

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

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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 rice under the project, designated "The Distribution of Wild Rice and the Ecotypic Differentiation of Cultivated Rice in Burma and Assam", supported by a Grant from the Ministry of Education, Japan. In this opportunity, 100 strains of cultivated rice stocked in Rice Research Station, (RRS), Chinsurah, West Bengal, India, were delivered him through the kindness of Dr. S. Biswas of the station. The grains of these strains were used for the morphological studies by the present author.

In the station, many strains of the cultivated rice, *Oryza sativa* L., were collected and studies in view of breeding program, including high yielding varieties in kharif and boro³⁾. On the other hand, they were not used for the studies on morphological characters. For genetic and breeding purposes, however, varietal variations and the methodologies of them should be ascertained as early as possible.

Taking these facts into account, the author had made to accomplish the work, the aim of which going to clarify the varietal variation and the phylogenetical 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 consideration. In the previous paper¹⁾, the record of morphological characters of the unhusked and the husked grains were mainly reported.

In the present paper, comparison of the unhusked and the husked grains for 12 characters and variation ranges in 6 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 experiments. They are listed up Table 1 of the previous paper¹⁾. In this table, collection number, original place are mentioned in detail. They have different meanings in view of physiological characters, *i.e.*, *aman* and *aus*, and should be separately considered also in morphological studies. According to this fact, they are divided into two groups in the present experimental series, *i.e.*, Group A...*aman* varieties (=strain Nos. 1~50), Group B...*aus* varieties (=strain Nos. 51~100).

Thirty grains were used for the measurement of each strain. Comparative values for 6 characters (Table 1) were illustrated by the ratio of value in the husked to the value in the unhusked grains in the respective characters. The following 6 characters of the unhusked and the husked grains (Table 2) were illustrated by the area (=length \times width) and volume (=length \times width \times thickness) for the unhusked and the husked grains, the area and volume quotients (=ratio of value of the husked to value of the unhusked grains). The whole data referring to the 12 characters were illustrated by the average values through the whole grains.

The variation ranges in 6 characters (Table 3) were illustrated by the maximum, the minimum and the pure-range 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

PART I. The respective characters

1. Quotients in L

Group A: The results are given in Table 1. The values for the individual grain level ranged from 0.76 (strain Nos. 13, 31, 34, 38 and 39) to 0.62 (No. 24). In the strain level, the largest (0.74) was obtained in Nos. 38 and 39, followed by Nos. 3, 28, 30, 31, 34 and 46 (0.73). The smallest (0.69) was noted in Nos. 11, 19 and 20. Average and its s.d. through the whole strains were found to be 0.71 ± 0.01 . The s.d. of each strain, *i.e.*, intra-population's variations, were found to be 0.01 ± 0.01 .

Table 1. Comparative table on some morphological characters of unhusked and husked grains; illustrated by the ratios of value in husked to value in unhusked grains in the respective characters

Strain No.	Length	Width	Thickness	L/W	L/T	W/T
1	0.72 ± 0.01	0.85 ± 0.03	0.91 ± 0.02	0.85 ± 0.03	0.80 ± 0.02	0.94 ± 0.04
2	0.70 ± 0.02	0.85 ± 0.02	0.92 ± 0.02	0.83 ± 0.03	0.76 ± 0.02	0.92 ± 0.03
3	0.73 ± 0.01	0.86 ± 0.03	0.90 ± 0.02	0.85 ± 0.04	0.80 ± 0.02	0.95 ± 0.04
4	0.72 ± 0.01	0.84 ± 0.04	0.90 ± 0.02	0.86 ± 0.04	0.81 ± 0.02	0.94 ± 0.05
5	0.71 ± 0.02	0.86 ± 0.04	0.90 ± 0.03	0.83 ± 0.04	0.79 ± 0.04	0.95 ± 0.05
6	0.72 ± 0.02	0.85 ± 0.04	0.89 ± 0.03	0.85 ± 0.04	0.81 ± 0.03	0.96 ± 0.05
7	0.71 ± 0.01	0.87 ± 0.04	0.91 ± 0.02	0.82 ± 0.04	0.78 ± 0.03	0.95 ± 0.05
8	0.71 ± 0.01	0.87 ± 0.04	0.91 ± 0.02	0.82 ± 0.04	0.78 ± 0.03	0.95 ± 0.05
9	0.70 ± 0.01	0.87 ± 0.03	0.91 ± 0.02	0.80 ± 0.03	0.77 ± 0.02	0.96 ± 0.04
10	0.72 ± 0.02	0.87 ± 0.03	0.91 ± 0.02	0.83 ± 0.02	0.79 ± 0.03	0.96 ± 0.04
11	0.69 ± 0.01	0.83 ± 0.04	0.90 ± 0.02	0.83 ± 0.04	0.77 ± 0.02	0.92 ± 0.04
12	0.70 ± 0.02	0.87 ± 0.03	0.92 ± 0.02	0.81 ± 0.03	0.76 ± 0.03	0.94 ± 0.04
13	0.73 ± 0.01	0.87 ± 0.03	0.91 ± 0.02	0.84 ± 0.03	0.80 ± 0.02	0.96 ± 0.04
14	0.70 ± 0.01	0.84 ± 0.04	0.91 ± 0.02	0.84 ± 0.04	0.77 ± 0.02	0.92 ± 0.05
15	0.71 ± 0.02	0.87 ± 0.03	0.89 ± 0.04	0.82 ± 0.04	0.79 ± 0.03	0.97 ± 0.05
16	0.72 ± 0.01	0.89 ± 0.02	0.91 ± 0.03	0.81 ± 0.02	0.79 ± 0.03	0.98 ± 0.03

Table 1. (Continued)

Strain No.	Length	Width	Thickness	L/W	L/T	W/T
17	0.71 ± 0.01	0.87 ± 0.03	0.90 ± 0.02	0.82 ± 0.03	0.80 ± 0.02	0.97 ± 0.04
18	0.71 ± 0.01	0.84 ± 0.03	0.90 ± 0.03	0.84 ± 0.03	0.79 ± 0.03	0.94 ± 0.03
19	0.69 ± 0.01	0.85 ± 0.03	0.91 ± 0.03	0.82 ± 0.03	0.76 ± 0.03	0.94 ± 0.04
20	0.69 ± 0.02	0.84 ± 0.03	0.90 ± 0.02	0.83 ± 0.03	0.77 ± 0.02	0.93 ± 0.04
21	0.70 ± 0.01	0.83 ± 0.03	0.93 ± 0.03	0.84 ± 0.03	0.75 ± 0.03	0.89 ± 0.04
22	0.71 ± 0.02	0.84 ± 0.04	0.90 ± 0.03	0.85 ± 0.03	0.80 ± 0.03	0.94 ± 0.05
23	0.70 ± 0.01	0.84 ± 0.03	0.90 ± 0.02	0.84 ± 0.03	0.78 ± 0.03	0.93 ± 0.03
24	0.70 ± 0.02	0.86 ± 0.03	0.92 ± 0.02	0.81 ± 0.03	0.76 ± 0.03	0.94 ± 0.04
25	0.72 ± 0.02	0.85 ± 0.02	0.92 ± 0.02	0.85 ± 0.03	0.79 ± 0.02	0.93 ± 0.03
26	0.71 ± 0.01	0.86 ± 0.03	0.91 ± 0.03	0.83 ± 0.03	0.79 ± 0.03	0.95 ± 0.05
27	0.70 ± 0.01	0.87 ± 0.02	0.92 ± 0.02	0.81 ± 0.02	0.77 ± 0.02	0.95 ± 0.04
28	0.73 ± 0.01	0.87 ± 0.03	0.91 ± 0.03	0.84 ± 0.03	0.81 ± 0.03	0.97 ± 0.04
29	0.70 ± 0.01	0.92 ± 0.03	0.92 ± 0.03	0.77 ± 0.02	0.77 ± 0.03	1.01 ± 0.04
30	0.73 ± 0.01	0.85 ± 0.04	0.91 ± 0.02	0.86 ± 0.04	0.81 ± 0.02	0.94 ± 0.06
31	0.73 ± 0.01	0.85 ± 0.04	0.91 ± 0.02	0.86 ± 0.05	0.81 ± 0.02	0.94 ± 0.05
32	0.71 ± 0.01	0.85 ± 0.02	0.90 ± 0.02	0.82 ± 0.04	0.79 ± 0.03	0.94 ± 0.03
33	0.72 ± 0.01	0.87 ± 0.04	0.92 ± 0.02	0.82 ± 0.04	0.78 ± 0.02	0.95 ± 0.05
34	0.73 ± 0.01	0.88 ± 0.03	0.91 ± 0.02	0.82 ± 0.03	0.80 ± 0.02	0.97 ± 0.04
35	0.70 ± 0.02	0.84 ± 0.03	0.91 ± 0.03	0.84 ± 0.03	0.78 ± 0.04	0.92 ± 0.04
36	0.71 ± 0.02	0.84 ± 0.02	0.91 ± 0.03	0.85 ± 0.03	0.79 ± 0.04	0.93 ± 0.03
37	0.72 ± 0.01	0.85 ± 0.03	0.91 ± 0.02	0.86 ± 0.04	0.79 ± 0.02	0.93 ± 0.05
38	0.74 ± 0.01	0.87 ± 0.02	0.91 ± 0.02	0.85 ± 0.02	0.81 ± 0.03	0.96 ± 0.03
39	0.74 ± 0.01	0.88 ± 0.02	0.91 ± 0.02	0.81 ± 0.03	0.78 ± 0.02	0.96 ± 0.04
40	0.71 ± 0.01	0.88 ± 0.03	0.92 ± 0.03	0.81 ± 0.03	0.78 ± 0.03	0.96 ± 0.04
41	0.72 ± 0.01	0.84 ± 0.03	0.91 ± 0.02	0.87 ± 0.02	0.80 ± 0.02	0.92 ± 0.04
42	0.72 ± 0.01	0.86 ± 0.03	0.91 ± 0.02	0.84 ± 0.03	0.79 ± 0.02	0.95 ± 0.04
43	0.71 ± 0.01	0.85 ± 0.03	0.92 ± 0.02	0.84 ± 0.03	0.77 ± 0.02	0.92 ± 0.04
44	0.71 ± 0.01	0.86 ± 0.03	0.92 ± 0.02	0.83 ± 0.03	0.78 ± 0.02	0.93 ± 0.04
45	0.72 ± 0.01	0.87 ± 0.03	0.91 ± 0.02	0.82 ± 0.03	0.79 ± 0.03	0.96 ± 0.04
46	0.73 ± 0.01	0.86 ± 0.03	0.91 ± 0.02	0.85 ± 0.03	0.80 ± 0.02	0.95 ± 0.04
47	0.71 ± 0.01	0.89 ± 0.02	0.92 ± 0.02	0.81 ± 0.02	0.78 ± 0.02	0.97 ± 0.03
48	0.71 ± 0.01	0.87 ± 0.03	0.91 ± 0.02	0.82 ± 0.03	0.78 ± 0.02	0.95 ± 0.04
49	0.72 ± 0.01	0.87 ± 0.03	0.91 ± 0.02	0.83 ± 0.03	0.79 ± 0.03	0.95 ± 0.03
50	0.71 ± 0.02	0.88 ± 0.03	0.92 ± 0.02	0.81 ± 0.04	0.77 ± 0.02	0.95 ± 0.03
51	0.69 ± 0.01	0.85 ± 0.03	0.90 ± 0.03	0.81 ± 0.03	0.78 ± 0.03	0.96 ± 0.05
52	0.70 ± 0.01	0.84 ± 0.03	0.89 ± 0.02	0.84 ± 0.04	0.79 ± 0.01	0.94 ± 0.05
53	0.70 ± 0.02	0.85 ± 0.03	0.91 ± 0.02	0.82 ± 0.03	0.77 ± 0.02	0.93 ± 0.04
54	0.70 ± 0.01	0.83 ± 0.02	0.91 ± 0.02	0.84 ± 0.03	0.77 ± 0.02	0.92 ± 0.03
55	0.70 ± 0.01	0.86 ± 0.03	0.90 ± 0.02	0.81 ± 0.03	0.77 ± 0.03	0.96 ± 0.04
56	0.71 ± 0.02	0.85 ± 0.03	0.90 ± 0.03	0.83 ± 0.04	0.79 ± 0.03	0.95 ± 0.04
57	0.70 ± 0.01	0.84 ± 0.02	0.90 ± 0.02	0.84 ± 0.02	0.78 ± 0.02	0.93 ± 0.02
58	0.70 ± 0.02	0.83 ± 0.04	0.90 ± 0.02	0.84 ± 0.05	0.77 ± 0.02	0.93 ± 0.06
59	0.70 ± 0.01	0.84 ± 0.03	0.89 ± 0.03	0.84 ± 0.03	0.78 ± 0.03	0.94 ± 0.04
60	0.68 ± 0.01	0.83 ± 0.02	0.89 ± 0.02	0.82 ± 0.03	0.77 ± 0.02	0.94 ± 0.04
61	0.74 ± 0.01	0.85 ± 0.02	0.92 ± 0.01	0.88 ± 0.03	0.81 ± 0.01	0.93 ± 0.03

Table 1. (Continued)

Strain No.	Length	Width	Thickness	L/W	L/T	W/T
62	0.70±0.01	0.86±0.02	0.91±0.01	0.81±0.03	0.77±0.02	0.94±0.03
63	0.71±0.01	0.85±0.01	0.91±0.01	0.83±0.03	0.78±0.01	0.94±0.02
64	0.70±0.01	0.85±0.02	0.92±0.02	0.83±0.02	0.76±0.02	0.92±0.03
65	0.71±0.01	0.85±0.02	0.92±0.02	0.84±0.02	0.78±0.02	0.92±0.03
66	0.72±0.01	0.86±0.02	0.91±0.02	0.84±0.02	0.79±0.02	0.93±0.03
67	0.71±0.01	0.81±0.03	0.90±0.02	0.88±0.03	0.80±0.03	0.90±0.04
68	0.71±0.01	0.85±0.02	0.91±0.01	0.84±0.02	0.78±0.01	0.93±0.03
69	0.69±0.01	0.83±0.02	0.90±0.02	0.83±0.02	0.76±0.02	0.92±0.03
70	0.71±0.01	0.84±0.02	0.91±0.02	0.84±0.02	0.78±0.02	0.93±0.03
71	0.72±0.01	0.88±0.02	0.90±0.02	0.82±0.03	0.80±0.04	0.98±0.02
72	0.70±0.01	0.84±0.02	0.90±0.02	0.83±0.02	0.78±0.03	0.94±0.03
73	0.69±0.02	0.86±0.02	0.91±0.01	0.80±0.02	0.76±0.02	0.95±0.03
74	0.71±0.01	0.79±0.02	0.91±0.02	0.89±0.03	0.78±0.03	0.88±0.03
75	0.70±0.01	0.89±0.02	0.91±0.02	0.79±0.02	0.77±0.04	0.98±0.03
76	0.71±0.02	0.86±0.02	0.91±0.01	0.82±0.02	0.78±0.02	0.95±0.03
77	0.71±0.01	0.85±0.02	0.90±0.02	0.84±0.03	0.79±0.02	0.94±0.03
78	0.71±0.01	0.87±0.02	0.90±0.02	0.82±0.02	0.78±0.02	0.97±0.04
79	0.72±0.01	0.80±0.03	0.91±0.01	0.90±0.04	0.79±0.02	0.88±0.04
80	0.71±0.02	0.74±0.04	0.89±0.02	0.97±0.05	0.80±0.03	0.83±0.04
81	0.72±0.01	0.81±0.02	0.90±0.02	0.89±0.02	0.80±0.02	0.90±0.03
82	0.70±0.01	0.83±0.03	0.90±0.02	0.84±0.04	0.78±0.02	0.93±0.04
83	0.71±0.02	0.87±0.03	0.90±0.02	0.82±0.03	0.79±0.04	0.97±0.03
84	0.72±0.01	0.83±0.03	0.90±0.02	0.87±0.03	0.79±0.02	0.92±0.03
85	0.71±0.02	0.82±0.02	0.90±0.01	0.86±0.04	0.79±0.02	0.91±0.03
86	0.72±0.01	0.84±0.03	0.91±0.02	0.86±0.03	0.80±0.02	0.93±0.04
87	0.69±0.02	0.83±0.02	0.91±0.02	0.84±0.03	0.76±0.02	0.91±0.03
88	0.69±0.01	0.82±0.02	0.91±0.02	0.84±0.03	0.77±0.03	0.91±0.03
89	0.72±0.01	0.83±0.02	0.91±0.02	0.87±0.03	0.80±0.02	0.92±0.03
90	0.70±0.01	0.82±0.03	0.87±0.03	0.86±0.04	0.81±0.04	0.94±0.04
91	0.70±0.01	0.85±0.03	0.88±0.02	0.83±0.03	0.79±0.02	0.96±0.04
92	0.71±0.01	0.83±0.02	0.89±0.02	0.85±0.02	0.79±0.02	0.93±0.03
93	0.70±0.02	0.84±0.03	0.91±0.02	0.83±0.03	0.76±0.03	0.93±0.04
94	0.70±0.01	0.86±0.02	0.91±0.02	0.83±0.04	0.78±0.02	0.94±0.03
95	0.72±0.01	0.86±0.02	0.90±0.02	0.84±0.02	0.80±0.02	0.95±0.02
96	0.72±0.01	0.85±0.02	0.91±0.02	0.85±0.02	0.80±0.02	0.94±0.03
97	0.73±0.01	0.84±0.03	0.90±0.02	0.86±0.03	0.81±0.02	0.94±0.04
98	0.68±0.02	0.84±0.02	0.90±0.01	0.82±0.03	0.76±0.03	0.93±0.02
99	0.68±0.02	0.83±0.02	0.90±0.02	0.82±0.03	0.76±0.02	0.93±0.03
100	0.69±0.01	0.82±0.02	0.89±0.02	0.85±0.02	0.78±0.02	0.92±0.03

Group B: The values for the individual grain level ranged from 0.78 (No. 56) to 0.63 (No. 98). In the strain level, the largest (0.74) was obtained in No. 61, followed by No. 97 (0.73). The smallest (0.68) was noted in Nos. 60, 98 and 99. Average and its s.d. through the whole strains were found to be 0.71 ± 0.01 . S.d. of each strain were found to be 0.01 ± 0.00 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.71 ± 0.01 . S.d. of each strain were found to be 0.01 ± 0.00 .

2. Quotients in W

Group A: The values for the individual grain level ranged from 0.97 (No. 29) to 0.74 (Nos. 31 and 33). In the strain level, the largest (0.92) was obtained in No. 29, followed by Nos. 16 and 47 (0.89). The smallest (0.83) was noted in Nos. 11 and 21. Average and its s.d. through the whole strains were found to be 0.86 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

Group B: The values for the individual grain level ranged from 0.94 (No. 67) to 0.65 (No. 80). In the strain level, the largest (0.89) was obtained in No. 75, followed by No. 71 (0.88) and Nos. 78 and 83 (0.87). The smallest (0.74) was noted in No. 80, followed by No. 74 (0.79) and No. 79 (0.80). It was noted that the value was particularly small in No. 80. Average and its s.d. through the whole strains were found to be 0.84 ± 0.02 . S.d. of each strain were found to be 0.02 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.85 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

3. Quotients in T

Group A: The values for the individual grain level ranged from 1.00 (No. 19) to 0.81 (Nos. 6 and 26). In the strain level, the largest (0.93) was obtained in No. 21. The smallest (0.89) was noted in Nos. 6 and 15. Average and its s.d. through the whole strains were found to be 0.91 ± 0.01 . S.d. of each strain were found to be 0.02 ± 0.01 .

Group B: The values for the individual grain level ranged from 0.96 (Nos. 54, 64 and 65) to 0.80 (No. 90). In the strain level, the largest (0.92) was obtained in Nos. 61, 64 and 65. The smallest (0.87) was noted in No. 90, followed by No. 91 (0.88). Average and its s.d. through the whole strains were found to be 0.90 ± 0.01 . S.d. of each strain were found to be 0.02 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.91 ± 0.01 . S.d. of each strain were found to be 0.02 ± 0.01 .

4. Quotients in L/W

Group A: The values for the individual grain level ranged from 1.00 (No. 31) to 0.71 (Nos. 32 and 50). In the strain level, the largest (0.87) was obtained in No. 41, followed by Nos. 4, 30, 31 and 37 (0.86). The smallest (0.77) was noted in No. 29, followed by No. 9 (0.80). Average and its s.d. through the whole strains were found to be 0.83 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

Group B: The values for the individual grain level ranged from 1.07 (No. 80) to 0.73 (Nos. 58 and 63). In the strain level, the largest (0.97) was obtained in No. 80, followed by No. 79 (0.90) and Nos. 74 and 81 (0.89). It was noticed that the value was particularly large in No. 80. The smallest (0.79) was noted in No. 75, followed by No. 73 (0.80) and Nos. 51, 55 and 62 (0.81). Average and its s.d. through the whole strains were found to be 0.84 ± 0.03 . S.d. of each strain were found to be 0.03 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.84 ± 0.03 . S.d. of each strain were found to be 0.03 ± 0.01 .

5. Quotients in L/T

Group A: The values for the individual grain level ranged from 0.88 (Nos. 1, 6, 32 and 36) to

0.65 (No. 35). In the strain level, the largest (0.81) was obtained in Nos. 4, 6, 28, 30, 31 and 38. The smallest (0.75) was noted in No. 21, followed by Nos. 2, 12, 19 and 24 (0.76). Average and its s.d. through the whole strains were found to be 0.79 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

Group B: The values for the individual grain level ranged from 0.93 (Nos. 67, 71 and 75) to 0.66 (No. 83). In the strain level, the largest (0.81) was obtained in Nos. 61, 90 and 97. The smallest (0.76) was noted in Nos. 64, 69, 73, 87, 93, 98 and 99. Average and its s.d. through the whole strains were found to be 0.78 ± 0.01 . S.d. of each strain were found to be 0.02 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.78 ± 0.02 . S.d. of each strain were found to be 0.02 ± 0.01 .

6. Quotients in W/T

Group A: The values for the individual grain level ranged from 1.08 (No. 8) to 0.82 (Nos. 21 and 33). In the strain level, the largest (1.01) was obtained in No. 29, which was the same as in case of W, followed by No. 16 (0.98) and Nos. 15, 17, 28, 34 and 47 (0.97). The smallest (0.89) was noted in No. 21, which was the same as in case of L/T, followed by Nos. 2, 11, 14, 35, 41 and 43 (0.92). Average and its s.d. through the whole strains were found to be 0.95 ± 0.02 . S.d. of each strain were found to be 0.04 ± 0.01 .

Group B: The values for the individual grain level ranged from 1.06 (Nos. 55, 60 and 78) to 0.71 (No. 80). In the strain level, the largest (0.98) was obtained in Nos. 71 and 75, followed by Nos. 78 and 83 (0.97). The smallest (0.83) was noted in No. 80, which was the same as in case of W, followed by Nos. 74 and 79 (0.88). It was noted that the value was particularly small in No. 80. Average and its s.d. through the whole strains were found to be 0.93 ± 0.03 . S.d. of each strain were found to be 0.03 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.94 ± 0.02 . S.d. of each strain were found to be 0.04 ± 0.01 .

7. Areas in UHG

Group A: The results are given in Table 2. The practical values for the individual grain level ranged from 32.43 mm^2 (No. 21) to 10.35 mm^2 (No. 29). In the strain level, the widest (29.48 mm^2) was obtained in No. 21, which was the same as in case of T, followed by No. 10 (27.18 mm^2) and No. 13 (27.10 mm^2). The narrowest (12.07 mm^2) was noted in No. 29, which was the same as in case of L/W, followed by No. 40 (17.69 mm^2) and No. 34 (19.20 mm^2). It was noticed that the value was particularly small in No. 29. Average and its s.d. through the whole strains were found to be 23.53 ± 2.86 .

The largest of s.d. (1.56) was obtained in No. 6, followed by Nos. 2 and 12 (1.55). The smallest of s.d. (0.65) was noted in No. 26, followed by No. 29 (0.67) and No. 40 (0.79). S.d. of each strain were found to be 1.13 ± 0.23 .

Group B: The practical values for the individual grain level ranged from 36.47 mm^2 (No. 55) to 17.28 mm^2 (No. 86). In the strain level, the widest (32.93 mm^2) was obtained in No. 99, followed by No. 55 (32.63 mm^2) and No. 98 (32.53 mm^2). The narrowest (21.04 mm^2) was noted in No. 86, followed by No. 66 (22.60 mm^2) and No. 94 (22.64 mm^2). Average and its s.d. through the whole strains were found to be 27.81 ± 3.22 .

The largest of s.d. (2.37) was obtained in No. 93, followed by No. 89 (2.05) and No. 92 (2.04). The smallest of s.d. (0.81) was noted in No. 70, followed by No. 75 (0.87) and No. 78 (0.90). S.d.

Table 2. Six characters of the unhusked and the husked grains; illustrated by the area (=length \times width), the volume (=length \times width \times thickness), the area and volume quotients (= ratio of value of husked to value of unhusked grains)

Strain No.	Unhusked		Husked		Quotient	
	Area (mm ²)	Volume (mm ³)	Area (mm ²)	Volume (mm ³)	Area	Volume
1	23.38 \pm 1.38	49.41 \pm 3.09	14.33 \pm 0.76	27.40 \pm 1.68	0.61 \pm 0.02	0.56 \pm 0.02
2	26.15 \pm 1.55	56.24 \pm 4.16	15.45 \pm 0.83	30.64 \pm 2.17	0.59 \pm 0.02	0.55 \pm 0.03
3	26.43 \pm 1.15	55.55 \pm 2.65	16.55 \pm 0.58	31.52 \pm 1.21	0.63 \pm 0.02	0.57 \pm 0.03
4	23.81 \pm 1.17	47.79 \pm 2.62	14.52 \pm 0.84	26.27 \pm 2.08	0.61 \pm 0.03	0.55 \pm 0.03
5	19.68 \pm 1.02	37.40 \pm 2.78	11.98 \pm 0.65	20.62 \pm 1.36	0.61 \pm 0.03	0.55 \pm 0.03
6	24.83 \pm 1.56	47.76 \pm 3.77	15.12 \pm 0.84	25.86 \pm 2.69	0.61 \pm 0.03	0.54 \pm 0.04
7	25.14 \pm 1.53	50.55 \pm 3.84	15.30 \pm 1.01	27.95 \pm 2.24	0.61 \pm 0.03	0.55 \pm 0.03
8	26.99 \pm 1.39	54.62 \pm 4.06	16.46 \pm 0.70	30.14 \pm 2.29	0.61 \pm 0.03	0.55 \pm 0.03
9	23.72 \pm 1.06	48.29 \pm 2.82	14.47 \pm 0.68	26.72 \pm 1.68	0.61 \pm 0.02	0.56 \pm 0.03
10	27.18 \pm 1.41	55.45 \pm 3.43	16.78 \pm 0.55	30.99 \pm 1.56	0.62 \pm 0.03	0.56 \pm 0.03
11	24.23 \pm 0.98	47.26 \pm 3.30	13.77 \pm 0.55	24.09 \pm 1.45	0.57 \pm 0.03	0.51 \pm 0.03
12	24.27 \pm 1.55	48.82 \pm 3.56	14.69 \pm 0.81	27.11 \pm 1.94	0.61 \pm 0.03	0.56 \pm 0.03
13	27.10 \pm 1.35	56.71 \pm 3.70	17.12 \pm 0.84	32.42 \pm 1.86	0.63 \pm 0.02	0.57 \pm 0.02
14	25.58 \pm 1.27	53.60 \pm 2.97	15.06 \pm 0.92	28.64 \pm 1.95	0.59 \pm 0.03	0.53 \pm 0.03
15	22.71 \pm 1.30	44.41 \pm 3.00	13.87 \pm 0.83	24.28 \pm 2.04	0.61 \pm 0.03	0.55 \pm 0.03
16	20.45 \pm 0.94	40.11 \pm 2.51	13.13 \pm 0.51	23.42 \pm 1.07	0.64 \pm 0.02	0.59 \pm 0.03
17	21.03 \pm 1.18	41.45 \pm 3.06	13.01 \pm 0.53	23.02 \pm 1.50	0.62 \pm 0.03	0.56 \pm 0.03
18	25.32 \pm 0.99	54.03 \pm 3.15	15.06 \pm 0.58	28.80 \pm 1.86	0.60 \pm 0.02	0.53 \pm 0.03
19	25.67 \pm 1.22	55.20 \pm 3.19	14.92 \pm 0.80	29.08 \pm 1.95	0.58 \pm 0.03	0.52 \pm 0.03
20	22.47 \pm 1.19	43.81 \pm 3.18	13.04 \pm 0.59	22.87 \pm 1.52	0.58 \pm 0.02	0.52 \pm 0.03
21	29.48 \pm 1.52	66.15 \pm 3.24	17.09 \pm 0.81	35.65 \pm 1.86	0.58 \pm 0.02	0.54 \pm 0.03
22	23.65 \pm 1.01	49.44 \pm 3.01	14.15 \pm 0.60	26.51 \pm 1.95	0.60 \pm 0.03	0.54 \pm 0.03
23	24.91 \pm 0.99	51.03 \pm 2.57	14.64 \pm 0.70	26.97 \pm 1.92	0.59 \pm 0.02	0.53 \pm 0.03
24	25.67 \pm 1.04	55.40 \pm 2.97	15.32 \pm 0.68	30.21 \pm 1.80	0.60 \pm 0.03	0.54 \pm 0.02
25	25.70 \pm 1.10	53.89 \pm 3.03	15.81 \pm 0.83	30.38 \pm 2.33	0.62 \pm 0.02	0.56 \pm 0.03
26	22.48 \pm 0.65	46.07 \pm 2.44	13.75 \pm 0.66	25.57 \pm 1.96	0.61 \pm 0.03	0.56 \pm 0.03
27	23.39 \pm 0.95	48.93 \pm 2.71	14.31 \pm 0.52	27.48 \pm 1.45	0.61 \pm 0.02	0.56 \pm 0.02
28	23.49 \pm 0.82	47.92 \pm 2.07	14.91 \pm 0.49	27.49 \pm 1.17	0.64 \pm 0.02	0.58 \pm 0.03
29	12.07 \pm 0.67	21.51 \pm 1.41	7.81 \pm 0.39	12.71 \pm 0.79	0.65 \pm 0.03	0.59 \pm 0.03
30	20.84 \pm 1.05	40.92 \pm 2.74	12.94 \pm 0.73	22.97 \pm 1.50	0.62 \pm 0.03	0.56 \pm 0.03
31	23.68 \pm 1.20	48.34 \pm 3.16	14.66 \pm 0.81	27.06 \pm 1.87	0.62 \pm 0.03	0.56 \pm 0.03
32	23.20 \pm 0.97	46.41 \pm 2.31	13.86 \pm 0.52	24.99 \pm 1.19	0.60 \pm 0.02	0.54 \pm 0.02
33	20.55 \pm 1.00	41.28 \pm 2.85	12.75 \pm 0.62	23.25 \pm 1.22	0.62 \pm 0.02	0.57 \pm 0.04
34	19.20 \pm 0.90	38.54 \pm 2.22	12.28 \pm 0.40	22.44 \pm 1.07	0.64 \pm 0.02	0.58 \pm 0.02
35	26.31 \pm 1.39	50.61 \pm 3.35	15.48 \pm 0.91	26.92 \pm 2.22	0.59 \pm 0.03	0.53 \pm 0.03
36	26.00 \pm 1.28	53.13 \pm 2.87	15.67 \pm 0.80	28.92 \pm 1.96	0.60 \pm 0.02	0.55 \pm 0.02
37	23.69 \pm 1.05	49.30 \pm 2.72	14.43 \pm 0.53	27.28 \pm 1.50	0.61 \pm 0.03	0.56 \pm 0.03
38	25.59 \pm 1.04	53.24 \pm 3.16	16.37 \pm 0.72	30.95 \pm 1.90	0.64 \pm 0.02	0.58 \pm 0.03
39	21.88 \pm 1.01	44.35 \pm 2.68	13.52 \pm 0.63	25.03 \pm 1.56	0.62 \pm 0.02	0.57 \pm 0.03
40	17.69 \pm 0.79	33.18 \pm 2.01	11.11 \pm 0.58	19.06 \pm 1.32	0.63 \pm 0.03	0.58 \pm 0.03
41	24.08 \pm 1.18	50.10 \pm 3.05	14.52 \pm 0.59	27.43 \pm 1.47	0.60 \pm 0.02	0.55 \pm 0.02
42	24.73 \pm 1.03	51.22 \pm 2.97	15.34 \pm 0.65	28.90 \pm 1.85	0.62 \pm 0.02	0.56 \pm 0.02

Table 2. (Continued)

Strain No.	Unhusked		Husked		Quotient	
	Area (mm ²)	Volume (mm ³)	Area (mm ²)	Volume (mm ³)	Area	Volume
43	23.94±0.90	50.92±2.45	14.44±0.64	28.29±1.56	0.60±0.02	0.56±0.03
44	23.02±0.92	48.07±2.50	14.04±0.69	26.98±1.68	0.61±0.03	0.56±0.03
45	22.00±1.29	44.46±3.02	13.77±0.60	25.35±1.55	0.63±0.02	0.57±0.03
46	22.43±1.18	46.28±2.67	14.00±0.50	26.11±1.19	0.63±0.02	0.57±0.02
47	21.41±0.89	43.02±2.34	13.51±0.57	24.82±1.33	0.63±0.02	0.58±0.02
48	26.22±1.21	55.96±2.96	16.27±0.93	31.67±2.02	0.62±0.02	0.57±0.02
49	22.95±1.00	46.87±2.82	14.36±0.56	26.66±1.70	0.63±0.02	0.57±0.02
50	20.31±1.30	41.13±2.92	12.59±0.64	23.45±1.48	0.62±0.03	0.57±0.03
51	31.01±1.62	74.68±3.78	18.28±0.72	39.34±2.11	0.59±0.02	0.53±0.03
52	29.39±1.37	68.70±4.30	17.30±0.83	36.02±1.97	0.59±0.03	0.53±0.03
53	28.99±1.65	64.62±4.61	17.18±0.85	34.83±2.32	0.59±0.03	0.54±0.03
54	28.70±1.47	63.73±3.71	16.72±0.78	33.61±1.65	0.59±0.02	0.53±0.02
55	32.63±1.89	81.33±4.52	19.41±1.00	43.44±2.19	0.60±0.02	0.53±0.02
56	25.91±1.40	60.13±4.23	15.71±1.02	32.90±2.70	0.61±0.03	0.55±0.03
57	28.36±1.76	62.58±4.23	16.58±0.83	32.96±1.84	0.59±0.02	0.53±0.02
58	30.84±1.43	74.78±4.85	17.89±1.22	39.00±3.33	0.58±0.04	0.52±0.04
59	32.18±1.77	75.16±4.13	18.87±0.90	39.44±2.37	0.59±0.02	0.53±0.02
60	31.40±1.76	73.39±4.19	17.86±0.96	37.07±2.09	0.57±0.02	0.51±0.01
61	26.88±1.01	58.07±2.68	16.84±0.80	33.24±1.74	0.63±0.02	0.57±0.02
62	27.46±1.24	59.82±3.55	16.30±0.81	32.21±2.07	0.59±0.02	0.54±0.02
63	26.78±1.06	58.74±2.68	16.03±0.72	31.92±1.69	0.60±0.01	0.54±0.01
64	29.91±1.44	65.85±3.40	17.64±0.80	35.77±1.96	0.59±0.02	0.54±0.02
65	26.98±1.40	60.18±3.68	16.30±0.77	33.30±2.18	0.61±0.01	0.55±0.02
66	22.60±1.10	44.32±2.72	13.82±0.52	24.70±1.29	0.61±0.02	0.56±0.02
67	30.26±1.61	69.16±4.61	17.42±0.84	35.90±2.17	0.58±0.03	0.52±0.03
68	26.94±1.16	59.91±2.75	16.11±0.80	32.75±1.71	0.60±0.02	0.55±0.02
69	32.30±1.58	79.11±6.23	19.00±0.77	40.59±2.77	0.57±0.02	0.51±0.02
70	23.78±0.81	48.60±2.65	14.04±0.42	25.63±1.99	0.59±0.02	0.54±0.02
71	24.70±1.10	51.12±2.60	15.47±0.61	28.64±1.29	0.63±0.02	0.56±0.03
72	25.49±1.28	53.00±3.33	15.03±0.56	28.04±1.69	0.59±0.02	0.53±0.02
73	30.32±1.25	68.30±3.87	17.81±0.60	36.31±1.76	0.59±0.02	0.53±0.02
74	29.20±1.37	67.36±4.64	16.40±1.02	34.30±2.67	0.56±0.02	0.51±0.02
75	24.27±0.87	52.93±2.43	14.96±0.55	29.55±1.04	0.62±0.02	0.56±0.02
76	28.60±1.57	63.44±3.82	17.37±0.81	35.17±1.96	0.61±0.02	0.56±0.02
77	22.79±1.14	44.86±2.45	13.85±0.59	24.63±1.33	0.61±0.01	0.55±0.02
78	25.70±0.90	52.81±2.37	15.71±0.58	29.08±1.92	0.61±0.02	0.55±0.02
79	27.45±1.61	62.55±4.92	15.70±1.11	32.43±3.07	0.57±0.02	0.52±0.02
80	30.54±1.25	69.14±4.00	15.94±1.08	32.17±2.78	0.52±0.03	0.47±0.03
81	27.71±1.06	63.37±3.51	16.06±0.79	33.09±2.04	0.58±0.02	0.53±0.02
82	28.70±1.09	62.02±3.16	16.67±0.60	32.29±1.54	0.58±0.02	0.52±0.02
83	26.52±1.46	56.11±3.80	16.21±0.86	30.82±2.15	0.61±0.02	0.55±0.02
84	28.27±1.35	66.28±4.03	16.77±0.95	35.48±2.60	0.59±0.02	0.54±0.02
85	30.92±1.75	69.51±4.95	18.01±1.19	36.52±2.83	0.58±0.02	0.53±0.02
86	21.04±1.40	41.06±3.16	12.75±0.83	22.55±2.08	0.61±0.03	0.55±0.03

Table 2. (Continued)

Strain No.	Unhusked		Husked		Quotient	
	Area (mm ²)	Volume (mm ³)	Area (mm ²)	Volume (mm ³)	Area	Volume
87	22.66±1.24	46.94±2.71	12.98±0.56	24.48±1.20	0.57±0.02	0.52±0.02
88	25.12±1.60	50.65±3.38	14.23±0.92	25.99±1.74	0.57±0.02	0.51±0.02
89	26.77±2.05	57.62±4.72	16.11±1.01	31.29±2.06	0.60±0.02	0.54±0.02
90	32.14±1.51	75.55±5.31	18.27±0.92	37.23±2.94	0.57±0.03	0.50±0.03
91	27.75±1.95	64.49±6.05	16.29±0.89	33.32±2.44	0.59±0.02	0.52±0.03
92	31.94±2.04	74.28±5.30	18.77±1.19	39.03±2.85	0.59±0.02	0.53±0.02
93	26.54±2.37	55.05±6.65	15.51±1.30	29.23±3.25	0.59±0.02	0.53±0.02
94	22.64±1.31	47.65±3.41	13.60±0.80	25.84±1.86	0.60±0.02	0.54±0.02
95	22.69±0.96	45.98±2.32	13.91±0.57	25.39±1.50	0.61±0.02	0.55±0.02
96	23.28±1.23	48.14±3.31	14.17±0.74	26.52±1.77	0.61±0.02	0.55±0.02
97	25.79±1.34	52.05±2.97	15.76±0.77	28.43±1.90	0.61±0.02	0.55±0.03
98	32.53±1.53	75.68±5.16	18.60±0.81	39.02±2.27	0.57±0.02	0.52±0.02
99	32.93±1.97	79.43±6.28	18.68±1.07	40.36±2.79	0.57±0.02	0.51±0.02
100	32.09±1.75	70.34±5.06	18.16±0.98	35.57±2.42	0.57±0.02	0.51±0.02

of each strain were found to be 1.44 ± 0.34 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 25.67 ± 3.72 . S.d. of each strain were found to be 1.28 ± 0.32 .

8. Volumes in UHG

Group A: The practical values for the individual grain level ranged from 72.97 mm^3 (No. 21) to 17.60 mm^3 (No. 29). In the strain level, the largest (66.15 mm^3) was obtained in No. 21, which was the same as in cases of T and area of UHG, followed by No. 13 (56.71 mm^3) and No. 48 (55.96 mm^3). It was noted that the value was particularly large in No. 21. The smallest (21.51 mm^3) was noted in No. 29, which was the same as in cases of L/W and area of UHG, followed by No. 40 (33.18 mm^3) and No. 5 (37.40 mm^3). It was noted that the value was particularly small in No. 29. Average and its s.d. through the whole strains were found to be 48.12 ± 7.10 .

The largest of s.d. (4.16) was obtained in No. 2, followed by No. 8 (4.06) and No. 7 (3.84). The smallest of s.d. (1.41) was noted in No. 29, followed by No. 40 (2.01) and No. 34 (2.22). S.d. of each strain were found to be 2.92 ± 0.51 .

Group B: The practical values for the individual grain level ranged from 92.79 mm^3 (No. 69) to 32.83 mm^3 (No. 86). In the strain level, the largest (81.33 mm^3) was obtained in No. 55, followed by No. 99 (79.43 mm^3) and No. 69 (79.11 mm^3). The smallest (41.06 mm^3) was noted in No. 86, which was the same as in case of area of UHG, followed by No. 66 (44.32 mm^3) and No. 77 (44.86 mm^3). Average and its s.d. through the whole strains were found to be 61.81 ± 10.46 .

The largest of s.d. (6.65) was obtained in No. 93, which was the same as in case of area of UHG, followed by No. 99 (6.28) and No. 69 (6.23). The smallest of s.d. (2.32) was noted in No. 95, followed by No. 78 (2.37) and No. 75 (2.43). S.d. of each strain were found to be 3.94 ± 1.10 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 54.97 ± 11.24 . S.d. of each strain were found to be 3.43 ± 1.00 .

9. Areas in HG

Group A: The practical values for the individual grain level ranged from 19.52 mm² (No. 48) to 6.80 mm² (No. 29). In the strain level, the widest (17.12 mm²) was obtained in No. 13, followed by No. 21 (17.09 mm²) and No. 10 (16.78 mm²). These combinations of strains were found to be the same as in case of area of UHG. The narrowest (7.81 mm²) was noted in No. 29, which was the same as in cases of L/W, area and volume of UHG, followed by No. 40 (11.11 mm²) and No. 5 (11.98 mm²). These combinations of strains were found to be the same as in case of the volume of UHG. Average and its s.d. through the whole strains were found to be 14.37 ± 1.62 .

The largest of s.d. (1.01) was obtained in No. 7, followed by No. 48 (0.93) and No. 14 (0.92). The smallest of s.d. (0.37) was noted in No. 29, which was the same as in case of the volume of UHG, followed by No. 34 (0.40) and No. 28 (0.49). S.d. of each strain were found to be 0.67 ± 0.14 .

Group B: The practical values for the individual grain level ranged from 20.96 mm² (No. 55) to 10.71 mm² (No. 86). In the strain level, the widest (19.41 mm²) was obtained in No. 55, which was the same as in case of the volume of UHG, followed by No. 69 (19.00 mm²) and No. 59 (18.87 mm²). The narrowest (12.75 mm²) was noted in No. 86, which was the same as in cases of the area and the volume of UHG, followed by No. 87 (12.98 mm²) and No. 94 (13.60 mm²). Average and its s.d. through the whole strains were found to be 16.38 ± 1.68 .

The largest of s.d. (1.30) was obtained in No. 93, which was the same as in cases of the area and volume of UHG, followed by No. 58 (1.22) and Nos. 85 and 92 (1.19). The smallest of s.d. (0.42) was noted in No. 70, which was the same as in case of the area of UHG, followed by No. 66 (0.52) and No. 75 (0.55). S.d. of each strain were found to be 0.83 ± 0.20 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 15.27 ± 2.23 . S.d. of each strain were found to be 0.75 ± 0.19 .

10. Volumes in HG

Group A: The practical values for the individual grain level ranged from 38.72 mm³ (No. 21) to 10.54 mm³ (No. 29). In the strain level, the largest (35.65 mm³) was obtained in No. 21, which was the same as in cases of the T, area and volume of UHG, followed by No. 13 (32.42 mm³) and No. 48 (31.67 mm³). These orders of strains were found to be the same as in case of the volume of UHG. The smallest (12.71 mm³) was noted in No. 29, which was the same as in cases of L/W, areas of UHG and HG, and volume of UHG. followed by No. 40 (19.06 mm³) and No. 5 (20.62 mm³). These orders of strains were found to be the same as in cases of the volume of UHG and area of HG. Average and its s.d. through the whole strains were found to be 26.67 ± 3.76 .

The largest of s.d. (2.68) was obtained in No. 6, which was the same as in case of the area of UHG, followed by No. 25 (2.33) and No. 8 (2.29). The smallest of s.d. (0.79) was noted in No. 29, which was the same as in cases of the area of HG and volume of UHG, followed by Nos. 16 and 34 (1.07). It was noted that the value was particularly small in No. 29. S.d. of each strain were found to be 1.69 ± 0.38 .

Group B: The practical values for the individual grain level ranged from 48.21 mm³ (No. 55) to 18.21 mm³ (No. 86). In the strain level, the largest (43.44 mm³) was obtained in No. 55, which was the same as in cases of the volume of UHG and area of HG, followed by No. 69 (40.59 mm³) and No. 99 (40.36 mm³). These combinations of strains were found to be the same as in case of the volume of UHG. The smallest (22.55 mm³) was noted in No. 86, which was the same as in cases of the areas of UHG and HG, and the volume of UHG, followed by No. 87 (24.48 mm³) and No. 77

(24.63 mm^3). Average and its s.d. through the whole strains were found to be 32.75 ± 4.96 .

The largest of s.d. (3.33) was obtained in No. 58, followed by No. 93 (3.25) and No. 79 (3.07). The smallest of s.d. (1.04) was noted in No. 75, followed by No. 87 (1.20) and Nos. 66 and 71 (1.29). S.d. of each strain were found to be 2.12 ± 0.54 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 29.71 ± 5.34 . S.d. of each strain were found to be 1.90 ± 0.51 .

11. Quotients in areas

Group A: The values for the individual grain level ranged from 0.71 (No. 29) to 0.52 (Nos. 11 and 24). In the strain level, the largest (0.65) was obtained in No. 29, which was the same as in cases of W and W/T, followed by Nos. 16, 28, 34 and 38 (0.64). The smallest (0.57) was noted in No. 11, followed by Nos. 19, 20 and 21 (0.58). These combinations of strains were found to be the same as in case of L. Average and its s.d. through the whole strains were found to be 0.61 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

Group B: The values for the individual grain level ranged from 0.69 (No. 56) to 0.45 (No. 80). In the strain level, the largest (0.63) was obtained in Nos. 61 and 71, followed by No. 75 (0.62). The smallest (0.52) was noted in No. 80, which was the same as in cases of W and W/T, followed by No. 74 (0.56). Average and its s.d. through the whole strains were found to be 0.59 ± 0.02 . S.d. of each strain were found to be 0.02 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.60 ± 0.02 . S.d. of each strain were found to be 0.02 ± 0.01 .

12. Quotients in volumes

Group A: The values for the individual grain level ranged from 0.66 (No. 44) to 0.44 (Nos. 19 and 33). In the strain level, the largest (0.59) was obtained in Nos. 16 and 29, followed by Nos. 28, 34, 40 and 47 (0.58). The smallest (0.51) was noted in No. 11, which was the same as in case of the quotient of areas, followed by Nos. 19 and 20 (0.52). These combinations of strains were found to be the same as in cases of L and of quotient of areas. Moreover, these orders of strains were found to be the same as in case of the quotient of areas. Average and its s.d. through the whole strains were found to be 0.56 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

Group B: The values for the individual grain level ranged from 0.66 (No. 56) to 0.41 (No. 80). In the strain level, the largest (0.57) was obtained in No. 61, which was the same as in cases of L and T, followed by Nos. 66, 71, 75 and 76 (0.56). The smallest (0.47) was noted in No. 80, which was the same as in cases of W, W/T and quotient of areas, followed by No. 99 (0.50). Average and its s.d. through the whole strains were found to be 0.53 ± 0.02 . S.d. of each strain were found to be 0.02 ± 0.01 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.55 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

PART II. Ranges among the respective characters

1. Lengths in UHG

Maximum: *Group A:* The results are given in Table 3. In this table, the maximum, the minimum and their range are shown. The longest (10.85 mm) was obtained in Nos. 6 and 8, followed by No. 10 (10.65 mm). The shortest (6.60 mm) was noted in No. 29, followed by No. 22

Table 3. Ranges of the unhusked 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	9.40	8.35	1.05	2.80	2.30	0.50	2.20	2.00	0.20	4.00	3.11	0.89	4.51	3.80	0.71	1.35	1.05	0.30
2	9.70	8.60	1.10	3.10	2.60	0.50	2.30	2.00	0.30	3.56	2.87	0.69	4.48	3.85	0.63	1.55	1.20	0.35
3	10.00	9.20	0.80	2.95	2.65	0.30	2.20	2.00	0.20	3.76	3.17	0.59	4.85	4.34	0.51	1.45	1.23	0.22
4	9.75	8.80	0.95	2.80	2.30	0.50	2.20	1.90	0.30	4.15	3.32	0.83	4.80	4.34	0.46	1.42	1.05	0.37
5	9.05	8.10	0.95	2.60	2.05	0.55	2.00	1.80	0.20	4.07	3.23	0.84	4.81	4.26	0.55	1.33	1.08	0.25
6	10.85	10.20	0.65	2.55	2.00	0.55	2.05	1.60	0.45	5.25	4.12	1.13	6.63	5.02	1.61	1.56	1.07	0.49
7	9.70	8.50	1.20	2.90	2.30	0.60	2.25	1.85	0.40	3.89	3.04	0.85	4.92	4.09	0.83	1.53	1.15	0.38
8	10.85	9.30	1.55	3.00	2.50	0.50	2.20	1.65	0.55	4.24	3.17	1.07	5.76	4.55	1.21	1.82	1.16	0.66
9	9.65	9.00	0.65	2.70	2.30	0.40	2.15	1.90	0.25	4.04	3.41	0.63	4.95	4.29	0.66	1.37	1.10	0.27
10	10.65	9.20	1.45	3.00	2.55	0.45	2.25	1.90	0.35	3.91	3.30	0.61	5.23	4.44	0.79	1.50	1.20	0.30
11	9.40	8.45	0.95	2.85	2.50	0.35	2.20	1.75	0.45	3.72	3.04	0.68	5.31	4.18	1.13	1.53	1.22	0.31
12	10.00	8.50	1.50	2.80	2.40	0.40	2.25	1.90	0.35	3.77	3.21	0.56	4.88	3.93	0.95	1.42	1.11	0.31
13	10.35	8.90	1.45	2.90	2.50	0.40	2.20	1.95	0.25	3.88	3.18	0.70	5.05	4.42	0.63	1.42	1.22	0.20
14	9.80	8.50	1.30	3.00	2.60	0.40	2.20	2.00	0.20	3.64	2.93	0.71	4.75	4.02	0.73	1.46	1.23	0.23
15	9.50	8.15	1.35	2.80	2.30	0.50	2.10	1.70	0.40	3.78	3.02	0.76	4.97	4.10	0.87	1.60	1.10	0.50
16	9.75	8.30	1.45	2.40	2.15	0.25	2.05	1.85	0.20	4.24	3.65	0.59	4.88	4.26	0.62	1.26	1.08	0.18
17	9.50	8.60	0.90	2.50	2.20	0.30	2.10	1.70	0.40	4.13	3.63	0.50	5.12	4.14	0.98	1.32	1.10	0.22
18	9.10	8.20	0.90	3.10	2.80	0.30	2.30	2.00	0.30	3.10	2.74	0.36	4.29	3.78	0.51	1.55	1.27	0.28
19	9.25	8.40	0.85	3.00	2.65	0.35	2.25	2.00	0.25	3.27	2.85	0.42	4.60	4.00	0.60	1.48	1.22	0.26
20	8.30	7.30	1.00	3.10	2.70	0.40	2.10	1.75	0.35	2.96	2.55	0.41	4.57	3.70	0.87	1.71	1.33	0.38
21	9.40	8.30	1.10	3.60	3.00	0.60	2.40	2.15	0.25	3.00	2.46	0.54	4.21	3.63	0.58	1.63	1.25	0.38
22	8.00	7.20	0.80	3.40	2.80	0.60	2.20	1.90	0.30	2.77	2.22	0.55	4.05	3.36	0.69	1.70	1.33	0.37
23	9.15	8.10	1.05	3.10	2.80	0.30	2.15	1.90	0.25	3.21	2.73	0.48	4.68	3.86	0.82	1.55	1.33	0.22
24	9.70	8.60	1.10	2.90	2.65	0.25	2.30	2.05	0.25	3.62	3.04	0.58	4.59	3.93	0.66	1.42	1.17	0.25
25	10.60	9.50	1.10	2.70	2.30	0.40	2.25	1.90	0.35	4.33	3.70	0.63	5.32	4.38	0.94	1.32	1.07	0.25

Table 3. (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	8.50	7.85	0.65	2.80	2.60	0.20	2.20	1.60	0.60	3.12	2.80	0.32	5.13	3.64	1.49	1.75	1.23	0.52
27	8.60	7.90	0.70	3.00	2.55	0.45	2.25	1.95	0.30	3.24	2.70	0.54	4.20	3.71	0.49	1.50	1.19	0.31
28	10.40	9.50	0.90	2.45	2.25	0.20	2.15	1.90	0.25	4.56	4.13	0.43	5.42	4.63	0.79	1.24	1.10	0.14
29	6.60	5.75	0.85	2.05	1.80	0.25	1.85	1.70	0.15	3.50	2.98	0.52	3.82	3.22	0.60	1.18	1.06	0.12
30	8.90	8.00	0.90	2.70	2.30	0.40	2.10	1.80	0.30	3.74	3.09	0.65	4.56	3.91	0.65	1.42	1.14	0.28
31	9.25	8.40	0.85	2.90	2.40	0.50	2.15	1.90	0.25	3.63	2.97	0.66	4.68	4.10	0.58	1.47	1.21	0.26
32	9.00	8.00	1.00	2.90	2.50	0.40	2.15	1.90	0.25	3.60	2.88	0.72	4.53	4.00	0.53	1.53	1.16	0.37
33	9.35	8.40	0.95	2.70	2.20	0.50	2.10	1.90	0.20	4.18	3.22	0.96	4.72	4.20	0.52	1.35	1.05	0.30
34	8.80	7.80	1.00	2.40	2.20	0.20	2.10	1.90	0.20	3.70	3.42	0.28	4.28	3.85	0.43	1.21	1.10	0.11
35	10.55	9.25	1.30	2.80	2.40	0.40	2.10	1.80	0.30	4.35	3.43	0.92	5.53	4.78	0.75	1.56	1.14	0.42
36	10.40	9.25	1.15	2.80	2.40	0.40	2.15	1.95	0.20	4.16	3.38	0.78	5.13	4.39	0.74	1.40	1.14	0.26
37	9.15	8.35	0.80	2.85	2.50	0.35	2.25	1.95	0.30	3.56	3.04	0.52	4.56	3.96	0.60	1.44	1.19	0.25
38	10.20	9.35	0.85	2.75	2.50	0.25	2.25	1.90	0.35	4.06	3.48	0.58	5.03	4.32	0.71	1.39	1.16	0.23
39	9.60	8.30	1.30	2.60	2.30	0.30	2.20	1.90	0.30	4.17	3.31	0.86	4.75	4.14	0.61	1.37	1.12	0.25
40	8.80	8.00	0.80	2.30	2.00	0.30	1.95	1.80	0.15	4.15	3.70	0.45	4.76	4.10	0.66	1.22	1.05	0.17
41	9.50	8.80	0.70	2.80	2.45	0.35	2.20	2.00	0.20	3.67	3.26	0.41	4.60	4.19	0.41	1.37	1.18	0.19
42	10.50	9.20	1.30	2.70	2.40	0.30	2.20	1.90	0.30	4.31	3.41	0.90	5.03	4.38	0.65	1.32	1.14	0.18
43	8.70	8.00	0.70	3.00	2.60	0.40	2.25	2.20	0.05	3.23	2.80	0.43	4.20	3.71	0.49	1.43	1.23	0.20
44	8.75	8.10	0.65	2.90	2.60	0.30	2.30	2.00	0.30	3.23	2.83	0.40	4.22	3.70	0.52	1.42	1.15	0.27
45	9.75	8.60	1.15	2.60	2.15	0.45	2.10	1.90	0.20	4.37	3.40	0.97	4.90	4.21	0.69	1.28	1.08	0.20
46	9.65	8.85	0.80	2.60	2.20	0.40	2.15	2.00	0.15	4.05	3.56	0.49	4.73	4.19	0.54	1.30	1.05	0.25
47	9.50	8.50	1.00	2.55	2.25	0.30	2.15	1.90	0.25	4.09	3.40	0.69	4.74	4.14	0.60	1.28	1.07	0.21
48	9.35	8.20	1.15	3.35	2.75	0.60	2.30	2.00	0.30	3.25	2.63	0.62	4.45	3.73	0.72	1.60	1.26	0.34
49	9.90	8.65	1.25	2.70	2.30	0.40	2.15	1.90	0.25	4.13	3.30	0.83	4.97	4.14	0.83	1.35	1.09	0.26
50	8.10	7.00	1.10	2.85	2.45	0.40	2.15	1.90	0.25	3.37	2.63	0.74	4.10	3.45	0.65	1.50	1.17	0.33

Table 3. (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	9.20	8.00	1.20	3.90	3.30	0.60	2.50	2.20	0.30	2.79	2.14	0.65	2.79	2.14	0.65	1.73	1.36	0.37
52	9.10	8.00	1.10	3.60	3.20	0.40	2.50	2.20	0.30	2.70	2.25	0.45	3.91	3.40	0.51	1.59	1.36	0.23
53	9.60	8.40	1.20	3.50	3.00	0.50	2.40	2.05	0.35	2.95	2.55	0.40	4.35	3.58	0.77	1.63	1.35	0.28
54	9.45	8.10	1.35	3.35	3.00	0.35	2.30	2.15	0.15	2.90	2.53	0.37	4.30	3.68	0.62	1.52	1.35	0.17
55	9.35	8.60	0.75	3.95	3.00	0.95	2.65	2.40	0.25	2.68	2.23	0.45	3.88	3.35	0.53	1.61	1.27	0.34
56	8.05	7.20	0.85	3.60	3.15	0.45	2.50	2.15	0.35	2.32	2.06	0.26	3.56	3.04	0.52	1.63	1.36	0.27
57	9.60	8.30	1.30	3.35	2.90	0.45	2.30	2.10	0.20	3.12	2.61	0.51	4.50	3.67	0.83	1.60	1.30	0.30
58	9.15	8.15	1.00	3.80	3.40	0.40	2.65	2.30	0.35	2.65	2.16	0.49	3.78	3.20	0.58	1.63	1.32	0.31
59	9.70	8.55	1.15	3.70	3.20	0.50	2.50	2.20	0.30	2.78	2.39	0.39	4.18	3.42	0.76	1.66	1.32	0.34
60	9.55	8.45	1.10	3.75	3.15	0.60	2.50	2.15	0.35	2.73	2.40	0.33	4.44	3.45	0.99	1.60	1.29	0.31
61	9.10	8.40	0.70	3.20	2.90	0.30	2.25	2.05	0.20	3.14	2.75	0.39	4.39	3.93	0.46	1.51	1.32	0.19
62	9.10	8.30	0.80	3.25	2.90	0.35	2.30	2.00	0.30	3.03	2.64	0.39	4.44	3.69	0.75	1.52	1.26	0.26
63	8.80	8.10	0.70	3.30	2.95	0.35	2.30	2.10	0.20	2.90	2.56	0.34	4.09	3.61	0.48	1.55	1.28	0.27
64	9.00	8.20	0.80	3.75	3.20	0.55	2.30	2.10	0.20	2.73	2.31	0.42	4.14	3.57	0.57	1.71	1.42	0.29
65	9.30	8.15	1.15	3.30	2.80	0.50	2.35	2.10	0.25	3.27	2.59	0.68	4.23	3.54	0.69	1.52	1.26	0.26
66	8.90	8.00	0.90	2.85	2.50	0.35	2.05	1.90	0.15	3.45	2.91	0.54	4.45	4.00	0.45	1.47	1.27	0.20
67	8.65	7.60	1.05	3.80	3.20	0.60	2.45	2.10	0.35	2.45	2.09	0.35	3.86	3.30	0.56	1.73	1.51	0.22
68	8.95	8.10	0.85	3.30	3.00	0.30	2.35	2.10	0.25	2.95	2.57	0.38	4.12	3.52	0.60	1.51	1.23	0.28
69	9.20	8.45	0.75	4.00	3.50	0.50	2.60	2.15	0.45	2.46	2.17	0.29	4.12	3.49	0.63	1.77	1.46	0.31
70	8.80	7.60	1.20	3.05	2.75	0.30	2.20	1.90	0.30	3.14	2.53	0.61	4.40	3.63	0.77	1.58	1.31	0.27
71	9.45	8.45	1.00	2.90	2.60	0.30	2.15	1.90	0.25	3.41	3.02	0.39	4.62	4.00	0.62	1.47	1.26	0.21
72	9.00	8.00	1.00	3.20	2.70	0.50	2.20	1.90	0.30	3.11	2.65	0.46	4.42	3.83	0.59	1.62	1.26	0.36
73	9.80	8.60	1.20	3.50	3.10	0.40	2.40	2.15	0.25	2.98	2.57	0.41	4.23	3.87	0.36	1.58	1.35	0.23
74	8.30	7.80	0.50	3.85	3.40	0.45	2.50	2.10	0.40	2.34	2.05	0.29	3.73	3.16	0.57	1.76	1.40	0.36
75	9.00	8.10	0.90	3.00	2.70	0.30	2.40	2.00	0.40	3.21	2.75	0.46	4.35	3.22	1.13	1.50	1.17	0.33

Table 3. (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	9.20	8.35	0.85	3.45	2.90	0.55	2.30	2.15	0.15	2.92	2.50	0.42	4.28	3.76	0.52	1.61	1.32	0.29
77	8.65	7.90	0.75	3.00	2.60	0.40	2.05	1.80	0.25	3.19	2.76	0.43	4.55	3.90	0.65	1.58	1.32	0.26
78	8.70	8.05	0.65	3.30	2.90	0.40	2.20	1.90	0.30	3.00	2.55	0.45	4.42	3.86	0.56	1.74	1.36	0.38
79	8.20	7.40	0.80	3.70	3.20	0.50	2.50	2.05	0.45	2.38	2.11	0.27	3.95	3.00	0.95	1.71	1.36	0.35
80	9.00	7.90	1.10	3.70	3.40	0.30	2.40	2.10	0.30	2.62	2.25	0.37	4.09	3.52	0.57	1.69	1.46	0.23
81	8.40	7.50	0.90	3.75	3.30	0.45	2.45	2.15	0.30	2.47	2.05	0.32	3.81	3.23	0.58	1.72	1.42	0.30
82	9.20	8.30	0.90	3.50	3.10	0.40	2.25	2.05	0.20	2.89	2.44	0.45	4.33	3.87	0.46	1.67	1.43	0.24
83	8.85	7.65	1.20	3.60	2.90	0.70	2.30	1.90	0.40	2.87	2.19	0.68	4.26	3.57	0.69	1.71	1.32	0.39
84	8.40	7.50	0.90	3.80	3.15	0.65	2.60	2.15	0.45	2.67	2.00	0.67	3.66	3.04	0.62	1.69	1.27	0.42
85	9.90	8.75	1.15	3.60	3.00	0.60	2.35	2.10	0.25	3.05	2.59	0.46	4.40	3.72	0.68	1.58	1.36	0.22
86	8.20	7.20	1.00	2.90	2.40	0.50	2.10	1.80	0.30	3.15	2.62	0.53	4.39	3.69	0.70	1.56	1.26	0.30
87	7.90	6.90	1.00	3.30	2.90	0.40	2.20	2.00	0.20	2.55	2.22	0.33	3.90	3.30	0.60	1.61	1.35	0.26
88	9.15	7.30	1.85	3.25	2.90	0.35	2.10	1.90	0.20	2.86	2.32	0.54	4.58	3.70	0.88	1.68	1.38	0.30
89	10.30	8.70	1.60	3.05	2.50	0.55	2.25	2.00	0.25	3.81	3.07	0.74	5.00	4.05	0.95	1.45	1.16	0.29
90	9.00	8.10	0.90	3.90	3.50	0.40	2.60	2.15	0.45	2.42	2.13	0.29	4.09	3.24	0.85	1.77	1.45	0.32
91	8.80	7.45	1.35	3.85	3.20	0.65	2.50	2.15	0.35	2.53	2.13	0.40	3.75	3.08	0.67	1.61	1.36	0.25
92	10.30	8.80	1.50	3.60	3.10	0.50	2.45	2.20	0.25	3.16	2.70	0.46	4.49	3.83	0.66	1.60	1.29	0.31
93	9.90	8.40	1.50	3.20	2.60	0.60	2.25	1.90	0.35	3.40	2.86	0.54	4.74	3.91	0.83	1.52	1.20	0.32
94	8.00	6.80	1.20	3.30	2.80	0.50	2.20	2.00	0.20	2.79	2.15	0.64	3.79	3.18	0.61	1.59	1.33	0.26
95	8.70	7.80	0.90	2.85	2.50	0.35	2.15	1.90	0.25	3.44	2.88	0.56	4.37	3.81	0.56	1.45	1.19	0.26
96	8.55	7.75	0.80	3.10	2.60	0.50	2.20	1.90	0.30	3.15	2.63	0.52	4.18	3.71	0.47	1.49	1.24	0.25
97	10.05	8.75	1.40	3.00	2.60	0.40	2.15	1.85	0.30	3.81	3.07	0.74	5.05	4.27	0.78	1.62	1.21	0.41
98	9.60	8.40	1.20	3.80	3.35	0.45	2.50	2.15	0.35	2.67	2.27	0.40	4.16	3.56	0.60	1.69	1.36	0.33
99	9.85	8.20	1.65	3.80	3.35	0.45	2.55	2.20	0.35	2.70	2.32	0.38	4.10	3.52	0.58	1.68	1.40	0.28
100	10.25	9.25	1.00	3.50	3.10	0.40	2.35	2.05	0.30	3.06	2.73	0.33	4.90	3.98	0.92	1.68	1.32	0.36

(8.00 mm) and No. 50 (8.10 mm). It was noted that the value was particularly small in No. 29. Average and its s.d. through the whole strains were found to be 9.46 ± 0.80 .

Group B: The longest (10.30 mm) was obtained in Nos. 89 and 92, followed by No. 100 (10.25 mm). The shortest (7.90 mm) was noted in No. 87, followed by No. 94 (8.00 mm) and No. 56 (8.05 mm). Average and its s.d. through the whole strains were found to be 9.10 ± 0.60 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 9.28 ± 0.73 .

Minimum: Group A: The longest (10.20 mm) was obtained in No. 6, followed by Nos. 25 and 28 (9.50 mm). The shortest (5.75 mm) was noted in No. 29, which was the same as in case of the maximum, followed by No. 50 (7.00 mm) and No. 22 (7.20 mm). It was noted that the value was particularly small in No. 29. These combinations of strains were found to be the same as in case of the maximum. Average and its s.d. through the whole strains were found to be 8.45 ± 0.73 .

Group B: The longest (9.25 mm) was obtained in No. 100, followed by No. 92 (8.80 mm) and Nos. 85 and 97 (8.75 mm). The shortest (6.80 mm) was noted in No. 94, followed by No. 87 (6.90 mm) and Nos. 56 and 86 (7.20 mm). Average and its s.d. through the whole strains were found to be 8.05 ± 0.51 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 8.25 ± 0.65 .

Range: Group A: The largest (1.55 mm) was obtained in No. 8, followed by No. 12 (1.50 mm) and Nos. 10 and 13 (1.45 mm). The smallest (0.65 mm) was noted in Nos. 6, 9, 26 and 44. Average and its s.d. through the whole strains were found to be 1.02 ± 0.25 .

Group B: The longest (1.85 mm) was obtained in No. 88, followed by No. 99 (1.65 mm) and No. 89 (1.60 mm). The smallest (0.50 mm) was noted in No. 74, followed by No. 78 (0.65 mm) and Nos. 61 and 63 (0.70 mm). Average and its s.d. through the whole strains were found to be 1.05 ± 0.28 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 1.04 ± 0.26 .

2. Widths in UHG

Maximum: Group A: The widest (3.60 mm) was obtained in No. 21, followed by No. 22 (3.40 mm) and Nos. 2, 20 and 23 (3.10 mm). The narrowest (2.05 mm) was noted in No. 29, which was the same as in cases of the maximum and of the minimum of L, followed by No. 40 (2.30 mm) and Nos. 16 and 34 (2.40 mm). Average and its s.d. through the whole strains were found to be 2.81 ± 0.27 .

Group B: The widest (4.00 mm) was obtained in No. 69, followed by No. 55 (3.95 mm) and Nos. 51 and 90 (3.90 mm). The narrowest (2.85 mm) was noted in Nos. 65 and 95, followed by Nos. 71 and 86 (2.90 mm). Average and its s.d. through the whole strains were found to be 3.45 ± 0.33 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 3.13 ± 0.44 .

Minimum: Group A: The widest (3.00 mm) was obtained in No. 21, which was the same as in case of the maximum of W, followed by Nos. 18, 22 and 23 (2.80 mm). The narrowest (1.80 mm) was noted in No. 29, which was the same as in cases of the maximum and of the minimum of L, and of the maximum of W, followed by Nos. 6 and 40 (2.00 mm). Average and its s.d. through the whole strains were found to be 2.42 ± 0.24 .

Group B: The widest (3.50 mm) was obtained in Nos. 69 and 90, followed by Nos. 58, 74 and 80 (3.40 mm). The narrowest (2.40 mm) was noted in No. 86, followed by Nos. 66, 89 and 95

(2.50 mm). These combinations of strains were found to be the same as in case of the maximum of W. Average and its s.d. through the whole strains were found to be 2.99 ± 0.29 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 2.70 ± 0.39 .

Range: Group A: The largest (0.60 mm) was obtained in Nos. 7, 21, 22 and 48. The smallest (0.20 mm) was noted in Nos. 26, 28 and 34. Average and its s.d. through the whole strains were found to be 0.39 ± 0.11 .

Group B: The largest (0.95 mm) was obtained in No. 55, followed by No. 83 (0.70 mm) and Nos. 84 and 91 (0.65 mm). It was noted that the value was particularly large in No. 55. The smallest (0.30 mm) was noted in Nos. 61, 68, 70, 71, 75 and 80. Average and its s.d. through the whole strains were found to be 0.46 ± 0.13 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.43 ± 0.12 .

3. Thicknesses in UHG

Maximum: Group A: The thickest (2.40 mm) was obtained in No. 21, which was the same as in cases of the maximum and of the minimum of W, followed by Nos. 2, 18, 24, 44 and 48 (2.30 mm). The thinnest (1.85 mm) was noted in No. 29, which was the same as in cases of the maxima and of the minima of L and W, followed by No. 40 (1.95 mm) and No. 5 (2.00 mm). Average and its s.d. through the whole strains were found to be 2.18 ± 0.10 .

Group B: The thickest (2.65 mm) was obtained in Nos. 55 and 58, followed by Nos. 69, 84 and 90 (2.60 mm). The thinnest (2.05 mm) was noted in Nos. 66 and 77, followed by Nos. 86 and 88 (2.10 mm). Average and its s.d. through the whole strains were found to be 2.35 ± 0.32 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 2.26 ± 0.16 .

Minimum: Group A: The thickest (2.20 mm) was obtained in No. 43, followed by No. 21 (2.15 mm) and No. 24 (2.05 mm). The thinnest (1.60 mm) was noted in Nos. 6 and 26, followed by No. 8 (1.65 mm). Average and its s.d. through the whole strains were found to be 1.89 ± 0.12 .

Group B: The thickest (2.40 mm) was obtained in No. 55, which was the same as in case of the range of W, followed by No. 58 (2.30 mm) and Nos. 51, 52, 59, 92 and 99 (2.20 mm). The thinnest (1.80 mm) was noted in Nos. 77 and 86, followed by No. 97 (1.85 mm). Average and its s.d. through the whole strains were found to be 2.06 ± 0.13 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 1.98 ± 0.15 .

Range: Group A: The largest (0.60 mm) was obtained in No. 26, followed by No. 8 (0.55 mm) and Nos. 6 and 11 (0.45 mm). The smallest (0.05 mm) was noted in No. 43, followed by Nos. 29, 40 and 46 (0.15 mm). Average and its s.d. through the whole strains were found to be 0.28 ± 0.10 .

Group B: The largest (0.45 mm) was obtained in Nos. 69, 79, 84 and 90. The smallest (0.15 mm) was noted in Nos. 54, 66 and 76. Average and its s.d. through the whole strains were found to be 0.29 ± 0.08 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.29 ± 0.09 .

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

Maximum: Group A: The largest (5.25) was obtained in No. 6, which was the same as in case of the minimum of L, followed by No. 28 (4.56) and No. 45 (4.37). It was noted that the value was particularly large in No. 6. The smallest (2.77) was noted in No. 22, followed by No. 20 (2.96) and No. 21 (3.00). Average and its s.d. through the whole strains were found to be 3.79 ± 0.48 .

Group B: The largest (3.81) was obtained in Nos. 89 and 97, followed by No. 66 (3.45). The smallest (2.32) was noted in No. 56, followed by No. 74 (2.34) and No. 79 (2.38). Average and its s.d. through the whole strains were found to be 2.92 ± 0.35 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 3.36 ± 0.61 .

Minimum: Group A: The largest (4.13) was obtained in No. 28, followed by No. 6 (4.12) and Nos. 25 and 40 (3.70). It was noted that the values were particularly large in Nos. 28 and 6. The smallest (2.22) was noted in No. 22, which was the same as in case of the maximum of L/W, followed by No. 21 (2.46) and No. 20 (2.55). 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 3.15 ± 0.39 .

Group B: The largest (3.07) was obtained in Nos. 89 and 97, which was the same as in case of the maximum of L/W, followed by No. 71 (3.02). The smallest (2.00) was noted in No. 84, followed by Nos. 74 and 81 (2.05). Average and its s.d. through the whole strains were found to be 2.46 ± 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 .

Range: Group A: The largest (1.13) was obtained in No. 6, which was the same as in cases of the minimum of L and of the maximum of L/W, followed by No. 8 (1.07) and No. 45 (0.97). The smallest (0.28) was noted in No. 34, followed by No. 26 (0.32) and No. 18 (0.36). Average and its s.d. through the whole strains were found to be 0.65 ± 0.20 .

Group B: The largest (0.74) was obtained in Nos. 89 and 97, which were the same as in cases of the maximum and of the minimum of L/W, followed by No. 83 (0.68). The smallest (0.26) was noted in No. 56, which was the same as in case of the maximum of L/W, followed by No. 79 (0.27) and Nos. 69, 74 and 90 (0.29). 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 0.45 ± 0.12 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.55 ± 0.19 .

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

Maximum: Group A: The largest (6.63) was obtained in No. 6, which was the same as in cases of the minimum of L, and of the maximum and of the range of L/W, followed by No. 8 (5.76) and No. 35 (5.53). It was noted that the value was particularly large in No. 6. The smallest (3.82) was noted in No. 29, which was the same as in cases of the maxima and of the minima of L and W, and of the maximum of T, followed by No. 22 (4.05) and No. 50 (4.10). These combinations of strains were found to be the same as in cases of the maximum and of the minimum of L. Moreover, these orders of strains were found to be the same as in case of the maximum of L. Average and its s.d. through the whole strains were found to be 4.77 ± 0.48 .

Group B: The largest (5.05) was obtained in No. 97, followed by No. 89 (5.00) and No. 100 (4.90). The smallest (2.79) was noted in No. 51, followed by No. 56 (3.56) and No. 84 (3.66). It was noted that the value was particularly small in No. 51. Average and its s.d. through the whole strains were

found to be 4.21 ± 0.39 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 4.49 ± 0.52 .

Minimum: Group A: The largest (5.02) was obtained in No. 6, which was the same as in cases of the minimum of L, of the maxima of L/W and L/T, and of the range of L/W, followed by No. 35 (4.78) and No. 28 (4.63). The smallest (3.22) was noted in No. 29, which was the same as in cases of the maxima and of minima of L and W, and of the maxima of T and L/T, followed by No. 22 (3.36) and No. 50 (3.45). These combinations of strains were found to be the same as in cases of the maximum and of the minimum of L, and the maximum of L/T. Moreover, these orders of strains were found to be the same as in case of the maxima of L and L/T. Average and its s.d. through the whole strains were found to be 4.07 ± 0.35 .

Group B: The largest (4.27) was obtained in No. 97, which was the same as in case of the maximum of L/T, followed by No. 89 (4.05) and Nos. 66 and 71 (4.00). The smallest (2.14) was noted in No. 51, which was the same as in case of the maximum of L/T, followed by No. 79 (3.00) and Nos. 56 and 84 (3.04). It was noted that the value was particularly small in No. 51. Average and its s.d. through the whole strains were found to be 3.55 ± 0.36 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 3.81 ± 0.44 .

Range: Group A: The largest (1.61) was obtained in No. 6, which was the same as in cases of the maxima of L/W and L/T, of the minima of L and L/T, and of the range of L/T, followed by No. 26 (1.49) and No. 8 (1.21). The smallest (0.41) was noted in No. 41, followed by No. 34 (0.43) and No. 4 (0.46). Average and its s.d. through the whole strains were found to be 0.72 ± 0.24 .

Group B: The largest (1.13) was obtained in No. 75, followed by No. 60 (0.99) and Nos. 79 and 89 (0.95). The smallest (0.36) was noted in No. 73, followed by No. 66 (0.45) and Nos. 61 and 82 (0.46). 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 0.69 ± 0.21 .

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

Maximum: Group A: The largest (1.82) was obtained in No. 8, which was the same as in case of the range of L, followed by No. 26 (1.75) and No. 20 (1.71). The smallest (1.18) was noted in No. 29, which was the same as in cases of the maxima and of the minima of L, W and L/T, and of the maximum of T, followed by No. 34 (1.21) and No. 40 (1.22). These combinations of strains were found to be the same as in case of the maximum of W. Average and its s.d. through the whole strains were found to be 1.44 ± 0.14 .

Group B: The largest (1.77) was obtained in Nos. 69 and 90, which were the same as in case of the minimum of W, followed by No. 74 (1.76). These orders of strains were found to be the same as in case of the minimum of W. The smallest (1.45) was noted in Nos. 89 and 95, followed by Nos. 66 and 71 (1.47). Average and its s.d. through the whole strains were found to be 1.61 ± 0.09 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 1.53 ± 0.15 .

Minimum: Group A: The largest (1.33) was obtained in Nos. 20, 22 and 23. The smallest (1.05) was noted in Nos. 1, 4, 33, 40 and 46. Average and its s.d. through the whole strains were found to be 1.16 ± 0.08 .

Group B: The largest (1.51) was obtained in No. 67, followed by Nos. 69 and 80 (1.46). The

smallest (1.16) was noted in No. 89, followed by No. 75 (1.17) and No. 95 (1.19). Average and its s.d. through the whole strains were found to be 1.32 ± 0.08 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 1.24 ± 0.11 .

Range: Group A: The largest (0.66) was obtained in No. 8, which was the same as in cases of the range of L and of the maximum of W/T, followed by No. 26 (0.52) and No. 15 (0.50). It was noted that the value was particularly large in No. 8. The smallest (0.11) was noted in No. 34, which was the same as in case of the range of L/W, followed by No. 29 (0.12) and No. 28 (0.14). Average and its s.d. through the whole strains were found to be 0.29 ± 0.11 .

Group B: The largest (0.42) was obtained in No. 84, followed by No. 97 (0.41) and No. 83 (0.39). The smallest (0.17) was noted in No. 54, followed by No. 61 (0.19) and No. 66 (0.20). Average and its s.d. through the whole strains were found to be 0.29 ± 0.06 .

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 0.29 ± 0.08 .

Discussion

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

Comparative values

1. In L/W, the largest (0.97) was obtained in No. 80. This value was attributable both to nearly the largest value (0.71) in L and the smallest value (0.74) in W. On the other hand, the smallest (0.77) was noted in No. 29. This value was attributable both to nearly the smallest value (0.70) in L and the largest value (0.92) in W. In L/T, the largest value (0.81) was obtained in No. 6. This value was attributable both to nearly the largest value (0.72) in L and the smallest value (0.89) in T. On the other hand, the smallest value (0.75) was noted in No. 21. This value was attributable both to nearly the smallest value (0.70) in L and the largest value (0.93) in T. In W/T, nearly the largest value (0.97) was obtained in No. 15. This value was attributable both to nearly the largest value (0.87) in W and the smallest value (0.89) in T. On the other hand, the smallest value (0.89) was noted in No. 21. This value was attributable both to the smallest value (0.83) in W and the largest value (0.93) in T.

In the quotient of areas, the largest value (0.65) was obtained in No. 29. This value was attributable to the particularly small value (12.07 mm^2) in UHG. On the other hand, nearly the smallest value (0.57) was noted in No. 11. This value was attributable to the small value (13.77 mm^2) in HG. In the quotient of volumes, the largest value (0.59) was also obtained in No. 29. This value was attributable to the particularly small value (21.51 mm^3) in UHG. On the other hand, the smallest value (0.51) was also noted in No. 11. This value was attributable to nearly the smallest value (24.09 mm^3) in HG. In general, these analysis in the quotients were fixed to be more difficult than the analysis in case of the comparative columns.

2. 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. 38 showed the largest value (0.74) in L, but showed the middle value (0.87) in W. In other case, No. 99 showed the smallest value (0.68) in L, but showed the middle value (0.83) in W.

Although the values were particularly large in some characters, the values were found to be

very small in the other characters in view of the same strains, and *vice versa*. For example, No. 21 showed the smallest value (0.83) in W, but showed the largest value (0.93) in T. These phenomena were found in the several combinations.

In view of the area and volume characters, it was ascertained that the larger is the value of one character, the larger is the value of another character.

3. In view of s.d., the following facts were ascertained to some extent. As the values of s.d. of comparative columns were ascertained to be very small, the considerations were done only in area and volume columns. In general, the larger is s.d. in some character, the larger is s.d. in another character. For example, No. 6 showed the largest s.d. (1.56) in area (UHG), and showed also the largest s.d. (2.69) in volume (HG), too. Some exceptions, however, were found. No. 26 showed the smallest s.d. (0.65) in area (UHG), but showed relatively large s.d. (1.96) in volume (HG).

In general, the larger is the practical value, the larger is its s.d. For example, No. 69 showed nearly the largest practical value (79.11 mm³) and nearly the largest s.d. (6.23) in volume (UHG). Some exceptions, however, were found. No. 55 showed nearly the largest practical value (32.63 mm²) and nearly the smallest s.d. (1.89) in area (UHG). These discrepancies might be interpreted to have some evolutionary meanings. But it was left inexplicable in the present time. It was noticeable that Nos. 2, 6, 12, 69, 89, 92, 93 and 99, and Nos. 26, 29, 34, 40, 70, 71, 75, 78, 87, 94 and 95 showed always the large s.d. and the small s.d. through the whole area and volume characters, respectively. All of the latter strains were fixed to be belonging to type C according to the tripartite classification.

4. In comparison with type A, type B and type C according to the tripartite classification²⁾, the following items were ascertained. Type A (strain No. 56) showed some general features as follows; the values of L/T, W/T, areas and volumes of UHG and HG, and quotient of areas were found to be larger than average of the whole materials used; values of L, W, L/W and quotient of volumes were found to be the same as in that; the value of T was found to be smaller than that.

In type B (28 strains, *i.e.*, Nos. 21, 51~55, 57~60, 64, 67, 69, 73, 74, 76, 79~82, 84, 85, 90~92, 98~100), the values of L/W, areas and volumes of UHG and HG were found to be larger than average of the whole strains; the value of L/T was found to be the same as in it; the values of L, W, T, W/T, quotients of areas and volumes were found to be smaller than in that. S.d. in the 4 characters were clearly fixed to be larger than the average of the whole strains.

In type C (the remaining 71 strains), the values of W, L/T, W/T and quotient of areas were found to be larger than the average of the whole strains; the values of L, T, L/W and quotient of volumes were found to be the same as in it; the values of areas and volumes of UHG and HG were found to be smaller than in that. S.d. in the 4 characters were clearly smaller than the average of the whole strains.

It was noticeable that the characters of area and volume in type B showed consistently the larger values, and that s.d. of the 4 characters in type B showed also consistently the larger values. These two facts meant that type B (= *javanica*) are looked upon as variable features in India and having shorter history than that of type C (= *indica*). These findings proposed an interesting problem for locality-specificities and strain differentiations.

5. In comparison with Group A and Group B in view of group-averages, the following items were ascertained. In practical values, 6 (W, T, L/T, W/T, quotients of areas and volumes), 5 (L/W, areas and volumes of UHG and HG) and 1 (L) showed the larger, smaller and the same values in Group A than those of Group B, respectively. It was noticeable that s.d. of Group B showed consistently larger values than that of Group A.

6. In the larger sets of W and W/T, the largests (0.92 in W and 1.01 in W/T) were obtained in No. 29, followed by Nos. 16 and 47 (0.89 in W and 0.97 in W/T). These orders of strains were finally illustrated as $29 > 16 = 47$. These orders of strains were fixed to be the same both in W and W/T. These phenomena were found in the other 3 cases, *i.e.*, ② $21 > 13 > 48 \dots$ No. 21 (66.15 mm^3 and 35.65 mm^3), No. 13 (56.71 mm^3 and 32.42 mm^3) and No. 48 (55.96 mm^3 and 31.67 mm^3) in the larger sets of volumes of UHG and HG; ③ $29 < 40 < 5 \dots$ No. 29 (21.51 mm^3 , 7.81 mm^2 and 12.71 mm^3), No. 40 (33.18 mm^3 , 11.11 mm^2 and 19.06 mm^3) and No. 5 (37.40 mm^3 , 11.98 mm^2 and 20.62 mm^3) in the smaller sets of volume of UHG, area of HG and volume of HG; ④ $11 < 19 = 20 \dots$ No. 11 (0.57 and 0.51) and Nos. 19 and 20 (0.58 and 0.52) in the smaller sets of quotients of areas and volumes.

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. Seven cases were ascertained, *i.e.*, ① $11 \cdot 14 \cdot 21$ in the smaller sets... W ($11 = 21 < 14$), W/T ($21 < 11 = 14$); ② $71 \cdot 75 \cdot 78 \cdot 83$ in the larger sets... W ($75 > 71 > 78 = 83$), W/T ($71 = 75 > 78 = 83$); ③ $74 \cdot 79 \cdot 80$ in the smaller sets... W ($80 < 74 < 79$), W/T ($80 < 74 = 79$); ④ $10 \cdot 13 \cdot 21 \cdot$ in the larger sets... area of UHG ($21 > 10 > 13$), area of HG ($13 > 21 > 10$); ⑤ $16 \cdot 28 \cdot 30 \cdot 34 \cdot 38$ in the larger sets... quotient of areas ($30 > 16 = 28 = 34 = 38$), quotient of volumes ($16 = 30 > 28 = 34 = 38$); ⑥ $55 \cdot 69 \cdot 99$ in the larger sets... volume of UHG ($55 > 99 > 69$), volume of HG ($55 > 69 > 99$); ⑦ $61 \cdot 71 \cdot 75$ in the larger sets... quotient of areas ($61 = 71 > 75$), quotient of volumes ($61 = 71 = 75$).

It was noticeable that these synchronized orders and combinations were found to be fewer cases in the comparative columns than that of areas and volumes columns. It meant that gene actions of these characters were independently expressed of each other.

Ranges in UHG

1. Although the values were particularly large or small in some characters, the values were found to be the standard level in the other characters in view of the same strains. For example, No. 6 showed the largest value (10.85 mm) in the maximum of L, but showed the middle value (2.55 mm) in the maximum of W. In other case, No. 87 showed the smallest value (7.90 mm) in the maximum of L, but showed the middle value (3.30 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 the other characters in view of the same strains, and *vice versa*. For example, No. 89 showed the largest value (10.30 mm) in the maximum of L, but showed nearly the smallest value (2.50 mm) in the minimum of W. In another case, No. 22 showed nearly the smallest value (8.00 mm) in the maximum of L, but showed nearly the largest value (3.40 mm) in the maximum of W. These phenomena were found in several combinations. In L/W, L/T and W/T, these facts were not ascertained in the present experiment.

2. In comparison with type A, type B and type C in accordance with the tripartite classification, the following items were ascertained. Type A showed the general features as follows; 8 characters (the maxima and the minima of W, T and W/T, and the ranges of W and T) showed the larger values than that of the average of the whole strains; the remaining 10 characters (the maxima, the minima and the ranges of L, L/W and L/T, and the range of W/T) showed the smaller values than that of the average of the whole strains. It was a remarkable fact that the maximum and the range of L/W, and the maxima and the minima of L and L/T showed the lowest and nearly the lowest values through the whole materials used, respectively. It was explicable as strain-specificities. Moreover, it might be anticipated that the values of L/W and L/T were

attributable to and were under the control of the value of L.

In type B, the values were found to be flexible in accordance with the respective characters. In view of the average values through the whole type B, in comparison with the average values through the whole strains, the tendencies were looked upon as nearly the same as in case of type A, except for the range of L, in which the value was larger than that of the average of the whole strains.

In type C, the tendencies were looked upon as the reversed results of type B, excepting for the range of W/T, in which the value was the same as the average of the whole strains.

3. In comparison with Groups A and B in view of group-averages, the following items were ascertained. Eight characters (the maxima and the minima of L, L/W and L/T, the ranges of L/W and L/T) showed the larger values in Group A than those in Group B. Nine characters (the maxima and the minima of W, T and W/T, the ranges of L, W and T) showed the smaller values in Group A than those of the Group B. One character (the range of W/T) showed the same values in both of the Groups A and B. It was noticeable that the whole characters of L/W and L/T, and W and T, showed the larger and the smaller values in Group A than those of Group B, respectively.

4. In the smaller sets of values, the smallests (6.60 mm in the maximum of L, 3.82 in the maximum of L/T and 3.22 in the minimum of L/T) were noted in No. 29, followed by No. 22 (8.00 mm, 4.05 and 3.36 in the same order) and No. 50 (8.10 mm, 4.10 and 3.45). These orders of strains were finally illustrated in these three characters as $29 < 22 < 50$. These phenomena were found in another 1 case, *i.e.*, ② $69 = 90 < 74 \dots$ Nos. 69 and 90 (3.50 mm and 1.77) and No. 74 (3.40 mm and 1.76) in the smaller sets of the minimum of W and of the maximum of W/T. It was noticeable that these synchronized orders of strains were not found in the pure-ranges.

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 the orders. Ten cases were ascertained, *i.e.*, ① $22 \cdot 29 \cdot 50$ in the smaller sets... the maximum of L ($29 < 22 < 50$), the minimum of L ($29 < 50 < 22$), the maximum of L/T ($29 < 22 < 50$), the minimum of L/T ($29 < 22 < 50$); ② $6 \cdot 25 \cdot 28$ in the larger sets... the minimum of L ($6 > 25 = 28$) and the minimum of L/W ($28 > 6 > 25$); ③ $21 \cdot 22 \cdot 23$ in the larger sets... the maximum of W ($21 > 22 > 23$), the minimum of W ($21 > 22 = 23$); ④ $6 \cdot 8 \cdot 26$ in the larger sets... the range of T ($26 > 8 > 6$), the range of L/T ($6 > 26 > 8$); ⑤ $20 \cdot 21 \cdot 22$ in the smaller sets... the maximum of L/W ($22 < 20 < 21$), the minimum of L/W ($22 < 21 < 20$); ⑥ $29 \cdot 34 \cdot 40$ in the smaller sets... the maximum of W ($29 < 40 < 34$), the maximum of W/T ($29 < 34 < 40$); ⑦ $71 \cdot 89 \cdot 97$ in the larger sets... the minimum of L/W ($89 = 97 > 71$), the minimum of L/T ($97 > 89 > 71$); ⑧ $56 \cdot 74 \cdot 79$ in the smaller sets... the maximum of L/W ($56 < 74 < 79$), the range of L/W ($56 < 79 < 74$); ⑨ $66 \cdot 86 \cdot 95$ in the smaller sets... the maximum of W ($66 = 95 < 86$), the minimum of W ($86 < 66 = 95$); ⑩ $51 \cdot 56 \cdot 84$ in the smaller sets... the maximum of L/T ($51 < 56 < 84$), the minimum of L/T ($51 < 56 = 84$).

Summary

In order to confirm the varietal variations of the cultivated rice delivered from Rice Research Station, Chinsurah, West Bengal, India, comparisons of the unhusked and the husked grains for 12 characters and variation ranges in 6 characters were carried out, following the previous paper. Those were divided into 2 groups; Group A—*aman* varieties, Group B—*aus* varieties. The results obtained here were summarized as follows:

Comparative values of length, width, thickness, L/W, L/T, W/T, area (UHG), volume (UHG), area (HG), volume (HG), quotient of areas and quotient of volumes in Group A were measured as

0.71, 0.86, 0.91, 0.83, 0.79, 0.95, 23.53 mm², 48.12 mm³, 14.37 mm², 26.67 mm³, 0.61 and 0.56 in average values, respectively. Those in Group B were measured in the same order as 0.71, 0.84, 0.90, 0.84, 0.78, 0.93, 27.81 mm², 61.81 mm³, 16.38 mm², 32.75 mm³, 0.59 and 0.53, respectively. Those in the whole strains of both of the groups were measured in the same order as 0.71, 0.85, 0.91, 0.84, 0.78, 0.94, 25.67 mm², 54.97 mm³, 15.27 mm², 29.71 mm³, 0.60 and 0.55, respectively. Six, 5 and 1 characters showed the larger, the smaller and the same values in Group A than those of Group B, respectively.

The maximum, the minimum and the pure-range of length, width, thickness, L/W, L/T and W/T of the unhusked grains in Group A were ascertained as 9.46 mm, 8.45 mm, 1.02 mm; 2.81 mm, 2.42 mm, 0.39 mm; 2.18 mm, 1.89 mm, 0.28 mm; 3.79, 3.15, 0.65; 4.77, 4.07, 0.72; 1.44, 1.16, 0.29 in average values, respectively. Those in Group B in the same order were ascertained as 9.10 mm, 8.05 mm, 1.05 mm; 3.45 mm, 2.99 mm, 0.46 mm; 2.35 mm, 2.06 mm, 0.29 mm; 2.92, 2.46, 0.45; 4.21, 3.55, 0.66; 1.61, 1.32, 0.29 in average values, respectively. Those in the whole strains of both of the groups in the same order were ascertained as 9.28 mm, 8.25 mm, 1.04 mm; 3.13 mm, 2.70 mm, 0.43 mm; 2.26 mm, 1.98 mm, 0.29 mm, 3.36, 2.81, 0.55; 4.49, 3.81, 0.69; 1.53, 1.24, 0.29 in average values, respectively. Eight, 9 and 1 characters showed the larger, the smaller and the same values in Group A than those of Group B, respectively.

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

Basing on the data obtained in these characters, several patterns were found to be varietal and strain specificities. Strains showing relatively large or small values in the respective characters were tentatively picked-up and grouped as "order" or "combination". These new techniques were fixed to be useful ones for testing the strain or geographical differentiations of rice varieties.

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