

Morphological Characters of the Cultivated Rice Grains of Madura, Indonesia (II)

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Received for Publication August 20, 1987

Introduction

During the period from June to July in 1981, the writer was sent to Indonesia for research on agricultural practices under the project, designated as "Ecological Biology and the Promotion on Tropical Primary Industry", supported by a grant from the Ministry of Education, Science and Culture, Japan. Rice cultivation in East Java, Indonesia, was studied from several viewpoints. Observations were also made in Middle Java and Bali Islands for the extensive comparisons, and the results obtained in East Java are briefly reported in the previous papers.

On the grain morphology of rice grains distributed in the islands of Indonesia, some reports have been published¹⁾. However, no distinct record has been reported on the grain morphology of cultivated rice varieties in Madura Island, East Java, Indonesia. In these districts, several cultivated rice, *Oryza sativa* L., are used in lowland and upland fields. Most of them are introduced from Java proper, Bali, India, the Philippines and others. It is said that improved varieties of the *indica* type of rice are being cultivated and that primitive types of *indica* and *javanica* are not used in these areas at the present. However, it is not certain whether the same can be said for Madura.

Accumulations of complete data endorsed by discussions on their aspects have been unfortunately far from being perfect. The present experimental series has been made to search the varietal variations, taking these facts into considerations.

In the previous paper⁴⁾, the records of morphological characters of the unhusked and the husked grains were reported, in order to confirm the morphological characters of grains which were to make the strain's specificities clear. In the present paper, comparisons of the unhusked and the husked grains of 12 characters and variation ranges in 24 characters were mainly described.

Materials and Methods

Twenty-nine strains of rice cultivars, *Oryza sativa* L., collected in East Java during the trip, especially on Madura Island, were used in this experimental series. They are listed in Table 1 of the previous paper⁴⁾. In this table, collection number, collection date, collection place, and detailed informations are mentioned.

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

The variation ranges in 24 characters (Tables 3, 4, 5 and 6) were illustrated by the maximum, the minimum and pure-range value in the whole grains. Moreover, summed-up data on variation ranges mentioned in the present experiment were analysed (Tables 7 and 8).

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

The results are given in Table 1. The values for the individual grain level ranged from 0.77 (strain Nos. 17, 22 and 26) to 0.58 (strain No. 18). In the strain level, the largest (0.74) was obtained in Nos. 11, 13 and 26. The smallest (0.64) was noted in No. 18, followed by No. 1 (0.66) and No. 15 (0.70). Average and its s.d. through the whole strains were found to be 0.72 ± 0.02 . The s.d. of each strain, *i.e.*, the ones showing intra-population's variations, obtained were found to be 0.01 ± 0.01 .

2. Quotients in W

The values for the individual grain level ranged from 0.97 (No. 9) to 0.66 (No. 1). In the strain level, the largest (0.89) was obtained in No. 29, followed by No. 25 (0.88) and No. 17 (0.87). The smallest (0.74) was noted in No. 1, followed by No. 18 (0.76) and No. 28 (0.79). Average and its s.d. through the whole strains were found to be 0.84 ± 0.03 . The s.d. of each strain were found to be 0.03 ± 0.01 .

3. Quotients in T

The values for the individual grain level ranged from 0.95 (Nos. 6 and 7) to 0.70 (No. 1). In the strain level, the largest (0.91) was obtained in Nos. 9 and 11, followed by 12 strains (0.90). The smallest (0.78) was noted in No. 1, which was the same as in case of W, followed by No. 18 (0.83) and No. 24 (0.85). It was noted that the value was particularly small in No. 1. Average and its s.d. through the whole strains were found to be 0.89 ± 0.03 . The s.d. of each strain were found to be 0.02 ± 0.01 .

4. Quotients in L/W

The values for the individual grain level ranged from 1.04 (No. 1) to 0.73 (No. 9). In the strain level, the largest (0.92) was obtained in No. 11, which was the same as in cases of L and T, followed by No. 28 (0.91) and No. 26 (0.90). The smallest (0.81) was noted in No. 29, followed by No. 25 (0.82). Average and its s.d. through the whole strains were found to be 0.86 ± 0.03 . The s.d. of each strain were found to be 0.03 ± 0.01 .

Table 1. Comparative table showing six morphological characters of the unhusked and the 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	0.66±0.04	0.74±0.04	0.78±0.05	0.89±0.08	0.86±0.06	0.98±0.09
2	0.72±0.01	0.84±0.03	0.88±0.02	0.86±0.03	0.82±0.03	0.96±0.04
3	0.72±0.01	0.86±0.02	0.90±0.02	0.85±0.04	0.81±0.02	0.96±0.03
4	0.71±0.01	0.83±0.02	0.89±0.02	0.86±0.02	0.80±0.02	0.94±0.05
5	0.72±0.01	0.84±0.03	0.90±0.02	0.86±0.03	0.80±0.02	0.93±0.04
6	0.72±0.01	0.84±0.03	0.90±0.03	0.86±0.03	0.80±0.02	0.94±0.04
7	0.72±0.01	0.85±0.03	0.90±0.01	0.85±0.04	0.80±0.02	0.94±0.04
8	0.71±0.02	0.85±0.03	0.90±0.01	0.84±0.03	0.79±0.02	0.95±0.03
9	0.71±0.01	0.86±0.04	0.91±0.02	0.84±0.04	0.79±0.02	0.95±0.05
10	0.72±0.01	0.83±0.02	0.90±0.01	0.87±0.03	0.80±0.03	0.93±0.03
11	0.74±0.01	0.80±0.03	0.91±0.01	0.92±0.04	0.82±0.02	0.89±0.04
12	0.72±0.01	0.85±0.03	0.89±0.01	0.85±0.03	0.84±0.03	0.89±0.01
13	0.74±0.01	0.86±0.02	0.90±0.02	0.86±0.02	0.82±0.02	0.95±0.04
14	0.71±0.02	0.84±0.02	0.90±0.02	0.84±0.02	0.79±0.02	0.94±0.03
15	0.70±0.01	0.83±0.01	0.89±0.02	0.84±0.02	0.78±0.02	0.93±0.02
16	0.72±0.01	0.84±0.02	0.90±0.02	0.85±0.02	0.80±0.02	0.94±0.03
17	0.73±0.02	0.87±0.03	0.89±0.01	0.84±0.03	0.82±0.02	0.98±0.03
18	0.64±0.02	0.76±0.03	0.83±0.04	0.84±0.04	0.77±0.05	0.92±0.05
19	0.72±0.01	0.85±0.02	0.89±0.02	0.84±0.03	0.81±0.02	0.96±0.03
20	0.72±0.01	0.84±0.02	0.89±0.01	0.86±0.03	0.81±0.02	0.94±0.02
21	0.72±0.01	0.81±0.02	0.88±0.02	0.89±0.02	0.82±0.02	0.92±0.03
22	0.72±0.02	0.84±0.04	0.90±0.02	0.86±0.04	0.81±0.03	0.95±0.04
23	0.72±0.01	0.83±0.04	0.89±0.02	0.87±0.04	0.81±0.02	0.94±0.05
24	0.72±0.02	0.86±0.02	0.85±0.03	0.84±0.03	0.85±0.04	1.02±0.05
25	0.72±0.01	0.88±0.02	0.89±0.02	0.82±0.02	0.81±0.02	0.99±0.02
26	0.74±0.02	0.83±0.02	0.90±0.01	0.90±0.03	0.83±0.02	0.92±0.03
27	0.72±0.01	0.82±0.01	0.89±0.02	0.89±0.02	0.80±0.03	0.91±0.02
28	0.72±0.02	0.79±0.03	0.89±0.02	0.91±0.04	0.80±0.03	0.89±0.03
29	0.72±0.01	0.89±0.03	0.90±0.01	0.81±0.02	0.80±0.01	0.99±0.03

5. Quotients in L/T

The values for the individual grain level ranged from 0.98 (No. 1) to 0.67 (No. 18). In the strain level, the largest (0.86) was obtained in No. 1, followed by No. 24 (0.85) and No. 12 (0.84). The smallest (0.77) was noted in No. 18, which was the same as in case of the L, followed by No. 15 (0.78) and Nos. 8, 9 and 14 (0.79). Average and its s.d. through the whole strains were found to be 0.81 ± 0.02 . The s.d. of each strain were found to be 0.03 ± 0.01 .

6. Quotients in W/T

The values for the individual grain level ranged from 1.12 (No. 24) to 0.82 (No. 28). In the strain level, the largest (1.02) was obtained in No. 24, followed by Nos. 25 and 29 (0.99). The smallest (0.89) was noted in Nos. 11, 12 and 28. Average and its s.d. through the whole strains were found to be 0.94 ± 0.03 . The s.d. of each strain were found to be 0.04 ± 0.02 .

7. Areas in UHG

The results are given in Table 2. The practical values for the individual grain level ranged from 37.05 mm² (strain No. 21) to 19.50 mm² (strain No. 24). In the strain level, the widest (33.75 mm²) was obtained in No. 21, followed by No. 16 (28.86 mm²) and No. 9 (28.42 mm²). The narrowest (21.77 mm²) was noted in No. 24, followed by No. 1 (22.02 mm²) and No. 25 (23.29 mm²). Average and its s.d. through the whole strains were found to be 26.06 ± 2.51.

The largest s.d. (2.11) was obtained in No. 9, followed by No. 25 (2.04) and Nos. 14 and 21 (1.83). The smallest (0.59) was noted in No. 1, followed by No. 11 (0.75) and No. 7 (0.85). It was noted that the value was particularly small in No. 1. The s.d. of each strain were found to be 1.40 ± 0.38.

Table 2. Six characters of the unhusked and the husked grains; illustrated by the area (=length×width), the volume (=length×width×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	22.02 ± 0.59	36.50 ± 3.64	10.78 ± 0.78	13.93 ± 2.37	0.49 ± 0.04	0.38 ± 0.04
2	25.55 ± 1.57	50.33 ± 3.34	15.47 ± 0.84	26.79 ± 1.50	0.61 ± 0.02	0.53 ± 0.02
3	24.29 ± 1.11	46.43 ± 1.82	15.02 ± 0.60	25.75 ± 0.98	0.62 ± 0.02	0.56 ± 0.02
4	24.24 ± 0.92	48.32 ± 2.52	14.35 ± 0.42	25.55 ± 1.04	0.59 ± 0.02	0.53 ± 0.02
5	26.94 ± 1.25	56.92 ± 2.13	16.09 ± 0.53	30.54 ± 1.75	0.60 ± 0.03	0.54 ± 0.03
6	28.35 ± 1.56	60.26 ± 3.95	17.01 ± 0.96	32.39 ± 1.96	0.60 ± 0.02	0.54 ± 0.03
7	26.47 ± 0.85	54.19 ± 2.28	16.24 ± 0.77	30.03 ± 1.96	0.61 ± 0.03	0.55 ± 0.02
8	27.37 ± 1.75	58.22 ± 3.79	16.49 ± 1.03	31.48 ± 2.00	0.60 ± 0.02	0.54 ± 0.02
9	28.42 ± 2.11	62.89 ± 5.16	17.33 ± 1.32	34.69 ± 2.58	0.61 ± 0.03	0.55 ± 0.03
10	27.03 ± 1.50	56.88 ± 3.34	16.14 ± 0.75	30.45 ± 1.77	0.60 ± 0.02	0.54 ± 0.02
11	25.66 ± 0.75	55.03 ± 1.82	15.19 ± 0.85	29.48 ± 1.81	0.59 ± 0.02	0.54 ± 0.02
12	24.19 ± 1.51	49.01 ± 3.45	14.90 ± 0.84	26.79 ± 1.79	0.62 ± 0.03	0.55 ± 0.02
13	27.10 ± 1.09	61.91 ± 2.79	17.04 ± 0.65	35.13 ± 1.43	0.63 ± 0.02	0.57 ± 0.02
14	28.36 ± 1.83	63.13 ± 5.50	16.89 ± 1.27	33.91 ± 3.71	0.60 ± 0.03	0.54 ± 0.03
15	26.65 ± 1.42	57.44 ± 3.88	15.50 ± 0.82	29.83 ± 1.88	0.58 ± 0.01	0.52 ± 0.01
16	28.86 ± 1.34	63.54 ± 5.23	17.44 ± 0.87	34.48 ± 3.19	0.61 ± 0.02	0.54 ± 0.02
17	25.54 ± 1.80	54.30 ± 4.58	16.19 ± 0.91	30.81 ± 2.20	0.64 ± 0.03	0.57 ± 0.03
18	25.16 ± 0.90	40.74 ± 1.60	12.09 ± 0.50	16.26 ± 1.15	0.48 ± 0.03	0.40 ± 0.03
19	26.23 ± 1.52	54.23 ± 3.67	16.17 ± 1.06	29.72 ± 2.41	0.62 ± 0.02	0.55 ± 0.03
20	23.68 ± 1.48	47.76 ± 4.15	14.38 ± 0.63	25.87 ± 1.60	0.61 ± 0.02	0.54 ± 0.02
21	33.75 ± 1.83	76.27 ± 5.49	19.51 ± 1.01	38.57 ± 2.46	0.58 ± 0.01	0.51 ± 0.02
22	26.19 ± 1.42	54.28 ± 3.35	16.12 ± 0.94	29.89 ± 1.96	0.62 ± 0.02	0.55 ± 0.02
23	27.33 ± 1.40	56.63 ± 3.12	16.41 ± 0.59	30.41 ± 1.51	0.60 ± 0.03	0.54 ± 0.03
24	21.77 ± 1.19	41.93 ± 3.23	13.52 ± 0.78	22.11 ± 1.96	0.62 ± 0.02	0.53 ± 0.02
25	23.29 ± 2.04	48.10 ± 5.19	14.77 ± 1.23	27.29 ± 3.06	0.63 ± 0.02	0.57 ± 0.02
26	28.21 ± 1.75	63.03 ± 4.02	17.34 ± 0.87	34.97 ± 1.76	0.62 ± 0.03	0.56 ± 0.03
27	24.26 ± 1.72	49.44 ± 4.67	14.27 ± 1.10	25.93 ± 2.61	0.59 ± 0.01	0.53 ± 0.02
28	26.69 ± 1.35	56.47 ± 3.65	15.17 ± 0.74	28.65 ± 1.46	0.57 ± 0.03	0.51 ± 0.03
29	23.99 ± 0.93	47.64 ± 2.59	15.27 ± 0.61	27.16 ± 1.65	0.64 ± 0.02	0.57 ± 0.02

8. Volumes in UHG

The practical values for the individual grain level ranged from 84.25 mm³ (No. 21) to 30.25 mm³ (No. 1). In the strain level, the largest (76.27 mm³) was obtained in No. 21, which was the same as in case of the area (UHG), followed by No. 16 (63.54 mm³) and No. 14 (63.13 mm³). It was noted that the value was particularly large in No. 21. The smallest (36.50 mm³) was noted in No. 1, which was the same as in cases of the W and T, followed by No. 18 (40.74 mm³) and No. 24 (41.93 mm³). These orders of strains were found to be the same as in case of the T. Average and its s.d. through the whole strains were found to be 54.20 ± 8.06 .

The largest s.d. (5.50) was obtained in No. 14, followed by No. 2 (5.49) and No. 16 (5.23). The smallest (1.60) was noted in No. 18, followed by Nos. 3 and 11 (1.82). The s.d. of each strain were found to be 3.59 ± 1.10 .

9. Areas in HG

The practical values for the individual grain level ranged from 21.08 mm² (No. 21) to 9.18 mm² (No. 1). In the strain level, the widest (19.51 mm²) was obtained in No. 21, which was the same as in cases of the area and volume (UHG), followed by No. 16 (17.44 mm²) and No. 26 (17.34 mm²). The narrowest (10.79 mm²) was noted in No. 1, which was the same as in cases of the W, T and volume (UHG), followed by No. 18 (12.09 mm²) and No. 24 (13.25 mm²). It was noticed that value was particularly small in No. 1. These orders of strains were found to be the same as in cases of the T and volume (UHG). Average and its s.d. through the whole strains were found to be 15.59 ± 1.70 .

The largest s.d. (1.32) was obtained in No. 9, which was the same as in case of the area (UHG), followed by No. 14 (1.27) and No. 25 (1.23). These combinations of strains were found to be the same as in case of the area (UHG). The smallest (0.42) was noted in No. 4, followed by No. 18 (0.50) and No. 5 (0.53). The s.d. of each strain were found to be 0.84 ± 0.22 .

10. Volumes in HG

The practical values for the individual grain level ranged from 43.40 mm³ (No. 16) to 11.65 mm³ (No. 1). In the strain level, the largest (38.57 mm³) was obtained in No. 21, which was the same as in cases of the areas (UHG and HG) and volume (UHG), followed by No. 13 (35.13 mm³) and No. 26 (34.97 mm³). The smallest (13.93 mm³) was noted in No. 1, which was the same as in cases of the W, T, volume (UHG) and area (HG), followed by No. 18 (16.26 mm³) and No. 24 (22.11 mm³). It was noticed that the value was particularly small in No. 1. These orders of strains were found to be the same as in cases of the T, volume (UHG) and area (HG). Average and its s.d. through the whole strains were found to be 28.93 ± 5.18 .

The largest s.d. (3.71) was obtained in No. 14, which was the same as in case of the volume (UHG), followed by No. 16 (3.19) and No. 25 (3.06). The smallest s.d. (0.98) was noted in No. 3, followed by No. 4 (1.04) and No. 18 (1.15). The s.d. of each strain were found to be 1.98 ± 0.62 .

11. Quotients in areas

The values for the individual grain level ranged from 0.69 (No. 17) to 0.42 (No. 1). In the strain level, the largest (0.64) was obtained in Nos. 17 and 29, followed by Nos. 13 and 25 (0.63). These combinations of strains were found to be the same as in case of the W. The smallest (0.48) was noted in No. 18, which was the same as in cases of the L, L/T and s.d. of volume (UHG), followed by No. 1 (0.49) and No. 28 (0.57). These combinations of strains were found to be the

same as in case of the W. Average and its s.d. through the whole strains were found to be 0.60 ± 0.04 . The s.d. of each strain were found to be 0.02 ± 0.01 .

12. Quotients in volumes

The values for the individual grain level ranged from 0.62 (Nos. 13 and 17) to 0.32 (No. 1). In the strain level, the largest (0.57) was obtained in Nos. 13, 17, 25 and 29. These combinations of strains were found to be the same as in cases of the W and quotient of areas. The smallest (0.38) was noted in No. 1, which was the same as in cases of the W, T, volumes (UHG and HG), area (HG) and s.d. of area (UHG), followed by No. 18 (0.40) and Nos. 21 and 28 (0.51). These orders of strains were found to be the same as in case of the W. Moreover, these combinations 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 0.53 ± 0.04 . The s.d. of each strain were found to be 0.02 ± 0.01 .

PART II. Ranges in the respective characters of UHG and HG items

1. Lengths of UHG

Ranges in the 6 morphological characters of unhusked grains are given in Table 3. In this table, the maximum, the minimum and their range are shown.

Maximum: The longest (10.65 mm) was obtained in Nos. 8 and 10, followed by No. 17 (10.50 mm). The shortest (8.00 mm) was noted in No. 1, followed by No. 24 (8.40 mm) and No. 13 (8.50 mm). Average and its s.d. through the whole strains (=29) were found to be 9.62 ± 0.69 .

Minimum: The longest (9.80 mm) was obtained in No. 18, followed by No. 8 (9.45 mm) and No. 6 (9.40 mm). The shortest (7.45 mm) was noted in No. 1, which was the same as in case of the maximum, followed by No. 24 (7.60 mm) and No. 13 (7.70 mm). These orders of strains ($1 < 24 < 13$) 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 8.52 ± 0.58 .

Range: The largest (1.85 mm) was obtained in No. 25, followed by Nos. 10 and 17 (1.60 mm). The smallest (0.55 mm) was noted in No. 1, which was the same as in cases of the maximum and the minimum of this character, followed by No. 18 (0.60 mm) and No. 23 (0.70 mm). Average and its s.d. through the whole strains were found to be 1.10 ± 0.33 .

2. Widths of UHG

Maximum: The widest (3.80 mm) was obtained in No. 21, followed by Nos. 9 and 13 (3.55 mm). The narrowest (2.60 mm) was noted in No. 18, followed by Nos. 3 and 4 (2.75 mm). Average and its s.d. through the whole strains were found to be 3.10 ± 0.30 .

Minimum: The widest (3.30 mm) was obtained in No. 21, which was the same as in case of the maximum of W, followed by Nos. 13, 14 and 16 (3.10 mm). The narrowest (2.30 mm) was noted in No. 2, followed by Nos. 8, 17, 18, 25 and 27 (2.40 mm). Average and its s.d. through the whole strains were found to be 2.71 ± 0.27 .

Range: The largest (0.55 mm) was obtained in Nos. 9 and 17, followed by Nos. 2, 8, 15, 21 and 26 (0.50 mm). The smallest (0.20 mm) was noted in Nos. 18 and 29, followed by Nos. 1, 4 and 11 (0.25 mm). Average and its s.d. through the whole strains were found to be 0.39 ± 0.10 .

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	8.00	7.45	0.55	3.00	2.75	0.25	1.95	1.40	0.55	2.89	2.48	0.41	5.35	3.82	1.53	2.07	1.54	0.53
2	10.00	9.00	1.00	2.80	2.30	0.50	2.10	1.90	0.20	4.13	3.33	0.80	5.26	4.57	0.69	1.47	1.12	0.35
3	10.20	8.80	1.40	2.75	2.45	0.30	2.00	1.80	0.20	3.94	3.26	0.68	5.67	4.50	1.17	1.53	1.25	0.28
4	9.65	8.90	0.75	2.75	2.50	0.25	2.10	1.90	0.20	3.76	3.33	0.43	4.95	4.31	0.64	1.42	1.10	0.32
5	9.15	8.20	0.95	3.40	3.00	0.40	2.20	1.90	0.30	2.88	2.47	0.41	4.82	3.82	1.00	1.71	1.36	0.35
6	10.45	9.40	1.05	3.05	2.60	0.45	2.25	2.05	0.20	3.87	3.15	0.72	4.90	4.37	0.53	1.46	1.26	0.20
7	10.05	9.10	0.95	2.90	2.60	0.30	2.15	1.90	0.25	3.72	3.19	0.53	5.16	4.30	0.86	1.47	1.26	0.21
8	10.65	9.45	1.20	2.90	2.40	0.50	2.25	2.05	0.20	4.17	3.44	0.73	5.00	4.40	0.60	1.38	1.07	0.31
9	9.40	8.20	1.20	3.55	3.00	0.55	2.30	2.15	0.15	2.94	2.42	0.52	4.14	3.71	0.43	1.60	1.33	0.27
10	10.65	9.05	1.60	3.00	2.60	0.40	2.20	2.00	0.20	3.96	3.30	0.66	5.07	4.27	0.80	1.50	1.20	0.30
11	8.80	8.00	0.80	3.25	3.00	0.25	2.20	2.05	0.15	2.93	2.48	0.45	4.09	3.68	0.41	1.52	1.36	0.16
12	9.55	8.65	0.90	2.85	2.50	0.35	2.10	1.95	0.15	3.61	3.18	0.43	4.88	4.15	0.73	1.39	1.24	0.15
13	8.50	7.70	0.80	3.55	3.10	0.45	2.35	2.10	0.25	2.74	2.23	0.51	3.70	3.35	0.35	1.67	1.35	0.32
14	9.55	8.00	1.55	3.50	3.10	0.40	2.40	2.00	0.40	2.85	2.41	0.44	4.27	3.46	0.81	1.71	1.33	0.38
15	8.85	7.95	0.90	3.50	3.00	0.50	2.35	2.00	0.35	2.85	2.40	0.45	4.12	3.45	0.67	1.63	1.32	0.31
16	9.20	8.40	0.80	3.50	3.10	0.40	2.45	2.05	0.40	2.85	2.53	0.32	4.37	3.57	0.80	1.66	1.32	0.34
17	10.50	8.90	1.60	2.95	2.40	0.55	2.25	2.00	0.25	4.06	3.36	0.70	5.00	4.24	0.76	1.38	1.14	0.24
18	10.40	9.80	0.60	2.60	2.40	0.20	1.75	1.55	0.20	4.33	3.89	0.44	6.45	5.77	0.68	1.63	1.41	0.22
19	9.65	8.20	1.45	3.15	2.75	0.40	2.20	1.95	0.25	3.45	2.73	0.72	4.70	3.82	0.88	1.59	1.27	0.32
20	8.85	7.85	1.00	3.10	2.65	0.45	2.15	1.90	0.25	3.05	2.63	0.42	4.34	3.79	0.55	1.53	1.32	0.21
21	10.15	8.80	1.35	3.80	3.30	0.50	2.40	2.00	0.40	2.82	2.33	0.49	4.51	3.79	0.72	1.85	1.42	0.43
22	9.85	8.45	1.40	3.00	2.70	0.30	2.20	2.00	0.20	3.54	2.82	0.72	4.80	4.02	0.78	1.50	1.27	0.23
23	9.85	9.15	0.70	3.10	2.70	0.40	2.20	2.00	0.20	3.61	3.08	0.53	4.88	4.27	0.61	1.51	1.25	0.26
24	8.40	7.60	0.80	2.90	2.50	0.40	2.10	1.80	0.30	3.17	2.81	0.36	4.58	3.86	0.72	1.54	1.29	0.25
25	10.20	8.35	1.85	2.80	2.40	0.40	2.20	1.95	0.25	4.00	3.21	0.79	5.23	4.18	1.05	1.37	1.11	0.26
26	10.10	8.80	1.30	3.20	2.70	0.50	2.30	2.10	0.20	3.63	2.94	0.69	4.51	3.87	0.64	1.45	1.22	0.23
27	9.85	8.40	1.45	2.80	2.40	0.40	2.10	1.85	0.25	3.81	3.07	0.74	4.92	4.10	0.82	1.35	1.17	0.18
28	9.20	8.20	1.00	3.20	2.90	0.30	2.25	2.00	0.25	3.03	2.63	0.40	4.55	3.82	0.73	1.54	1.32	0.22
29	9.30	8.20	1.10	2.90	2.70	0.20	2.10	1.90	0.20	3.32	2.91	0.41	4.51	4.15	0.36	1.53	1.33	0.20

3. Thicknesses of UHG

Maximum: The thickest (2.45 mm) was obtained in No. 16, followed by Nos. 14 and 21 (2.40 mm). The thinnest (1.75 mm) was noted in No. 18, which was the same as in cases of the maximum and the range of W, followed by No. 1 (1.95 mm) and No. 3 (2.00 mm). Average and its s.d. through the whole strains were found to be 2.19 ± 0.14 .

Minimum: The thickest (2.15 mm) was obtained in No. 9, which was the same as in case of the range of W, followed by Nos. 13 and 26 (2.10 mm). The thinnest (1.40 mm) was noted in No. 1, which was the same as in cases of the maximum, the minimum and range of L, followed by No. 18 (1.55 mm) and Nos. 3 and 24 (1.80 mm). These combinations of strains (1·3·18) were found to be the same as in case of the maximum of T. Average and its s.d. through the whole strains were found to be 1.94 ± 0.15 .

Range: The largest (0.55 mm) was obtained in No. 1, which was the reversed result of the minimum of T, followed by Nos. 14, 16 and 21 (0.40 mm). The smallest (0.15 mm) was noted in Nos. 9, 11 and 12. Average and its s.d. through the whole strains were found to be 0.25 ± 0.09 .

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

Maximum: The largest (4.33) was obtained in No. 18, which was the same as in case of the minimum of L, followed by No. 8 (4.17) and No. 2 (4.13). The smallest (2.74) was noted in No. 13, followed by No. 21 (2.82) and Nos. 14, 15 and 16 (2.85). Average and its s.d. through the whole strains were found to be 3.45 ± 0.49 .

Minimum: The largest (3.89) was obtained in No. 18, which was the same as in cases of the minimum of L and the maximum of L/W, followed by No. 8 (3.44) and No. 17 (3.36). The smallest (2.23) was noted in No. 13, which was the same as in case of the maximum of L/W, followed by No. 21 (2.33) and No. 15 (2.40). Average and its s.d. through the whole strains were found to be 2.90 ± 0.41 .

Range: The largest (0.80) was obtained in No. 2, followed by No. 25 (0.79) and No. 27 (0.74). The smallest (0.32) was noted in No. 16, followed by No. 24 (0.36) and No. 28 (0.40). Average and its s.d. through the whole strains were found to be 0.55 ± 0.15 .

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

Maximum: The largest (6.45) was obtained in No. 18, which was the same as in cases of the minimum of L, the maximum and the minimum of L/W, followed by No.3 (5.67) and No. 1 (5.35). The smallest (3.70) was noted in No. 13, which was the same as in cases of the maximum and the minimum of L/W, followed by No. 11 (4.09) and No. 15 (4.12). Average and its s.d. through the whole strains were found to be 4.78 ± 0.53 .

Minimum: The largest (5.77) was obtained in No. 18, which was the same as in cases of the maxima of L/W and L/T, and the minima of L and L/W, followed by No. 2 (4.57) and No. 3 (4.50). The smallest (3.35) was noted in No. 13, which was the same as in cases of the maxima of L/W and L/T, and the minimum of L/W, followed by No. 15 (3.45) and No. 14 (3.46). Average and its s.d. through the whole strains were found to be 4.05 ± 0.46 .

Range: The largest (1.53) was obtained in No. 1, which was the same as in case of the range of T, followed by No. 3 (1.17) and No. 25 (1.05). The smallest (0.35) was noted in No. 13, which was the same as in cases of the maxima and the minima of L/W and L/T, followed by No. 29 (0.36) and No. 11 (0.41). Average and its s.d. through the whole strains were found to be 0.74 ± 0.24 .

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

Maximum: The largest (2.07) was obtained in No. 1, which was the same as in cases of the ranges of T and L/T, followed by No. 21 (1.85) and No. 16 (1.66). These combinations of strains (1·16·21) were found to be the same as in case of the range of T. The smallest (1.35) was noted in No. 27, followed by No. 25 (1.37) and Nos. 8 and 17 (1.38). Average and its s.d. through the whole strains were found to be 1.55 ± 0.15 .

Minimum: The largest (1.54) was obtained in No. 1, which was the same as in cases of the maximum of W/T, and the ranges of T and L/T, followed by No. 21 (1.42) and No. 18 (1.41). The smallest (1.07) was noted in No. 8, followed by No. 4 (1.10) and No. 25 (1.11). Average and its s.d. through the whole strains were found to be 1.27 ± 0.10 .

Range: The largest (0.53) was obtained in No. 1, which was the same as in cases of the ranges of T and L/T, the maximum and the minimum of W/T, followed by No. 21 (0.43) and No. 14 (0.38). These combinations of strains (1·14·21) were found to be the same as in case of the range of T. The smallest (0.15) was noted in No. 12, which was the same as in case of the range of T, followed by No. 11 (0.16) and No. 27 (0.18). Average and its s.d. through the whole strains were found to be 0.28 ± 0.08 .

7. Lengths of HG

Ranges in the 6 morphological characters of the husked grains are given in Table 4. In this table, the maximum, the minimum and their range are shown.

Maximum: The longest (7.75 mm) was obtained in No. 10, which was the same as in case of the maximum of L (UHG), followed by No. 8 (7.55 mm) and No. 6 (7.50 mm). The shortest (5.40 mm) was noted in No. 1, which was the same as in cases of the maximum, the minimum and the range of L (UHG), and the minimum of T (UHG), followed by No. 24 (6.10 mm) and Nos. 13 and 15 (6.20 mm). It was noticeable that the value was particularly small in No. 1. These orders of strains ($1 < 24 < 13$) were found to be the same as in cases of the maximum and the minimum of L (UHG). Average and its s.d. through the whole strains ($=29$) were found to be 6.86 ± 0.53 .

Minimum: The longest (6.75 mm) was obtained in No. 17, which was the same as in case of the range of W (UHG), followed by Nos. 6 and 26 (6.70 mm). The shortest (4.50 mm) was noted in No. 1, which was the same as in cases of the maximum, the minimum and the range of L (UHG), the minimum of T (UHG) and the maximum of L (HG), followed by No. 24 (5.40 mm) and Nos. 14, 15 and 20 (5.50 mm). It was noticeable that the value was particularly small in No. 1. These orders of strains ($1 < 24 < 15$) were found to be the same as in case of the maximum of L (HG). Average and its s.d. through the whole strains were found to be 6.06 ± 0.50 .

Range: The largest (1.45 mm) was obtained in No. 25, which was the same as in case of the range of L (UHG), followed by No. 14 (1.30 mm) and No. 10 (1.15 mm). The smallest (0.40 mm) was noted in Nos. 5 and 11, followed by Nos. 4 and 23 (0.45 mm). Average and its s.d. through the whole strains were found to be 0.80 ± 0.26 .

8. Widths of HG

Maximum: The widest (3.10 mm) was obtained in No. 21, which was the same as in cases of the maximum and the minimum of W (UHG), followed by Nos. 9, 13 and 14 (3.00 mm). These orders of strains ($21 > 9 = 13$) were found to be the same as in case of the maximum of W (UHG). The narrowest (1.90 mm) was noted in No. 18, which was the same as in cases of the maxima of W and T, and the range of W (UHG), followed by No. 1 (2.25 mm) and Nos. 3, 4 and 27 (2.30

Table 4. Ranges of the husked grains in the strain level; length (mm), width (mm), thickness (mm), width (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	5.40	4.50	0.90	2.25	1.80	0.45	1.50	1.10	0.40	2.83	2.00	0.83	4.55	3.38	1.17	2.00	1.31	0.69
2	7.20	6.55	0.65	2.40	2.00	0.40	1.85	1.60	0.25	3.40	2.81	0.59	4.50	3.68	0.82	1.44	1.08	0.36
3	7.10	6.35	0.75	2.30	2.10	0.20	1.80	1.60	0.20	3.33	2.87	0.46	4.24	3.61	0.63	1.44	1.22	0.22
4	6.80	6.35	0.45	2.30	2.10	0.20	1.85	1.70	0.15	3.24	2.78	0.46	3.91	3.43	0.48	1.29	1.16	0.13
5	6.30	5.90	0.40	2.75	2.50	0.25	2.00	1.70	0.30	2.50	2.18	0.32	3.68	3.05	0.63	1.59	1.28	0.31
6	7.50	6.70	0.80	2.60	2.20	0.40	2.05	1.85	0.20	3.32	2.74	0.58	3.95	3.40	0.55	1.37	1.10	0.27
7	7.25	6.50	0.75	2.45	2.20	0.25	1.90	1.70	0.20	3.16	2.73	0.43	4.03	3.53	0.50	1.36	1.18	0.18
8	7.55	6.50	1.05	2.50	2.00	0.50	2.00	1.80	0.20	3.50	2.78	0.72	4.08	3.49	0.59	1.33	1.00	0.33
9	6.90	5.80	1.10	3.00	2.50	0.50	2.05	1.90	0.15	2.60	2.08	0.52	3.45	2.90	0.55	1.53	1.22	0.31
10	7.75	6.60	1.15	2.50	2.15	0.35	2.00	1.75	0.25	3.44	2.68	0.76	4.11	3.35	0.76	1.39	1.15	0.24
11	6.35	5.95	0.40	2.75	2.35	0.40	2.00	1.85	0.15	2.64	2.22	0.42	3.30	3.00	0.30	1.41	1.18	0.23
12	7.00	6.30	0.70	2.50	2.20	0.30	1.90	1.70	0.20	3.09	2.59	0.50	3.83	3.46	0.37	1.39	1.16	0.23
13	6.20	5.65	0.55	3.00	2.65	0.35	2.15	1.90	0.25	2.30	1.88	0.42	3.02	2.63	0.39	1.58	1.26	0.32
14	6.80	5.50	1.30	3.00	2.60	0.40	2.20	1.80	0.40	2.52	2.02	0.50	3.49	2.64	0.85	1.66	1.23	0.43
15	6.20	5.50	0.70	2.90	2.50	0.40	2.05	1.80	0.25	2.43	2.02	0.41	3.26	2.83	0.43	1.57	1.28	0.29
16	6.65	6.10	0.55	2.90	2.60	0.30	2.25	1.80	0.45	2.48	2.16	0.32	3.53	2.90	0.63	1.56	1.26	0.30
17	7.45	6.75	0.70	2.65	2.10	0.55	2.00	1.80	0.20	3.44	2.64	0.80	4.03	3.50	0.53	1.33	1.10	0.23
18	6.55	5.75	0.80	1.90	1.85	0.05	1.50	1.20	0.30	3.51	3.11	0.40	5.42	4.26	1.16	1.58	1.27	0.31
19	7.00	5.90	1.10	2.70	2.20	0.50	2.00	1.70	0.30	3.04	2.22	0.82	3.78	3.00	0.78	1.59	1.15	0.44
20	6.30	5.50	0.80	2.60	2.30	0.30	1.90	1.70	0.20	2.58	2.24	0.34	3.47	3.14	0.33	1.47	1.27	0.20
21	7.10	6.30	0.80	3.10	2.70	0.40	2.15	1.80	0.35	2.56	2.05	0.51	3.64	3.14	0.50	1.67	1.26	0.41
22	7.10	6.15	0.95	2.65	2.30	0.35	2.00	1.80	0.20	3.09	2.32	0.77	3.92	3.26	0.66	1.47	1.20	0.27
23	7.10	6.65	0.45	2.50	2.30	0.20	2.00	1.80	0.20	2.96	2.70	0.26	3.94	3.40	0.54	1.39	1.15	0.24
24	6.10	5.40	0.70	2.50	2.10	0.40	1.70	1.45	0.25	2.65	2.30	0.35	3.93	3.18	0.75	1.60	1.31	0.29
25	7.45	6.00	1.45	2.40	2.10	0.30	2.00	1.65	0.35	3.34	2.67	0.67	4.45	3.33	1.12	1.37	1.08	0.29
26	7.40	6.70	0.70	2.65	2.30	0.35	2.10	1.90	0.20	3.13	2.55	0.58	3.70	3.24	0.46	1.33	1.10	0.23
27	7.20	6.10	1.10	2.30	2.00	0.30	1.90	1.65	0.25	3.35	2.82	0.53	3.97	3.39	0.58	1.24	1.08	0.16
28	6.50	5.80	0.70	2.60	2.30	0.30	2.00	1.80	0.20	2.83	2.38	0.45	3.61	2.57	1.04	1.39	1.15	0.24
29	6.70	6.00	0.70	2.55	2.30	0.25	1.90	1.70	0.20	2.63	2.39	0.24	3.69	3.39	0.30	1.47	1.33	0.14

mm). These orders of strains ($18 < 1 < 3$) were found to be the same as in case of the maximum of T (UHG). Moreover, these combinations of strains ($1 \cdot 3 \cdot 18$) were found to be the same in case of the minimum of T (UHG). Average and its s.d. through the whole strains were found to be 2.59 ± 0.26 .

Minimum: The widest (2.70 mm) was obtained in No. 21, which was the same as in cases of the maxima of W (UHG and HG) and the minimum of W (UHG), followed by No. 13 (2.65 mm) and Nos. 14 and 16 (2.60 mm). These combinations of strains ($13 \cdot 14 \cdot 16 \cdot 21$) were found to be the same as in case of the minimum of W (UHG). The narrowest (1.80 mm) was noted in No. 1, which was the same as in cases of the maxima of L (UHG and HG), the minima of L (UHG and HG) and T (UHG), and the range of L (UHG), followed by No. 18 (1.85 mm) and Nos. 2, 8 and 27 (2.00 mm). Average and its s.d. through the whole strains were found to be 2.25 ± 0.23 .

Range: The largest (0.55 mm) was obtained in No. 17, which was the same as in cases of the minimum of L (UHG) and the range of W (UHG), followed by Nos. 8, 9 and 19 (0.50 mm). These combinations of strains ($8 \cdot 9 \cdot 17$) was found to be the same as in case of the range of W (UHG). The smallest (0.05 mm) was noted in No. 18, which was the same as in cases of the maxima of W (UHG and HG) and T (UHG), and the range of W (UHG), followed by Nos. 3, 4 and 23 (0.20 mm). It was noticed that the value was particularly small in No. 18. These orders of strains ($18 < 3 = 4$) 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 0.34 ± 0.11 .

9. Thicknesses of HG

Maximum: The thickest (2.25 mm) was obtained in No. 16, which was the same as in case of the maximum of T (UHG), followed by No. 14 (2.20 mm) and Nos. 13 and 21 (2.15 mm). These orders of strains ($16 > 14 > 21$) were found to be the same as in case of the maximum of T (UHG). Moreover, these combinations of strains ($13 \cdot 14 \cdot 16 \cdot 21$) were found to be the same as in cases of the minima of W (UHG and HG). The thinnest (1.50 mm) was noted in Nos. 1 and 18, followed by No. 24 (1.70 mm). Average and its s.d. through the whole strains were found to be 1.96 ± 0.17 .

Minimum: The thickest (1.90 mm) was obtained in Nos. 9, 13 and 26. These combinations of strains ($9 \cdot 13 \cdot 26$) were found to be the same as in case of the minimum of T (UHG). The thinnest (1.10 mm) was noted in No. 1, which was the same as in cases of the maxima of L (UHG and HG) and T (HG), the minima of L (UHG and HG), W (HG) and T (UHG), and the range of L (UHG), followed by No. 18 (1.20 mm) and No. 24 (1.45 mm). These combinations of strains ($1 \cdot 18 \cdot 24$) were found to be the same as in case of the maximum of T (HG). Average and its s.d. through the whole strains were found to be 1.71 ± 0.18 .

Range: The largest (0.45 mm) was obtained in No. 16, which was the same as in cases of the maxima of T (UHG and HG), followed by Nos. 1 and 14 (0.40 mm). These combinations of strains ($1 \cdot 14 \cdot 16$) were found to be the same as in case of the range of T (UHG). The smallest (0.15 mm) was noted in Nos. 4, 9 and 11. Average and its s.d. through the whole strains were found to be 0.25 ± 0.08 .

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

Maximum: The largest (3.51) was obtained in No. 18, which was the same as in cases of the maxima of L/W (UHG) and L/T (UHG), and the minima of L (UHG), L/W (UHG) and L/T (UHG), followed by No. 8 (3.50) and Nos. 10 and 17 (3.44). The smallest (2.30) was noted in No.

13, which was the same as in cases of the maxima and the minima of L/W and L/T (UHG), and the range of L/T (UHG), followed by No. 15 (2.43) and No. 16 (2.48). Average and its s.d. through the whole strains were found to be 2.96 ± 0.38 .

Minimum: The largest (3.11) was obtained in No. 18, which was the same as in cases of the maxima of L/W (UHG and HG), L/T (UHG), and the minima of L (UHG), L/W (UHG) and L/T (UHG), followed by No. 3 (2.87) and No. 27 (2.82). The smallest (1.88) was noted in No. 13, which was the same as in cases of the maxima of L/W (UHG and HG) and L/T (UHG), the minima of L/W (UHG) and L/T (UHG), and the range of L/T (UHG), followed by No. 1 (2.00) and No. 15 (2.02). Average and its s.d. through the whole strains were found to be 2.45 ± 0.32 .

Range: The largest (0.83) was obtained in No. 1, which was the same as in cases of the maximum and the minimum of W/T (UHG), and the ranges of T, L/T and W/T (UHG), followed by No. 19 (0.82) and No. 17 (0.80). The smallest (0.24) was noted in No. 29, which was the same as in case of the range of W (UHG), followed by No. 23 (0.26) and Nos. 5 and 16 (0.32). Average and its s.d. through the whole strains were found to be 0.52 ± 0.17 .

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

Maximum: The largest (5.42) was obtained in No. 18, which was the same as in cases of the maxima of L/W (UHG and HG) and L/T (UHG), and the minima of L (UHG), L/W (UHG and HG) and L/T (UHG), followed by No. 1 (4.55) and No. 2 (4.50). It was noticeable that the value was particularly large in No. 18. The smallest (3.02) was noted in No. 13, which was the same as in cases of the maxima of L/W (UHG and HG) and L/T (UHG), the minima of L/W (UHG and HG) and L/T (UHG), and the range of L/T (UHG), followed by No. 15 (3.26) and No. 11 (3.30). These combinations of strains (11·13·15) were found to be the same as in case of the maximum of L/T (UHG). Average and its s.d. through the whole strains were found to be 3.88 ± 0.40 .

Minimum: The largest (4.26) was obtained in No. 18, which was the same as in cases of the maxima of L/W (UHG and HG) and L/T (UHG and HG), and the minima of L (UHG) and L/W (UHG and HG), followed by No. 2 (3.68) and No. 3 (3.61). These orders of strains (18>2>3) were found to be the same as in case of the minimum of L/T (UHG). The smallest (2.57) was noted in No. 28, followed by No. 13 (2.63) and No. 14 (2.64). Average and its s.d. through the whole strains were found to be 3.24 ± 0.35 .

Range: The largest (1.17) was obtained in No. 1, which was the same as in cases of the maximum and the minimum of W/T (UHG) and the ranges of T (UHG), L/W (UHG) and L/T (UHG), followed by No. 18 (1.16) and No. 25 (1.12). The smallest (0.30) was noted in Nos. 11 and 29, which was the same as in case of the range of W (UHG), followed by No. 20 (0.33). Average and its s.d. through the whole strains were found to be 0.64 ± 0.24 .

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

Maximum: The largest (2.00) was obtained in No. 1, which was the same as in cases of the maximum and the minimum of W/T (UHG), and the ranges of T (UHG), L/W (HG) and L/T (UHG and HG), followed by No. 21 (1.67) and No. 14 (1.66). These orders of strains (1>21>14) were found to be the same as in case of the range of W/T (UHG). Moreover, these combinations of strains (1·14·21) were found to be the same as in case of the range of T (UHG). The smallest (1.24) was noted in No. 27, which was the same as in case of the maximum of W/T (UHG), followed by No. 4 (1.29) and Nos. 8, 17 and 26 (1.33). Average and its s.d. through the

whole strains were found to be 1.48 ± 0.15 .

Minimum: The largest (1.33) was obtained in No. 29, followed by Nos. 1 and 24 (1.31). The smallest (1.00) was noted in No. 8, which was the same as in case of the minimum of W/T (UHG), followed by Nos. 2, 25 and 27 (1.08). These combinations of strains (2·8·25·27) 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 1.19 ± 0.08 .

Range: The largest (0.69) was obtained in No. 1, which was the same as in cases of the maxima of W/T (UHG and HG), the minimum of W/T (UHG), and the ranges of T (UHG), L/W (HG) and L/T (UHG and HG), followed by No. 19 (0.44) and No. 14 (0.43). The smallest (0.13) was noted in No. 4, which was the same as in case of the range of T (HG), followed by No. 29 (0.14) and No. 27 (0.16). Average and its s.d. through the whole strains were found to be 0.29 ± 0.11 .

PART III. Ranges in the respective characters of comparative, area and volume items

1. Quotients in L

Maximum: The results are given in Table 5. In this table, the maximum, the minimum and their range are shown. The largest (0.77) was obtained in Nos. 17, 22 and 26. The smallest (0.72) was noted in No. 15, followed by 8 strains (0.73). Average and its s.d. through the whole strains were found to be 0.74 ± 0.02 .

Minimum: The largest (0.72) was obtained in No. 11, followed by Nos. 22 and 29 (0.71). The smallest (0.58) was noted in No. 18, followed by No. 1 (0.59) and No. 8 (0.65). It was noticeable that the values were particularly small in Nos. 1 and 18. Average and its s.d. through the whole strains were found to be 0.69 ± 0.03 .

Range: The largest (0.14) was obtained in No. 1, followed by Nos. 8 and 18 (0.08). It was noticeable that the value was particularly large in No. 1. The smallest (0.02) was noted in No. 29, followed by Nos. 4, 6, 13 and 21 (0.03). Average and its s.d. through the whole strains were found to be 0.05 ± 0.02 .

2. Quotients in W

Maximum: The largest (0.97) was obtained in No. 9, followed by No. 17 (0.94) and No. 29 (0.93). The smallest (0.78) was noted in No. 1, followed by No. 18 (0.79) and No. 28 (0.82). Average and its s.d. through the whole strains were found to be 0.88 ± 0.04 .

Minimum: The largest (0.84) was obtained in No. 17, which was the same as in case of the maximum of L, followed by No. 25 (0.83) and Nos. 13, 24 and 29 (0.82). The smallest (0.66) was noted in No. 1, which was the same as in case of the maximum of W, followed by No. 22 (0.70) and No. 18 (0.71). Average and its s.d. through the whole strains were found to be 0.79 ± 0.04 .

Range: The largest (0.19) was obtained in No. 22, which was the same as in case of the maximum of L, followed by No. 9 (0.18) and No. 5 (0.13). The smallest (0.04) was noted in Nos. 15 and 27, followed by No. 21 (0.05). Average and its s.d. through the whole strains were found to be 0.10 ± 0.03 .

3. Quotients in T

Maximum: The largest (0.95) was obtained in Nos. 6 and 7, followed by No. 13 (0.94). The smallest (0.86) was noted in No. 1, which was the same as in cases of the maximum and the

Table 5. Ranges of comparative values in the strain level

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	0.73	0.59	0.14	0.78	0.66	0.12	0.86	0.70	0.16	1.04	0.76	0.28	0.98	0.77	0.11	1.11	0.85	0.26
2	0.74	0.70	0.04	0.88	0.78	0.10	0.93	0.83	0.10	0.90	0.82	0.08	0.86	0.77	0.09	1.02	0.86	0.16
3	0.74	0.68	0.06	0.88	0.81	0.07	0.92	0.87	0.05	1.00	0.79	0.21	0.85	0.74	0.11	1.01	0.90	0.11
4	0.73	0.70	0.03	0.86	0.80	0.06	0.93	0.85	0.08	0.88	0.82	0.06	0.85	0.77	0.08	1.11	0.90	0.21
5	0.73	0.68	0.05	0.89	0.76	0.13	0.93	0.85	0.08	0.94	0.81	0.13	0.85	0.76	0.09	0.99	0.87	0.12
6	0.73	0.70	0.03	0.88	0.79	0.09	0.95	0.86	0.09	0.91	0.82	0.09	0.83	0.76	0.07	1.00	0.87	0.13
7	0.74	0.69	0.05	0.90	0.79	0.11	0.95	0.88	0.07	0.91	0.79	0.12	0.82	0.74	0.08	1.01	0.86	0.15
8	0.73	0.65	0.08	0.89	0.81	0.08	0.91	0.86	0.05	0.88	0.79	0.09	0.82	0.72	0.10	0.99	0.90	0.09
9	0.75	0.70	0.05	0.97	0.79	0.18	0.93	0.87	0.06	0.89	0.73	0.16	0.85	0.76	0.09	1.09	0.85	0.24
10	0.74	0.69	0.05	0.86	0.79	0.07	0.91	0.86	0.05	0.91	0.80	0.11	0.87	0.68	0.19	0.99	0.89	0.10
11	0.76	0.72	0.04	0.86	0.75	0.11	0.91	0.88	0.03	0.98	0.85	0.13	0.85	0.80	0.05	0.97	0.83	0.14
12	0.75	0.69	0.06	0.92	0.80	0.12	0.90	0.85	0.05	0.89	0.81	0.08	0.92	0.78	0.14	0.90	0.85	0.05
13	0.75	0.72	0.03	0.91	0.82	0.09	0.94	0.85	0.09	0.91	0.83	0.08	0.88	0.78	0.10	1.00	0.91	0.09
14	0.74	0.69	0.05	0.91	0.81	0.10	0.93	0.85	0.08	0.89	0.81	0.08	0.83	0.73	0.10	1.00	0.88	0.12
15	0.72	0.69	0.03	0.85	0.81	0.04	0.91	0.85	0.06	0.87	0.81	0.06	0.83	0.76	0.07	0.97	0.90	0.07
16	0.74	0.70	0.04	0.88	0.80	0.08	0.92	0.87	0.05	0.90	0.80	0.10	0.85	0.77	0.08	1.00	0.88	0.12
17	0.77	0.70	0.07	0.94	0.84	0.10	0.91	0.84	0.07	0.88	0.78	0.10	0.85	0.78	0.07	1.06	0.93	0.13
18	0.66	0.58	0.08	0.79	0.71	0.08	0.88	0.75	0.13	0.90	0.78	0.12	0.86	0.67	0.19	1.00	0.84	0.16
19	0.74	0.69	0.05	0.88	0.80	0.08	0.91	0.85	0.06	0.90	0.79	0.11	0.85	0.78	0.07	1.01	0.89	0.12
20	0.73	0.69	0.04	0.89	0.81	0.08	0.90	0.86	0.04	0.90	0.81	0.09	0.84	0.76	0.08	0.98	0.90	0.08
21	0.73	0.70	0.03	0.84	0.79	0.05	0.91	0.85	0.06	0.93	0.84	0.09	0.86	0.78	0.08	0.99	0.88	0.11
22	0.77	0.71	0.06	0.89	0.70	0.19	0.93	0.85	0.08	0.92	0.81	0.11	0.86	0.78	0.08	1.03	0.87	0.16
23	0.74	0.70	0.04	0.89	0.77	0.12	0.93	0.86	0.07	0.93	0.81	0.12	0.85	0.77	0.08	1.04	0.83	0.21
24	0.74	0.69	0.05	0.90	0.82	0.12	0.89	0.79	0.10	0.90	0.79	0.11	0.92	0.80	0.12	1.12	0.92	0.20
25	0.74	0.69	0.05	0.92	0.83	0.09	0.93	0.85	0.08	0.87	0.77	0.10	0.86	0.76	0.10	1.05	0.95	0.10
26	0.77	0.70	0.07	0.88	0.79	0.09	0.91	0.89	0.02	0.96	0.86	0.10	0.85	0.78	0.07	1.00	0.87	0.13
27	0.74	0.69	0.05	0.83	0.79	0.04	0.91	0.86	0.05	0.92	0.84	0.08	0.86	0.76	0.10	0.95	0.90	0.05
28	0.76	0.69	0.07	0.82	0.73	0.09	0.91	0.86	0.05	0.98	0.85	0.13	0.86	0.76	0.10	0.94	0.82	0.12
29	0.73	0.71	0.02	0.93	0.82	0.11	0.90	0.88	0.02	0.86	0.79	0.07	0.84	0.79	0.05	1.04	0.92	0.12

minimum of W, followed by No. 18 (0.88) and No. 24 (0.89). Average and its s.d. through the whole strains were found to be 0.92 ± 0.02 .

Minimum: The largest (0.89) was obtained in No. 26, which was the same as in case of the maximum of L, followed by Nos. 7, 11 and 29 (0.88). The smallest (0.70) was noted in No. 1, which was the same as in cases of the maxima of L and T, and the minimum of W, followed by No. 18 (0.75) and No. 24 (0.79). It was noted that the value was particularly small in No. 1. These orders of strains ($1 < 18 < 24$) were found to be the same as in case of the maximum of T. Average and its s.d. through the whole strains were found to be 0.85 ± 0.04 .

Range: The largest (0.16) was obtained in No. 1, which was the same as in case of the range of L, followed by No. 18 (0.13) and Nos. 2 and 24 (0.10). The smallest (0.02) was noted in Nos. 26 and 29, followed by No. 11 (0.03). Average and its s.d. through the whole strains were found to be 0.07 ± 0.03 .

4. Quotients in L/W

Maximum: The largest (1.04) was obtained in No. 1, which was the same as in cases of the ranges of L and T, followed by No. 3 (1.00) and Nos. 11 and 28 (0.98). The smallest (0.86) was noted in No. 29, which was the same as in cases of the ranges of L and T, followed by Nos. 15 and 25 (0.87). Average and its s.d. through the whole strains were found to be 0.91 ± 0.04 .

Minimum: The largest (0.86) was obtained in No. 26, which was the same as in cases of the maximum of L and the minimum of T, followed by Nos. 11 and 28 (0.85). The smallest (0.73) was noted in No. 9, followed by No. 1 (0.76) and No. 25 (0.77). Average and its s.d. through the whole strains were found to be 0.81 ± 0.03 .

Range: The largest (0.28) was obtained in No. 1, which was the same as in cases of the maximum of L/W, and ranges of L and T, followed by No. 3 (0.21) and No. 9 (0.16). The smallest (0.06) was noted in Nos. 4 and 15, followed by No. 29 (0.07). Average and its s.d. through the whole strains were found to be 0.11 ± 0.04 .

5. Quotients in L/T

Maximum: The largest (0.98) was obtained in No. 1, which was the same as in cases of the maximum of L/W, and the ranges of L, T and L/W, followed by Nos. 12 and 24 (0.92). It was noticeable that the value was particularly large in No. 1. The smallest (0.82) was noted in Nos. 7 and 8, followed by Nos. 6, 14 and 15 (0.83). Average and its s.d. through the whole strains were found to be 0.84 ± 0.03 .

Minimum: The largest (0.80) was obtained in Nos. 11 and 24, which was the same as in case of the minimum of L, followed by No. 29 (0.79). The smallest (0.67) was noted in No. 18, which was the same as in case of the minimum of L, followed by No. 10 (0.68) and No. 8 (0.72). Average and its s.d. through the whole strains were found to be 0.76 ± 0.03 .

Range: The largest (0.19) was obtained in Nos. 10 and 18, followed by No. 12 (0.14). It was noticeable that the values were particularly large in Nos. 10 and 18. The smallest (0.05) was noted in Nos. 11 and 29, which were the same as in cases of the maximum of L/W, and the ranges of L and T, followed by Nos. 6, 15, 17, 19 and 26 (0.07). These combinations of strains were found to be the same as in case of the range of T. Average and its s.d. through the whole strains were found to be 0.10 ± 0.03 .

6. Quotients in W/T

Maximum: The largest (1.12) was obtained in No. 24, which was the same as in case of the minimum of L/T, followed by Nos. 1 and 4 (1.11). The smallest (0.90) was noted in No. 12, followed by No. 28 (0.94) and No. 27 (0.95). Average and its s.d. through the whole strains were found to be 1.01 ± 0.05 .

Minimum: The largest (0.95) was obtained in No. 25, followed by No. 17 (0.93) and Nos. 24 and 29 (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 No. 28, followed by Nos. 11 and 23 (0.83). Average and its s.d. through the whole strains were found to be 0.88 ± 0.03 .

Range: The largest (0.26) was obtained in No. 1, which was the same as in cases of the maxima of L/W and L/T, and the ranges of L, T and L/W, followed by No. 9 (0.24) and Nos. 4 and 23 (0.21). The smallest (0.05) was noted in Nos. 12 and 27, followed by No. 15 (0.07). Average and its s.d. through the whole strains were found to be 0.13 ± 0.05 .

7. Areas in UHG

Maximum: The results are given in Table 6. In this table, the maximum, the minimum and their range are shown. The widest (37.05 mm^2) was obtained in No. 21, followed by No. 9 (32.90 mm^2) and No. 16 (32.03 mm^2). The narrowest (23.25 mm^2) was noted in No. 1, which was the same as in cases of the maxima and the minima of W and T (Table 3), followed by No. 24 (23.64 mm^2) and No. 29 (26.04 mm^2). Average and its s.d. through the whole strains were found to be 28.89 ± 2.83 .

Minimum: The widest (29.70 mm^2) was obtained in No. 21, which was the same as in case of the maximum of area (UHG), followed by No. 6 (26.13 mm^2) and No. 16 (26.04 mm^2). The narrowest (19.50 mm^2) was noted in No. 24, followed by No. 25 (20.04 mm^2) and No. 12 (20.25 mm^2). Average and its s.d. through the whole strains were found to be 23.57 ± 2.07 .

Range: The largest (8.30 mm^2) was obtained in No. 9, which was the same as in case of the maximum of W, followed by No. 26 (7.71 mm^2) and No. 21 (7.35 mm^2). The smallest (1.64 mm^2) was noted in No. 1, which was the same as in cases of the maxima and the minima of W and T, and the maximum of area (UHG), followed by No. 11 (2.66 mm^2) and No. 18 (2.74 mm^2). Average and its s.d. through the whole strains were found to be 5.33 ± 1.54 .

8. Volumes in UHG

Maximum: The largest (84.25 mm^3) was obtained in No. 21, which was the same as in cases of the maximum and the minimum of area (UHG), followed by No. 9 (75.67 mm^3) and No. 16 (75.27 mm^3). It was noticeable that the value was particularly large in No. 21. These orders of strains ($21 > 9 > 16$) were found to be the same as in case of the maximum of area (UHG). The smallest (43.58 mm^3) was noted in No. 1, which was the same as in cases of the maxima and the minima of W and T, and the maximum and the range of area (UHG), followed by No. 18 (43.68 mm^3) and No. 24 (48.80 mm^3). These orders of strains were found to be the same as in cases of the maximum and the minimum of T. Average and its s.d. through the whole strains were found to be 61.38 ± 9.19 .

Minimum: The largest (65.12 mm^3) was obtained in No. 21, which was the same as in cases of the maxima of area (UHG) and volume (UHG), and the minimum of area (UHG), followed by No. 16 (58.63 mm^3) and No. 13 (56.67 mm^3). The smallest (30.25 mm^3) was noted in No. 1, which was the same as in cases of the maxima of W, T, area (UHG) and volume (UHG), the

Table 6. Ranges of area, volume and quotient

Strain No.	Unhusked						Husked						Quotient					
	Area		Volume		Area		Volume		Area		Volume		Area		Volume			
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
1	23.25	21.61	1.64	43.58	30.25	13.33	11.93	9.18	2.75	18.14	11.65	6.49	0.53	0.42	0.11	0.42	0.32	0.10
2	28.00	21.85	6.15	55.44	44.79	10.65	16.80	13.60	3.20	29.61	24.51	5.10	0.65	0.55	0.10	0.59	0.50	0.09
3	28.05	22.50	5.55	50.49	42.75	7.74	16.10	13.65	2.45	27.18	23.21	3.97	0.65	0.57	0.08	0.60	0.52	0.08
4	26.54	22.25	4.29	54.41	43.95	10.46	15.08	13.65	1.43	27.14	23.56	3.58	0.62	0.56	0.06	0.57	0.49	0.08
5	30.03	25.01	5.02	63.06	51.27	11.79	16.88	15.05	1.83	33.40	26.47	6.66	0.64	0.53	0.11	0.58	0.47	0.11
6	31.42	26.13	5.29	66.44	53.57	12.87	19.24	15.41	3.83	36.56	28.51	8.05	0.64	0.57	0.07	0.59	0.49	0.10
7	28.07	24.70	3.37	58.05	49.40	8.65	17.76	14.63	3.13	33.06	25.43	7.63	0.65	0.55	0.10	0.58	0.49	0.09
8	30.45	24.00	6.45	64.11	51.00	13.11	17.88	14.00	3.88	33.97	26.46	7.51	0.64	0.57	0.07	0.58	0.50	0.08
9	32.90	24.60	8.30	75.67	54.12	21.55	20.70	15.00	5.70	41.40	30.75	10.65	0.68	0.56	0.12	0.61	0.51	0.10
10	30.00	24.44	5.56	63.76	51.32	12.44	17.44	14.62	2.82	34.04	27.05	6.99	0.62	0.56	0.06	0.56	0.49	0.07
11	27.46	24.80	2.66	59.04	51.05	7.99	17.05	14.28	2.77	33.25	26.64	5.61	0.65	0.55	0.10	0.58	0.50	0.08
12	26.65	20.25	6.40	54.63	39.49	15.14	17.00	13.69	3.31	30.60	23.27	7.33	0.68	0.57	0.11	0.59	0.50	0.09
13	29.76	24.64	5.12	69.91	56.67	13.24	18.00	15.82	2.18	37.80	32.21	5.59	0.68	0.60	0.08	0.62	0.53	0.09
14	31.99	25.20	6.79	71.98	54.60	17.38	18.88	14.58	4.30	39.84	26.24	13.60	0.65	0.53	0.12	0.59	0.48	0.11
15	30.63	24.45	6.18	65.85	50.88	14.97	17.69	14.41	3.28	32.73	27.22	5.51	0.60	0.56	0.04	0.54	0.49	0.05
16	32.03	26.04	5.99	75.27	58.63	16.64	19.29	15.86	3.43	43.40	30.87	12.53	0.64	0.58	0.06	0.58	0.51	0.07
17	29.50	22.92	6.58	66.38	46.99	19.39	18.55	14.49	4.06	37.10	26.81	10.29	0.69	0.60	0.09	0.62	0.52	0.10
18	26.26	23.52	2.74	43.68	38.36	5.32	12.46	10.64	1.82	18.53	14.36	4.17	0.52	0.43	0.09	0.44	0.35	0.09
19	30.08	23.52	6.56	63.17	47.50	15.67	18.02	13.97	4.05	33.74	25.15	8.59	0.64	0.56	0.08	0.58	0.48	0.10
20	26.25	21.20	5.05	56.44	42.40	14.04	15.75	13.46	2.29	29.93	23.17	6.76	0.65	0.58	0.07	0.59	0.50	0.09
21	37.05	29.70	7.35	84.25	65.12	19.13	21.08	17.55	3.53	41.60	33.86	7.74	0.60	0.56	0.04	0.55	0.48	0.07
22	28.50	23.80	4.70	59.07	48.06	11.01	17.89	14.57	3.32	32.99	25.42	7.57	0.65	0.56	0.09	0.59	0.51	0.08
23	29.76	24.71	5.05	62.85	50.66	12.19	17.40	15.41	1.99	33.38	27.74	5.64	0.65	0.56	0.09	0.58	0.49	0.09
24	23.64	19.50	4.14	48.80	35.10	13.70	14.40	11.76	2.64	25.25	18.34	6.91	0.66	0.59	0.07	0.56	0.49	0.07
25	27.03	20.04	6.99	59.47	40.08	19.39	17.14	12.60	4.54	34.28	22.68	11.60	0.66	0.60	0.06	0.59	0.51	0.08
26	31.47	23.76	7.71	70.81	52.27	18.54	19.21	15.41	3.80	38.42	30.82	7.60	0.67	0.56	0.11	0.60	0.53	0.07
27	26.60	21.84	4.76	55.86	42.09	13.77	15.84	12.81	3.03	29.72	21.32	8.40	0.61	0.57	0.04	0.55	0.49	0.06
28	28.52	24.36	4.16	62.74	51.04	11.70	16.25	14.16	2.08	32.24	25.88	6.36	0.61	0.51	0.10	0.54	0.46	0.08
29	26.04	22.14	3.90	54.68	42.07	12.61	17.09	13.80	3.29	32.47	23.46	9.01	0.68	0.58	0.10	0.61	0.52	0.09

minima of W and T, and the range of area (UHG), followed by No. 24 (35.10 mm³) and No. 18 (38.36 mm³). These combinations of strains were found to be the same as in cases of the maxima of T and volume (UHG), and the minimum of T. Average and its s.d. through the whole strains were found to be 47.78 ± 7.30 .

Range: The largest (21.55 mm³) was obtained in No. 9, which was the same as in cases of the maximum of W and the range of area (UHG), followed by Nos. 17 and 25 (19.39 mm³). The smallest (5.32 mm³) was noted in No. 18, which was the same as in cases of the minima of L and L/T, followed by No. 3 (7.74 mm³) and No. 11 (7.99 mm³). It was noticeable that the value was particularly small in No. 18. Average and its s.d. through the whole strains were found to be 13.60 ± 3.78 .

9. Areas in HG

Maximum: The widest (21.08 mm²) was obtained in No. 21, which was the same as in cases of the maxima and the minima of area (UHG) and volume (UHG), followed by No. 9 (20.70 mm²) and No. 16 (19.29 mm²). These orders of strains were found to be the same as in cases of the maxima of area (UHG) and volume (UHG). The narrowest (11.93 mm²) was noted in No. 1, which was the same as in cases of the maxima of W, T, area (UHG) and volume (UHG), the minima of W, T and volume (UHG), and the range of area (UHG), followed by No. 18 (12.46 mm²) and No. 24 (14.40 mm²). These orders of strains were found to be the same as in cases of the maxima of T and volume (UHG) and the minimum of T (UHG). Moreover, these combinations of strains were found to be the same as in case of the minimum of volume (UHG). Average and its s.d. through the whole strains were found to be 17.20 ± 2.00 .

Minimum: The widest (17.55 mm²) was obtained in No. 21, which was the same as in cases of the maxima of areas (UHG and HG) and volume (UHG), and the minima of area (UHG) and volume (UHG), followed by No. 16 (15.86 mm²) and No. 13 (15.82 mm²). These orders of strains were found to be the same as in case of the minimum of volume (UHG). The narrowest (9.18 mm²) was noted in No. 1, which was the same as in cases of the maxima of W, T, areas (UHG and HG) and volume (UHG), the minima of W, T and volume (UHG), and the range of area (UHG), followed by No. 18 (10.64 mm²) and No. 24 (11.76 mm²). These orders of strains were found to be the same as in cases of the maxima of T, volume (UHG) and area (HG) and the minimum of T. Moreover, these combinations of strains were found to be the same as in case of the minimum of volume (UHG). Average and its s.d. through the whole strains were found to be 14.07 ± 1.59 .

Range: The largest (5.70 mm²) was obtained in No. 9, which was the same as in cases of the maximum of W, and the ranges of area (UHG) and volume (UHG), followed by No. 25 (4.54 mm²) and No. 14 (4.30 mm²). The smallest (1.43 mm²) was noted in No. 4, which was the same as in case of the range of L/W, followed by No. 18 (1.82 mm²) and No. 23 (1.99 mm²). Average and its s.d. through the whole strains were found to be 3.13 ± 0.93 .

10. Volumes in HG

Maximum: The largest (43.40 mm³) was obtained in No. 16, followed by No. 21 (41.60 mm³) and No. 9 (41.40 mm³). These combinations of strains were found to be the same as in cases of the maxima of areas (UHG and HG) and volume (UHG). The smallest (18.14 mm³) was noted in No. 1, which was the same as in cases of the maxima of W, T, areas (UHG and HG) and volume (UHG), the minima of W, T, volume (UHG) and area (HG), and the range of area

(UHG), followed by No. 18 (18.53 mm³) and No. 24 (25.25 mm³). It was noticeable that the values were particularly small in Nos. 1 and 18. These orders of strains were found to be the same as in cases of the maxima of T, volume (UHG) and area (HG), and the minima of T and area (HG). Moreover, these combinations of strains were found to be the same as in case of the minimum of volume (UHG). Average and its s.d. through the whole strains were found to be 32.82 ± 5.82 .

Minimum: The largest (33.86 mm³) was obtained in No. 21, which was the same as in cases of the maxima and the minima of areas (UHG and HG) and volume (UHG), followed by No. 13 (32.21 mm³) and No. 16 (30.87 mm³). These combinations of strains were found to be the same as in cases of the minima of volume (UHG) and area (HG). The smallest (11.65 mm³) was noted in No. 1, which was the same as in cases of the maxima of W, T, areas (UHG and HG) and volumes (UHG and HG), the minima of W, T, volume (UHG) and area (HG), and the range of area (UHG), followed by No. 18 (14.36 mm³) and No. 23 (18.34 mm³). It was noticeable that the value was particularly small in No. 1. These orders of strains were found to be the same as in cases of the maxima of T, area (HG) and volumes (UHG and HG), and the minima of T and area (HG). Moreover, these combinations of strains were found to be the same as in case of the minimum of volume (UHG). Average and its s.d. through the whole strains were found to be 25.29 ± 4.70 .

Range: The largest (13.60 mm³) was obtained in No. 14, followed by No. 16 (12.53 mm³) and No. 25 (11.60 mm³). The smallest (3.58 mm³) was noted in No. 4, which was the same as in cases of the ranges of L/W and area (HG), followed by No. 3 (3.97 mm³) and No. 18 (4.17 mm³). Average and its s.d. through the whole strains were found to be 7.50 ± 2.39 .

11. Quotients in areas

Maximum: The largest (0.69) was obtained in No. 17, which was the same as in cases of the maximum of L and the minimum of W, followed by Nos. 9, 12, 13 and 29 (0.68). These combinations of strains were found to be the same as in case of the maximum of W. The smallest (0.52) was noted in No. 18, which was the same as in cases of the minima of L and L/T, and the range of volume (UHG), followed by No. 1 (0.53) and Nos. 15 and 21 (0.60). Average and its s.d. through the whole strains were found to be 0.64 ± 0.04 .

Minimum: The largest (0.60) was obtained in Nos. 13, 17 and 25. These combinations of strains were found to be the same as in case of the minimum of W. The smallest (0.42) was noted in No. 1, which was the same as in cases of the maxima of W, T, areas (UHG and HG) and volumes (UHG and HG), the minima of W, T, area (HG) and volumes (UHG and HG), and the range of area (UHG), followed by No. 18 (0.43) and No. 28 (0.51). These orders 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 0.56 ± 0.04 .

Range: The largest (0.12) was obtained in Nos. 9 and 14, which was the same as in cases of the maximum of W, and the ranges of areas (UHG and HG) and volume (UHG), followed by Nos. 1, 5, 12 and 26 (0.11). The smallest (0.04) was noted in Nos. 15, 21 and 27. These combinations of strains were found to be the same as in case of the range of W. Average and its s.d. through the whole strains were found to be 0.08 ± 0.02 .

12. Quotients in volumes

Maximum: The largest (0.62) was obtained in Nos. 13 and 17, followed by Nos. 9 and 29

(0.61). These combinations of strains were found to be the same as in case of the maximum of quotient of areas. The smallest (0.42) was noted in No. 1, which was the same as in cases of the maxima of W, T, areas (UHG and HG) and volumes (UHG and HG), the minima of W, T, area (HG), volumes (UHG and HG) and quotient of areas, and the range of area (HG), followed by No. 18 (0.44) and Nos. 15 and 28 (0.54). These combinations of strains were found to be the same as in case of the maximum of quotient of areas. Average and its s.d. through the whole strains were found to be 0.57 ± 0.04 .

Minimum: The largest (0.53) was obtained in Nos. 13 and 26, which was the same as in case of the minimum of quotient of areas and the maximum of quotient of volumes, followed by Nos. 3, 17 and 29 (0.52). The smallest (0.32) was noted in No. 1, which was the same as in cases of the maxima of W, T, areas (UHG and HG), volumes (UHG and HG) and quotient of volumes, the minima of W, T, area (HG), volumes (UHG and HG) and quotient of areas, and the range of area (UHG), followed by No. 18 (0.35) and No. 28 (0.46). These orders of strains were found to be the same as in cases of the maximum of W and the minimum of quotient of areas. Moreover, these combinations of strains were found to be the same as in case of the maximum of quotient of volumes. Average and its s.d. through the whole strains were found to be 0.49 ± 0.05 .

Range: The largest (0.11) was obtained in Nos. 5 and 14, followed by 5 strains (0.10). The smallest (0.05) was noted in No. 15, which was the same as in cases of the maximum of L, and the ranges of W, L/W and quotient of areas, followed by No. 27 (0.06) and 5 strains (0.07). These combinations of strains were found to be the same as in cases of the ranges of W and quotient of areas. Average and its s.d. through the whole strains were found to be 0.09 ± 0.01 .

Discussion

Basing on the results obtained in the previous⁴⁾ and the present experiments, the following problematic items are to be discussed here.

Comparative values

1. In L/W, the largest (0.92) was obtained in No. 11. This value was attributable both to the largest value (0.74) in L and the relatively small value (0.80) in W. On the other hand, the smallest (0.81) was noted in No. 29. This value was attributable both to the relatively small value (0.72) in L and the largest value (0.89) in W. In L/T, nearly the largest (0.84) was obtained in No. 12. This value was attributable both to the relatively large value (0.72) in L and relatively small value (0.89) in T. On the other hand, nearly the smallest (0.78) was noted in No. 15. This value was attributable both to nearly the smallest value (0.70) in L and nearly the largest value (0.89) in T. In W/T, nearly the largest (0.99) was obtained in No. 29. This value was attributable both to the largest (0.89) in W and relatively small value (0.90) in T. On the other hand, the smallest (0.89) was noted in No. 11. This value was attributable both to the relatively small value (0.80) in W and the largest (0.91) in T.

In quotient of areas, nearly the largest (0.61) was obtained in No. 9. This value was attributable to nearly the widest value (28.42 mm^2) in UHG. On the other hand, nearly the smallest (0.49) was noted in No. 1. This value was attributable to nearly the narrowest value (22.02 mm^2) in UHG. In quotient of volumes, nearly the largest (0.54) was obtained in No. 16. This value was attributable to nearly the largest (63.54 mm^3) in UHG. On the other hand, the

smallest (0.38) was noted in No. 1. This value was attributable to the smallest (36.50 mm^3) in UHG. In general, these analyses in the quotients were fixed to be more difficult than those in case of the comparative characters.

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. 11 showed the largest value (0.74) in L, but showed the middle value (0.80) in W. In another case, No. 15 showed nearly the smallest value (0.70) in L, but showed the middle value (0.83) in W.

Although a few values were particularly large in some characters, those were found to be quite small in the other characters in view of the same strains, and *vice versa*. For example, No. 11 showed the largest value (0.74) in L, but showed the smallest value (0.89) in W/T. In another case, No. 1 showed the smallest values in W (0.74) and T (0.73), but showed the largest value (0.86) in L/T. These phenomena were found in a few combinations.

In view of 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 items were ascertained to some extent. As the values of s.d. of the comparative columns were ascertained to be very small, excepting s.d. of L/W in No. 1 (0.08), the considerations were done only in the area and volume columns. In general, the larger is the s.d. in some character, the larger is the s.d. in another character. For example, No. 9 showed the largest s.d. (2.11) in area (UHG), and showed also the largest s.d. (1.32) in area (HG). However, some exceptions were found. For example, No. 21 showed nearly the largest s.d. (1.83) in area (UHG), but showed the middle value of s.d. (1.01) in area (HG).

In general, the larger is the practical value, the larger is its s.d. For example, No. 21 showed the largest value (76.27 mm^3) and nearly the largest s.d. (5.49) in volume (UHG). However, some exceptions were found. For example, No. 25 showed nearly the smallest value (23.29 mm^2) and nearly the largest s.d. (2.04) in area (UHG). These discrepancies may be looked upon as an expression of an evolutionary meaning. But it was left inexplicable in the present time. It was noticeable that Nos. 9, 14, 21 and 25, and Nos. 1, 3, 4, 5, 7, 11, 18 and 24 showed always the large s.d. and the small s.d. through the whole area and volume characters, respectively. All of the former and the latter were fixed to be belonging to type B and type C, respectively, in accordance with the tripartite classification⁵⁾, which was the same as in case of Indian strains²⁾.

4. In comparison of type B and type C made in accordance with the tripartite classification, the following items were ascertained. Type B (4 strains, *i.e.*, Nos. 9, 14, 16 and 21) showed some general features as follows; the values of T, areas (UHG and HG), volumes (UHG and HG) and quotient of volumes were found to be larger than average of the whole strains (=29); values of L, W, L/W, W/T and quotient of areas were found to be the same as in that; and the value of L/W was found to be smaller than in that. It was noted that s.d. in the 4 characters of area and volume columns were clearly fixed to be larger than the average of the whole strains.

In type C (the remaining 25 strains), the values of areas and volumes (UHG and HG) and quotient of areas were found to be smaller than average of the whole strains; the values of the remaining 7 characters were found to be the same as in that. It was noted that s.d. in the 4 characters of area and volume columns were clearly fixed to be smaller than average of the whole strains, formally making a striking contrast to type B. These facts meant that type B (= *javanica*) is to be looked upon as variable features in Madura and having only light breeding weight than those of type C (= *indica*). These findings proposed an interesting problem on the locality-

specificities, strain-differentiations and agronomical importance of the native peoples.

5. In the smaller sets of W and quotient of volumes, the smallest ones (0.74 in W and 0.38 in quotient of volumes) were noted in No. 1, followed by No. 18 (0.76 in W and 0.40 in quotient of volumes), and No. 28 (0.79 in W and 0.51 in quotient of volumes). These orders of strains were finally illustrated as $1 < 18 < 28$. These orders of strains were fixed to be the same both in W and quotient of volumes. These phenomema were found only in the other 1 case; ② $1 < 18 < 24$... No. 1 (0.78, 36.50 mm^3 , 10.78 mm^2 and 13.93 mm^3), No. 18 (0.83, 40.74 mm^3 , 12.09 mm^2 and 16.26 mm^3) and No. 24 (0.85, 41.93 mm^3 , 13.52 mm^2 and 22.11 mm^3) in the smaller sets of T, volume (UHG), area (HG) and volume (HG).

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. Four cases were ascertained as follows; ① $17 \cdot 25 \cdot 29$ in the larger sets...W ($29 > 25 > 17$), quotient of areas ($17 = 29 > 25$) and quotient of volumes ($17 = 25 = 29$); ② $13 \cdot 17 \cdot 25 \cdot 29$ in the larger sets...quotient of areas ($17 = 29 > 13 = 25$) and quotient of volumes ($13 = 17 = 25 = 29$); ③ $9 \cdot 14 \cdot 25$ in the larger sets of s.d. ... area of UHG ($9 > 25 > 14$) and area of HG ($9 > 14 > 25$); ④ $1 \cdot 18 \cdot 28$ in the smaller sets...W ($1 < 18 < 28$), quotient of areas ($18 < 1 < 28$) and quotient of volumes ($1 < 18 < 28$).

It was noticeable that these synchronized orders and combinations of strains were found to be fewer cases in the comparative columns than those of area and volume columns. It meant that gene actions of these characters were independently expressed of each other. It was also noticeable that the combinations of s.d. in areas and volumes were quite the same ones as in the whole cases of UHG and HG.

Ranges in the respective characters of UHG and HG items

6. In the larger sets of values, the larger ones (3.80 mm in the maximum of W of UHG and 3.10 mm in the maximum of W of HG) were obtained in No. 21, followed by Nos. 9 and 13 (3.55 mm in the maximum of W of UHG and 3.00 mm in the maximum of HG). These orders of strains were finally illustrated in these two characters as $21 > 9 = 13$. These phenomena were found in the other 8 cases, *i.e.*, ② $16 > 14 = 21$... the maxima of T of UHG and HG; ③ $18 > 2 > 3$... the minima of L/T of UHG and HG; ④ $1 > 21 > 14$... the range of W/T of UHG and the maximum of W/T of HG; ⑤ $1 < 24 < 13$... the maximum and the minimum of L of UHG and the maximum of L of HG; ⑥ $1 < 24 < 15$... the maximum and the minimum of L of HG; ⑦ $18 < 3 = 4$... the maximum of W of UHG and the range of W of HG; ⑧ $18 < 1 < 3$... the maxima of T of UHG and W of HG; ⑨ $13 < 21 < 15$... the maximum and the minimum of L/W of UHG.

On the other hand, some sets of the strains did not show the same orders, but showed the same combinations, which meant the same strain numbers regardless of its orders. Ten cases were found, *i.e.*, ① $13 \cdot 14 \cdot 16 \cdot 21$ in the larger sets... the minimum of W of UHG ($21 > 13 > 14 = 16$) and the minimum of W of HG ($21 > 13 = 14 = 16$); ② $8 \cdot 9 \cdot 17$ in the larger sets... the range of W of UHG ($17 > 8 = 9$) and the range of W of HG ($17 = 9 > 8$); ③ $9 \cdot 13 \cdot 26$ in the larger sets... the minimum of T of UHG ($9 > 13 = 26$) and the minimum of T of HG ($9 = 13 = 26$); ④ $1 \cdot 14 \cdot 16$ in the larger sets... the range of T of UHG ($1 > 14 = 16$) and the range of T of HG ($16 > 1 = 14$); ⑤ $1 \cdot 16 \cdot 21$ in the larger sets... the range of T of UHG ($1 > 16 = 21$) and the maximum of W/T of HG ($1 > 21 > 16$); ⑥ $1 \cdot 3 \cdot 18$ in the smaller sets... the minimum of T of UHG ($1 < 18 < 3$) and the maximum of W of HG ($18 < 1 < 3$); ⑦ $1 \cdot 18 \cdot 24$ in the smaller sets... the maximum ($1 = 18 < 24$) and the minimum ($1 < 18 < 24$) of T of HG; ⑧ $8 \cdot 25 \cdot 27$ in the smaller sets... the maximum of W/

T of UHG ($27 < 25 < 8$), the maximum ($27 < 8 = 25$) and the minimum ($8 < 25 = 27$) of W/T of HG; ⑨ $2 \cdot 25 \cdot 27$ in the smaller sets... the minimum of W of UHG ($2 < 25 = 27$), the maximum ($27 < 2 < 25$) and the minimum ($2 = 25 = 27$) of W/T of HG; ⑩ $11 \cdot 13 \cdot 15$ in the smaller sets... the maxima of L/T of UHG ($13 < 11 < 15$) and HG ($13 < 15 < 11$).

Ranges in the respective characters of comparative, area and volume items

7. 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. 17 showed the largest value (0.77) in the maximum of L, but showed the middle value (0.84) in the minimum of T. In other case, No. 26 showed the largest value (0.77) in the maximum of L, but showed the middle value (0.91) in the maximum of T.

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. 15 showed the smallest value (0.72) in the maximum of L, but showed nearly the largest value (0.69) in the minimum of L. In other case, No. 22 showed the largest value (0.77) in the maximum of L, but showed nearly the smallest value (0.70) in the minimum of W. These phenomena were found in the several combinations.

In view of area and volume characters, it was said, in general, the larger is the value of the maximum, the larger is the values of the minimum and of the range in the respective characters. This tendency was looked upon as the same one as in case of the comparative characters. However, some disorders were found. For example, No. 13 showed the largest or relatively larger values (29.76 mm^2 , 69.91 mm^3 , 18.00 mm^2 and 37.80 mm^3 ; 24.64 mm^2 , 56.67 mm^3 , 15.82 mm^2 and 32.21 mm^3) in the maxima and the minima of area (UHG), volume (UHG), area (HG) and volume (HG), respectively, but showed relatively small values (5.12 mm^2 , 13.24 mm^3 , 2.18 mm^2 and 5.59 mm^3) in the ranges in the same orders, respectively. In other case, No. 25 showed nearly the smallest or relatively smaller values (27.03 mm^2 , 59.47 mm^3 , 17.14 mm^2 and 34.28 mm^3 ; 20.04 mm^2 , 40.08 mm^3 , 12.60 mm^2 and 22.68 mm^3) in the maxima and minima in the same orders, but showed nearly the largest or relatively larger values (6.99 mm^2 , 19.39 mm^3 , 4.54 mm^2 and 11.60 mm^3) in the ranges in the same orders, respectively. This tendency was looked upon as strain specificity in these strains.

8. In comparison with type B and type C in accordance with the tripartite classification, the following facts were ascertained. Type B showed the general features as follows; in the comparative characters (Table 5), 6 characters (the maxima of W and W/T, the minima of L, W and T, the range of W/T) and 7 characters (the maxima of L/W and L/T, the minima of L/W and W/T, and ranges of L, T and L/T) showed the larger and the smaller values than the average of the whole strains, respectively. The remaining 5 characters showed the same ones as the average of the whole strains.

In area and volume characters (Table 6), 3 characters (the maximum and the minimum of quotient of areas, and the range of quotient of volumes) showed the same as the average of the whole strains. The remaining 15 characters showed the larger values than the average of the whole strains.

In type C, in comparative characters (Table 5), 2 characters (the minimum of W and the maximum of T) showed the smaller values than the average of the whole strains. The remaining 16 characters showed the same as the average of the whole strains. In area and volume characters

(Table 6), 4 characters showed the same as the average of the whole strains. The remaining 14 characters showed the smaller values than the average of the whole strains.

The tendencies were looked upon as the reversed results observable between type B and type C, and between the comparative characters and area and volume characters.

9. In the larger sets of values, the largest (37.05 mm² in the maximum of area [UHG], 84.25 mm³ in the maximum of volume [UHG] and 21.08 mm² in the maximum of area [HG]) were obtained in No.21, followed by No. 9 (32.90 mm², 75.67 mm³ and 20.70 mm² in the same order) and No. 16 (32.03 mm², 75.27 mm³ and 19.29 mm² in the same order). These orders of strains were finally illustrated in these characters as 21>9>16. These phenomena were found in the other 3 cases, *i.e.*, ② 21>16>13... No. 21 (65.12 mm³ and 17.55 mm²), No. 16 (58.63 mm³ and 15.86 mm²) and No. 13 (56.67 mm³ and 15.82 mm²) in the larger sets of the minima of volume [UHG] and area [HG]; ③ 1<18<24... No. 1 (0.86, 0.70, 43.58 mm³, 11.93 mm², 9.18 mm², 18.14 mm³ and 11.65 mm³), No. 18 (0.88, 0.75, 43.68 mm³, 12.46 mm², 10.64 mm², 18.53 mm³ and 14.36 mm³) and No. 24 (0.89, 0.79, 48.80 mm³, 14.40 mm², 11.76 mm², 25.25 mm³ and 18.34 mm³) in the smaller sets of the maximum of T, the minimum of T, the maximum of volume [UHG], the maximum and the minimum of area [HG], the maximum and the minimum of volume [HG]; ④ 1<18<28... No. 1 (0.78, 0.42 and 0.32), No. 18 (0.79, 0.43 and 0.35) and No. 28 (0.82, 0.51 and 0.46) in the smaller sets of the maximum of W, the minima of quotients of areas and volumes.

It was noticed that these phenomena were found in many cases in area and volume columns than those of the comparative characters. No case was found in ranges at all. Moreover, order No. ③ was constituted by 7 character-combinations. It was also noticeable that ①, and ③·④ were constituted by only the strains belonging to type B and type C, respectively.

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. Nine cases were found, *i.e.*, ① 9·17·29 in the larger sets... the maxima of W (9>17>29) and of quotient of areas (17>9=29); ② 13·17·25 in the larger sets... the minima of W (17>25>13) and of quotient of areas (13=17=25); ③ 17·24·25·29 in the larger sets... the minima of W (17>25>24=29) and of W/T (25>17>24=29); ④ 9·16·21 in the larger sets --- the maxima of areas [UHG and HG] and volume [UHG] (21>9>16) and of volume [HG] (16>21>9); ⑤ 13·16·21 in the larger sets --- the minima of volume [UHG] and area [HG] (21>16>13) and of volume [HG] (21>13>16); ⑥ 9·13·17·29 in the larger sets... the maxima of quotients of areas (17>9=13=29) and of volumes (13=17>9=29); ⑦ 11·26·29 in the smaller sets... the ranges of T (26=29<11) and of quotient of L/T (11=29<26); ⑧ 15·21·27 in the smaller sets... the ranges of W (15=27<21) and of quotient of volumes (15<27<21); ⑨ 1·15·18 in the smaller sets... the maxima of quotients of areas (18<1<15) and of volumes (1<18<15).

It was noted that these phenomena were found in many cases in area and volume columns than those of the comparative characters, which was the same as in case of the orders. In these cases, ④, and ①·②·③·⑦·⑨ were constituted by only the strains belonging to type B and type C, respectively. Those phenomena were not mutually found both in the comparative and the area and volume characters.

10. From the data obtained in the present experiments, varietal variations were summed-up in view of the pure-ranges, and are shown in Table 7. In this table, strains showing the relatively large (roman figure in the table) and relatively small (*italic figure* in the table) values were illustrated in Nos. 1, 2 and 3 in 24 characters. These were some developing new techniques.

Table 7. Strains showing the relatively larger values (roman numerical figure) and the smaller values (*italic numerical figure*) in the 24 characters, cited from the pure-ranges; 1 - the largest or smallest, 2 - the second, 3 - the third values in the respective characters

Strain No.	Character numbers																																				Total		
	Unhusked						Husked						Comparison						Area and Volume																				
	1	2	3	4	5	6	11	12	13	14	15	16	21	22	23	24	25	26	31	32	33	34	35	36	L	S	T												
1	<i>1</i>	3	1		1	1			2			1	1	1	2	<i>1</i>	<i>1</i>		1	2	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>	2	<i>1</i>	2	<i>1</i>	8	<i>11</i>	19								
2		3		1																									2	0	2								
3					2			2																					1	<i>1</i>	2								
4		3						3	2	<i>1</i>				<i>1</i>														0	5	5									
5								<i>1</i>				3																0	2	2									
6																												0	0	0									
7																												0	0	0									
8		3							2										3									2	<i>1</i>	3									
9		1	<i>1</i>						2	<i>1</i>							1		3		3						4	3	7										
10	2								3																			2	0	2									
11		3	<i>1</i>		3			<i>1</i>		<i>1</i>			<i>1</i>		1		1	1		<i>1</i>							3	7	10										
12			<i>1</i>			2													3	<i>1</i>							1	3	4										
13					<i>1</i>	<i>1</i>									1											2	3	1	4	2	6								
14			2			3	2		2				3						3		3						6	<i>1</i>	7										
15		3													3				2								1	2	3										
16			2	<i>1</i>						1	3										2	2	2				5	2	7										
17	2	1							1		3					3											7	0	7										
18	2	<i>1</i>							<i>1</i>		2			<i>1</i>	2	2		<i>1</i>			2	2	2	<i>1</i>	2	1	2	1	12	13									
19									2		2		2														3	0	3										
20												3															0	<i>1</i>	1										
21		3	2			2															1	1	1	1		3	7	<i>1</i>	8										
22																											0	0	0										
23	3							3	2		2																0	4	4										
24				2												3		2	1	<i>1</i>	3	3	3			2	6	8											
25	1			2	3		1				3				2		2	2	3						3	1	9	2	11										
26		3												1			3				3	3				5	0	5											
27				3		3						3														1	2	3											
28				3											3		2	<i>1</i>						3	3	1	5	6											
29	<i>1</i>				2					<i>1</i>	<i>1</i>	2			1		<i>1</i>	2						1	1	4	6	10											

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

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

In the larger ranges, the highest frequency (=9) was found in No. 25, followed by No. 1 (=8) and Nos. 17 and 21 (=7). The lowest frequency (=0) was noted in 7 strains. One, 1, 2, 1, 2, 3, 2, 4, 6 and 7 strains showed the larger values in 9, 8, 7, 6, 5, 4, 3, 2, 1 and 0 characters, respectively. Average and its s.d. through the whole characters were found to be 2.72 ± 2.64 .

In the smaller ranges, the highest frequency (=12) was found in No. 18, followed by No. 1 (=11) and No. 11(=7). The lowest frequency (=0) was noted in 8 strains. One, 1, 1, 2, 2, 1, 2,

6, 5 and 8 strains showed the smaller values in 12, 11, 7, 6, 5, 4, 3, 2, 1 and 0 characters, respectively. Average and its s.d. through the whole characters were found to be 2.13 ± 3.13 .

In the whole ranges, the highest frequency (=19) was found in No. 1, followed by No. 18 (=13) and No. 25 (=11). The lowest frequency (=0) was noted in Nos. 6, 7 and 22. One, 1, 1, 2, 2, 4, 2, 2, 2, 4, 4, 1 and 3 strains showed the total frequencies in 19, 13, 11, 10, 8, 7, 6, 5, 4, 3, 2, 1 and 0 characters, respectively. Average and its s.d. through the whole characters were found to be 5.45 ± 4.24 . It was reasonably found that the results found in the larger ranges were fixed to be the reversed status from those of the smaller ranges. It was noticeable that the s.ds. were remarkably large through the 3 categories mentioned above.

In view of the tripartite classification, the following facts were ascertained. Type B in the larger ranges, 1, 1, 1 and 1 strains showed the larger values in 7, 6, 5 and 4 characters, respectively. Average and its s.d. through the whole characters were found to be 5.50 ± 1.11 . In the smaller ranges, 1, 1 and 2 strains showed the smaller values in 3, 2 and 1 characters, respectively. Average and its s.d. through the whole characters were found to be 1.75 ± 0.83 . In the whole ranges, 1 and 3 strains showed the total frequencies in 8 and 7 characters, respectively. Average and its s.d. through the whole characters were found to be 7.25 ± 0.43 .

Type C in the larger ranges, 1, 1, 1, 1, 2, 2, 4, 6 and 7 strains showed the larger values in 9, 8, 7, 5, 4, 3, 2, 1 and 0 characters, respectively. Average and its s.d. through the whole characters were found to be 2.28 ± 2.54 . In the smaller ranges, 1, 1, 1, 2, 2, 1, 1, 5, 3 and 8 strains showed the smaller values in 12, 11, 7, 6, 5, 4, 3, 2, 1 and 0 characters, respectively. Average and its s.d. through the whole characters were found to be 2.88 ± 3.33 . In the whole ranges, 1, 1, 1, 2, 1, 1, 2, 2, 2, 4, 4, 1 and 3 strains showed the total frequencies in 19, 13, 11, 10, 8, 7, 6, 5, 4, 3, 2, 1 and 0 characters, respectively. Average and its s.d. through the whole characters were found to be 5.16 ± 4.50 .

It was noticeable that type B showed relatively higher frequencies in the larger ranges and the total ones. On the other hand, type B showed relatively lower frequencies in the smaller ranges. Moreover, s.ds. were fixed to be of higher level through the whole cases. It meant that varietal variations were ascertained to be conspicuous values.

These analysing techniques were used for the recent time by the present author. Further practices should be requested.

11. Basing on the previons⁴⁾ and the present experiments, another new technique to analyse the varietal variations was adopted. On the strain-average, the maximum, the minimum and their range, strains of the relatively large or small values were picked-up and arranged in accordance with the tripartite classification. The results are shown in Table 8. For examples, # mark dotted at C line in character No. 1 (=length of UHG) in strain-average at the larger column means that 3 strains showing the largest (strain No. 18=10.07 mm), the second (No. 8=10.06 mm) and the third (No. 6=9.91 mm) were classified to type C. In other example, # mark dotted at M line in character No. 2 (=width of UHG) in strain-average at the larger column means that 3 strains showing relatively large values were found to be mixed with type B and type C, *i.e.*, the largest (strain No. 21=3.59 mm), the second (No. 13=3.39 mm) and the third (No. 14=3.30 mm) belonged to type B, type C and type B, respectively.

In the total, cases of type B, type C and the mixed one were ascertained as 10 (5.2% for the grand total cases as 192 [8×24]), 123 (64.1%) and 59 (30.7%), respectively. Numbers of strains were accounted as 4 (13.8% for the total 29 strains) and 25 (86.2% for the total 29 strains) in type B and type C, respectively. Accordingly, ratios from 10 to 123 showed significant differences in

Table 8. Characters showing the relatively large and small values in 29 strains; cited mainly from the pure-range shown in Table 7. # mark dotted at C line in character number 1 in strain-average at the large column means that 3 strains showing the largest (strain No. 18), the second (No. 8) and the third (No. 6) were classified to type C.

Character No.	Average			Maximum			Minimum			Range			Total												
	Large			Small			Large			Small			Large			Small									
	B	C	M	B	C	M	B	C	M	B	C	M	B	C	M	B	C	M							
1	#			#			#			#			#			#			0	8	0				
2		#		#				#			#			#			#			1	4	3			
3		#		#		#		#			#		#			#		#	1	3	4				
4	#				#		#		#		#			#		#		#	0	4	4				
5	#			#			#		#		#			#		#		#	0	7	1				
6		#		#			#		#		#		#			#		#	0	4	4				
11	#			#			#		#		#			#		#		#	0	6	2				
12		#		#		#		#			#		#		#		#		1	4	3				
13		#		#		#		#			#		#		#		#		1	3	4				
14	#			#		#		#		#		#		#		#		#	0	5	3				
15	#			#		#		#		#		#		#		#		#	0	6	2				
16		#		#			#		#		#		#		#		#		0	5	3				
21	#			#			#		#		#		#		#		#		0	6	2				
22	#			#		#		#		#		#		#		#		#	0	5	3				
23		#		#		#		#		#		#		#		#		#	0	7	1				
24	#			#		#		#		#		#		#		#		#	0	6	2				
25	#			#		#		#		#		#		#		#		#	0	6	2				
26	#			#		#		#		#		#		#		#		#	0	7	1				
31	#			#		#		#		#		#		#		#		#	2	4	2				
32	#			#		#		#		#		#		#		#		#	2	4	2				
33		#		#		#		#		#		#		#		#		#	1	4	3				
34		#		#		#		#		#		#		#		#		#	1	4	3				
35	#			#		#		#		#		#		#		#		#	0	6	2				
36	#			#		#		#		#		#		#		#		#	0	5	3				
L	2	13	9				7	11	6				1	15	8			0	8	16	10	47	39		
S				0	20	4				0	20	4				0	19	5		0	17	7	0	76	20

Character numbers; the same as mentioned in Table 7.

B, C, M; type B, type C and those mixed out of them in accordance with the tripartite classification.

comparison with ratio of 4 to 25 (χ^2 test). It meant that type B had the tendency of showing a few relatively extreme values through the whole characters and the whole strains. Averages and their s.ds. through the whole characters (=24) were found to be 0.42 ± 0.64 , 5.13 ± 1.33 and 2.46 ± 1.04 in type B, type C and the mixed one, respectively. It was noticed that the value of s.d. in type B was found to be very small as the same as in case of the practical value.

In type B, averages and their s.ds. through the average, the maximum, the minimum, the range and the total were found to be 2.50 ± 2.69 , 0.00 ± 0.00 and 1.25 ± 2.28 in the large, the small and the total ones, respectively. In type C, these were found to be in the same order as 11.75 ± 2.59 , 19.00 ± 1.23 and 15.38 ± 4.15 , respectively. In the mixed one, these were found in the same

order as 9.75 ± 3.77 , 5.00 ± 1.23 and 7.38 ± 3.67 , respectively. Significant differences were ascertained between the mutual columns in the whole cases. It might be of universal validity for analysing strain differentiations.

It was noticeable that all of s.d. through the 4 characters (character Nos. 31–34, area and volume items) were classified into the mixed one and type C in large and small columns, respectively, excepting the one case, *i.e.*, large column of character No. 32. It was an incomprehensible result at the present time.

Summary

In order to confirm the morphological characters of the cultivated rice collected in Madura, Indonesia, comparative values, area and volume characters, and the variation ranges for 24 characters were investigated, following the previous paper. The main results obtained during this study were summarized as follows:

Comparative values of length, width, thickness, L/W, L/T and W/T were measured as 0.72, 0.84, 0.89, 0.86, 0.81 and 0.94 in the average values, respectively. Area (UHG), volume (UHG), area (HG), volume (HG), quotient of areas and quotient of volumes were measured as 26.06 mm², 54.20 mm³, 15.59 mm², 28.93 mm³, 0.60 and 0.53 in average values, respectively.

The maxima, the minima and the ranges of length, width, thickness, L/W, L/T and W/T in views of UHG were measured as 9.62 mm, 8.52 mm, 1.10 mm; 3.10 mm, 2.71 mm, 0.39 mm; 2.19 mm, 1.94 mm, 0.25 mm; 3.45, 2.90, 0.55; 4.78, 4.05, 0.74; 1.55, 1.27, 0.28 in average values, respectively. Those in views of HG in the same orders were ascertained as 6.86 mm, 6.06 mm, 0.80 mm; 2.59 mm, 2.25 mm, 0.34 mm; 1.96 mm, 1.71 mm, 0.25 mm; 2.96, 2.45, 0.52; 3.88, 3.24, 0.64; 1.48, 1.19, 0.29 in average values, respectively.

The maxima, the minima and their ranges of the comparative values of length, width, thickness, L/W, L/T and W/T were ascertained as 0.74, 0.69, 0.05; 0.88, 0.79, 0.10; 0.92, 0.85, 0.07; 0.91, 0.81, 0.11; 0.86, 0.76, 0.10; 1.01, 0.88, 0.13 in average values, respectively. The maxima, the minima and their ranges of area (UHG), volume (UHG), area (HG) and volume (HG), quotient of areas and the quotient of volumes were ascertained as 28.89 mm², 23.57 mm², 5.33 mm²; 61.38 mm³, 47.78 mm³, 13.60 mm³; 17.20 mm², 14.07 mm², 3.13 mm²; 32.82 mm³, 25.29 mm³, 7.50 mm³; 0.64, 0.56, 0.08; 0.57, 0.49, 0.09 in average values, respectively.

Basing on the data obtained in these characters, several patterns were found as variety- and strain-specificities. According to the tripartite classification, some specific features were found. Strains showing relatively large or small values in the respective characters were picked-up and grouped into the categories of “order” and “combination”. These techniques were already fixed to be useful for testing the strain or geographical differentiations of rice varieties. From the data obtained in the previous and the present experiments, varietal variations were summed-up in view of the pure-ranges for 24 characters. Some interesting facts were ascertained.

On the strain-average, the maximum, the minimum and their ranges, an analysing method was newly adopted, and some aspects of type B and type C were ascertained. It might be expected that this newly devised method might have some universal validity for analysing strain-differentiations.

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