly the lowest values through the whole materials, respectively. These phenomena were found to be nearly the same as in case of the UHG. So, it was explicable as the strain's specificity. Moreover, it might be anticipated that the values of L/W and L/T were attributable to, and under the control of, the value of L.

In type B, the values were ascertained to be flexible in accordance with the respective characters. In view of the average values through the whole strains belonging to type B, in comparison with the average values through the whole strains, 3 characters, *i.e.*, the maxima, the minima and the ranges of W and W/T, the maximum and the minimum of T, showed the larger values. One character, *i.e.*, the range of T, showed the same value. The remaining 9 characters, *i.e.*, the maxima, the minima and the ranges of L, L/W and L/T, showed the smaller values. The phenomena were found to be nearly the same as in case of UHG.

In type C, the values were found to be very variable in accordance with the respective characters and the respective strains. In view of the average values through type C, and in

comparison with the average values through the whole strains, 9 characters, *i. e.*, the maxima, the minima and the ranges of L, L/W and L/T, showed the larger values. Two characters, *i. e.*, the ranges of T and W/T, showed the same values. The remaining 7 characters, *i. e.*, the maxima and the minima of W, T and W/T, and the range of W, showed the smaller values. These phenomena were looked upon as nearly the reversed results of type B.

3. In comparison with Group A and Group B in view of the group-averages, the following facts were ascertained. In the HG, 10 characters, *i. e.*, the maxima, the minima and the ranges of L, L/W and L/T, and the range of T, showed the larger values in Group A than those in Group B. The remaining 8 characters, *i. e.*, the maxima, and the minima of W, T and W/T, and the ranges of W and W/T, showed the smaller values in Group A than those in Group B. It was noticeable that the whole characters of L, L/W and L/T, and of W and L/T, showed the larger and the smaller values in Group A than those in Group B, respectively. These phenomena might be looked upon as geographical specificities.

In comparative values, 12 characters, *i. e.*, the maxima of L, W, T and W/T, the minima of W and W/T, and the ranges of 6 characters, showed the larger values in Group A than those of Group B; 3 characters, *i. e.*, the maximum of L/T, the minima of L and T, showed the same values in both of the groups. The remaining 3 characters, *i. e.*, the maximum of L/W, the minima of L/W and L/T, showed the smaller values in Group A than those of Group B. It was noticeable that the whole characters of W and W/T, showed the larger values in Group A than those in Group B. These phenomena might also be looked upon as geographical and grain fullness³⁾ specificities. Moreover, it was noteworthy that Group A showed always the larger values than those of Group B in the ranges. It was quite an interesting matter in view of strain specificity.

4. In the larger sets of values, the largests (7.15 mm in the minimum of L, 4.00 in the maximum of L/W, 3.45 in the minimum of L/W and 4.11 in the minimum of L/T) were obtained in No. 6, followed by No. 28 (7.00 mm, 3.95, 3.41 and 3.64 in the same order) and No. 25 (6.90 mm, 3.69, 3.18 and 3.59 in the same order). These orders of strains were finally illustrated as $6 > 28 > 25$. These phenomena were found in the other 11 cases, *i. e.*, ② $29 < 22 < 50 \cdots$ No. 29 (3.00 and 2.47), No. 22 (3.12 and 2.65) and No. 50 (3.17 and 2.72) in the smaller sets of the maximum and the minimum of L/T; ③ $28 = 34 < 46 \cdots$ Nos. 28 and 34 (1.17 and 0.12) and No. 46 (1.19 and 0.14) in the smaller sets of the maximum and the range of W/T; ④ $90 > 83 = 84 \cdots$ No. 90 (0.45 mm and 0.49) and Nos. 83 and 84 (0.40 mm and 0.48) in the larger sets of the ranges of T and W/T; ⑤ $29 < 6 = 40 \cdots$ No. 29 (1.80 mm and 1.70 mm) and Nos. 6 and 40 (2.00 mm and 1.80 mm) in the smaller sets of the minima of W (UHG) and of T (HG); ⑥ $6 = 26 < 8 \cdots$ Nos. 6 and 26 (1.60 mm and 1.30 mm) and No. 8 (1.65 mm and 1.45 mm) in the smaller sets of the minima of T (UHG and HG); ⑦ $26 > 8 > 6 \cdots$ No. 26 (0.60 mm and 0.70 mm), No. 8 (0.55 mm and 0.60 mm) and No. 6 (0.45 mm and 0.50 mm) in the larger sets of the ranges of T (UHG and HG); ⑧ $29 < 22 < 50 \cdots$ No. 29 (6.60 mm, 3.83, 3.22, 3.00 and 2.47), No. 22 (8.00 mm, 4.05, 3.36, 3.12 and 2.65), No. 50 (8.10 mm, 4.10, 3.45, 3.17 and 2.72) in the smaller sets of the maximum of L (UHG), the maximum and the minimum of L/T (UHG), the maximum and the minimum of L/T (HG); ⑨ $22 < 20 < 21 \cdots$ No. 22 (2.77 and 2.29), No. 20 (2.96 and 2.40) and No. 21 (3.00 and 2.42) in the smaller sets of the maxima of L/W (UHG and HG); ⑩ $87 < 94 < 56 \cdots$ No. 87 (7.90 mm and 5.30 mm), No. 94 (8.00 mm and 5.65 mm) and No. 56 (8.05 mm and 5.80 mm) in the smaller sets of the

maxima of L (UHG and HG); ⑪ $66=95<86$...Nos. 66 and 95 (2.85 mm and 2.40 mm) and No. 86 (2.90 mm and 2.50 mm) in the smaller sets of the maxima of W (UHG and HG); ⑫ $97>89>100$...No. 97 (5.05 and 4.06), No. 89 (5.00 and 4.00) and No. 100 (4.90 and 3.73) in the larger sets of the maxima of L/T (UHG and HG). Eight combinations (Nos. ⑤ to ⑫) were found to be the same as in case of UHG.

On the other hand, some sets of strains did not show the same strain orders, but showed the same combinations, which meant the same strain numbers regardless of its orders. Twenty-one cases were ascertained, *i. e.*, ① $6\cdot25\cdot28$ in the larger sets...maximum ($6>25>28$) and the minimum ($6>28>25$) in L, the maximum and the minimum of L/W and the minimum of L/T ($6>28>25$); ② $22\cdot29\cdot50$ in the smaller sets...the minimum of L ($29<22=50$), the maximum and the minimum of L/T ($29<22<50$); ③ $89\cdot97\cdot100$ in the larger sets...the minimum of L ($89>97=100$) and the maximum of L/T ($97>89>100$); ④ $55\cdot58\cdot69$ in the larger sets...the maxima of W ($58>55=69$) and T ($55>58=69$); ⑤ $22\cdot29\cdot50$ in the smaller sets...the maxima ($29<22<50$ in UHG), the minima ($29<50<22$ in UHG and $29<22=50$ in HG) of L, the maxima and the minima of L/T ($29<22<50$ in UHG and HG); ⑥ $20\cdot22\cdot23$ in the larger sets...the minima of W/T in UHG ($20=22=23$) and in HG ($20=22>23$); ⑦ $6\cdot25\cdot28$ in the larger sets...the maximum of L ($6>25>28$ in HG), the minima of L ($6>25=28$ in UHG and $6>28>25$ in HG), the maximum and the minimum of L/W ($6>28>25$ in HG), the minimum of L/W ($28>6>25$ in UHG) and the minimum of L/T ($6>28>25$ in HG); ⑧ $5\cdot29\cdot40$ in the smaller sets...the minimum of W ($29<5=40$ in HG) and the maximum of T ($29<40<5$ in UHG); ⑨ $21\cdot22\cdot48$ in the larger sets...the range of W ($21=22>48$ in UHG), the maximum ($48>21>22$) and the minimum ($21>22=48$) of W in HG; ⑩ $6\cdot8\cdot26$ in the larger sets...the range ($26>8>6$ in UHG and HG) of T, and the range of L/T ($6>26>8$) in UHG; ⑪ $20\cdot21\cdot22$ in the smaller sets...the maxima ($22<20<21$) in UHG and HG, and the minimum ($22<21<20$) in UHG of L/W; ⑫ $6\cdot8\cdot35$ in the larger sets...the maxima of L/T in UHG ($6>8>35$) and in HG ($6>35>8$); ⑬ $8\cdot15\cdot26$ in the larger sets...the ranges of W/T in UHG ($8>26>15$) and in HG ($26>8>15$); ⑭ $86\cdot87\cdot94$ in the smaller sets...the minima of L in UHG ($94<87<86$) and in HG ($87=94<86$); ⑮ $88\cdot89\cdot99$ in the larger sets...the ranges of L in UHG ($88>99>89$) and in HG ($89>88=99$); ⑯ $51\cdot55\cdot69$ in the larger sets...the maximum in UHG ($69>55>51$) and the minimum in HG ($51=55=69$) of W; ⑰ $55\cdot58\cdot69$ in the larger sets...the maximum of W in HG ($58>55=69$) and the maxima of T in UHG and HG ($55=58>69$); ⑱ $77\cdot86\cdot97$ in the smaller sets...the minima of T in UHG ($77=86<97$) and in HG ($86<77<97$); ⑲ $66\cdot89\cdot97$ in the larger sets...the maximum in UHG ($89=97>66$) and the minimum in HG ($89>97>66$) in L/W; ⑳ $71\cdot89\cdot97$ in the larger sets...the minimum of L/W in UHG ($89=97>71$), the minima of L/T ($97>89>71$ in UHG and HG); ㉑ $89\cdot97\cdot100$ in the larger sets...the minimum of L in UHG ($89>97=100$), the maxima of L/T ($97>89>100$) in UHG and HG.

5. In the larger series of set of L of the comparative values, the largest (0.72) was obtained in No. 61, followed by Nos. 81 and 84 (0.70). In the larger series of set of L/T, the largest (0.79) was obtained in No. 61, followed by Nos. 81 and 84 (0.77). These orders of strains were finally illustrated in both cases as $61>81=84$, and were fixed to be the same as both characters. Such a phenomenon as this was noted only in this case. It was noteworthy that these synchronized orders of strains were found in quite a few cases in comparison with UHG and HG characters.

On the other hand, some sets of strains did not show the same orders, but showed the same combinations, which meant showing the same strain numbers regardless of orders. Seven cases were ascertained, *i. e.*, ① 13·34·38·39 in the larger sets...the maximum ($13=34=38=39$) and the minimum ($38=39>13=34$) in L; ② 5·22·24 in the larger sets...the ranges of L ($24>5>22$) and L/T ($24>5=22$); ③ 16·29·47 in the larger sets...the minima of W ($16=29>47$) and W/T ($16>29>47$); ④ 20·21·23 in the smaller sets...the maxima of W ($20<21=23$) and W/T ($21=23<20$); ⑤ 19·24·35 in the smaller sets...the minima of L ($24<19=35$) and L/T ($35<24<19$); ⑥ 61·81·84 in the smaller sets...the ranges of L ($61=81=84$) and L/T ($61=84<81$); ⑦ 65·79·80 in the smaller sets...the maximum ($80<79<65$) and the minimum ($80<65<79$) in W/T.

Summary

In order to confirm the varietal variations of the cultivated rice delivered from Rice Research Station, Chinsurah, West Bengal, India, variation ranges in 12 characters were investigated following the previous papers. Those were divided into 2 groups, *i. e.*, Group A-*aman* varieties, Group B-*aus* varieties. The results obtained here were summarized as follows :

1. In view of the husked grains, the maxima, the minima and the pure-ranges of length, width, thickness, L/W, L/T and W/T in Group A were ascertained as 6.71 mm, 6.03 mm, 0.68 mm ; 2.42 mm, 2.09 mm, 0.33 mm ; 1.98 mm, 1.69 mm, 0.28 mm ; 3.15, 2.62, 0.53 ; 3.80, 3.18, 0.62 ; 1.38, 1.09, 0.29 in average values, respectively. Those of Group B were ascertained in the same orders as 6.35 mm, 5.69 mm, 0.66 mm ; 2.91 mm, 2.48 mm, 0.42 mm ; 2.12 mm, 1.84 mm, 0.27 mm ; 2.47, 2.06, 0.41 ; 3.31, 2.81, 0.50 ; 1.51, 1.22, 0.30 in average values, respectively. Those of the whole strains of both of the groups were ascertained in the same orders as 6.53 mm, 5.86 mm, 0.67 mm ; 2.66 mm, 2.29 mm, 0.38 mm ; 2.05 mm, 1.77 mm, 0.28 mm ; 2.81, 2.34, 0.47 ; 3.55, 3.00, 0.56 ; 1.45, 1.15, 0.29 in average values, respectively. Ten and 8 characters showed the larger and the smaller values in Group A than those in Group B, respectively.

2. In view of the comparative values, those in Group A were ascertained in the same orders as 0.74, 0.68, 0.06 ; 0.92, 0.80, 0.11 ; 0.95, 0.86, 0.10 ; 0.90, 0.77, 0.13 ; 0.84, 0.73, 0.10 ; 1.03, 0.87, 0.16 in average values, respectively. Those of Group B were ascertained in the same orders as 0.73, 0.68, 0.05 ; 0.89, 0.79, 0.10 ; 0.94, 0.86, 0.08 ; 0.91, 0.79, 0.12 ; 0.84, 0.74, 0.09 ; 1.00, 0.86, 0.13 in average values, respectively. Those of the whole strains of both of the groups were ascertained in the same orders as 0.73, 0.68, 0.05 ; 0.90, 0.80, 0.11 ; 0.95, 0.86, 0.09 ; 0.90, 0.78, 0.13 ; 0.84, 0.73, 0.10 ; 1.01, 0.87, 0.15 in average values, respectively. Twelve and 3 characters showed the larger and the smaller values in Group A than those in Group B, respectively.

3. According to the tripartite classifications, some specificities were found. It was noticeable that those of type B (= *javanica*) are looked upon as variable features in India and having the shorter history of cultivation than those of type C (= *indica*).

4. Basing on the data obtained in these characters, several patterns and strain-specificities were found. Strains showing relatively large or small values in the respective characters were picked-up and grouped in the categories of "order" or "combination". These new techniques

were fixed to be useful for testing strain or geographical differentiations of rice varieties.

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