

Distribution and Some Morphological Characters of the Wild Rice in the Central India (III)

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Introduction

During the period from December in 1978 to January in 1979, the writer was sent to India for collection of the wild and cultivated rice. In this opportunity, 11 strains of wild rice were collected in the central India, which was denoted here as follows; southern part of West Bengal, southern part of Bihar, Orissa, Andhra Pradesh and Madhya Pradesh. Geographical distribution of wild rice found was briefly illustrated in Figure 1 of the previous paper¹⁾.

Though Ramiah *et al.*⁵⁾ stated that cultivated rice had been originated in south India, accumulation of complete data on these aspect has been far from being perfect.

The present series was made to accomplish the works which are going to clarify the distribution and ecotypic differentiation of wild rice in the central India. In the previous papers, the habitat and the record of morphological characters of the unhusked and husked grains of wild rice collected in the central India¹⁾, and the variation ranges in 12 characters and some mutual relations³⁾ were reported.

In the present paper, comparison of the unhusked and husked grains for 12 characters and variation ranges in the same 12 characters were mainly described, in order to confirm the morphological characters of grains as well as to make clear the species specificities and the ecotypic differentiation of those grains. In the present state of affairs, it is yet not clear whether variation ranges could be fully used in analyzing strain differentiations or not. These characters were used in pulses collected in India²⁾. These were used in wild rice species³⁾. Following the previous paper, these characters were adopted in this paper for ascertaining variations and valuabilities owing to the respective strains and characters.

Strains showing relatively large or small values in the respective characters were, moreover, picked-up and grouped into "order" or "combination". These new methodologies were attempted with good intent to clarify the process of varietal variations.

Lastly, data obtained here and in northeastern India⁴⁾ were compared and extensively discussed for analyzing geographical specificities.

The records on the relations between the respective two characters and some considerations of wild rice in the whole India and in the world are going to be published in the separate articles.

Materials and Methods

Eleven strains of wild rice were collected in this collection-trip, and they were used for morphological investigations. Their collection number, collection date, district and habitat were mentioned

in Table 1 of the previous paper³⁾. Thirty grains were used for the measurements of each strain.

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

The variation ranges in 12 characters (Tables 3 and 4) were illustrated by the maximum, the minimum and the pure-range-value in the whole grains.

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

Results

PART I. The respective characters

1. Quotient in length

The results are given in Table 1. The values for the individual grain level ranged from 0.76 (strain No. 1) to 0.63 (No. 5). In the strain level, the largest (0.72) was obtained in No. 10, followed by Nos. 1, 2, 7, 8 and 11 (0.71). The smallest (0.67) was noted in No. 5, followed by No. 3 (0.69). Average and its s.d. through the whole strains were found to be 0.70 ± 0.01 . The s.d. of each strain, *i.e.*, intra-population's variations, were found to be 0.02 ± 0.01 .

Table 1. Comparative table on some morphological characters of unhusked and husked grains of the wild species; illustrating 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	0.71 ± 0.02	0.88 ± 0.03	0.89 ± 0.01	0.81 ± 0.04	0.80 ± 0.03	0.99 ± 0.04
2	0.71 ± 0.02	0.85 ± 0.02	0.90 ± 0.02	0.83 ± 0.02	0.78 ± 0.03	0.95 ± 0.03
3	0.69 ± 0.01	0.70 ± 0.02	0.82 ± 0.05	0.99 ± 0.03	0.84 ± 0.04	0.84 ± 0.03
4	0.70 ± 0.01	0.82 ± 0.01	0.85 ± 0.03	0.86 ± 0.03	0.83 ± 0.03	0.96 ± 0.03
5	0.67 ± 0.02	0.83 ± 0.02	0.89 ± 0.02	0.81 ± 0.03	0.76 ± 0.03	0.93 ± 0.03
6	0.70 ± 0.01	0.79 ± 0.02	0.87 ± 0.03	0.87 ± 0.02	0.80 ± 0.03	0.92 ± 0.04
7	0.71 ± 0.02	0.87 ± 0.02	0.86 ± 0.04	0.81 ± 0.03	0.84 ± 0.05	1.04 ± 0.07
8	0.71 ± 0.01	0.81 ± 0.03	0.89 ± 0.02	0.87 ± 0.04	0.80 ± 0.03	0.92 ± 0.04
9	0.70 ± 0.02	0.78 ± 0.02	0.87 ± 0.02	0.90 ± 0.02	0.81 ± 0.03	0.90 ± 0.03
10	0.72 ± 0.02	0.84 ± 0.01	0.88 ± 0.02	0.86 ± 0.03	0.82 ± 0.03	0.95 ± 0.02
11	0.71 ± 0.02	0.81 ± 0.03	0.89 ± 0.01	0.87 ± 0.05	0.81 ± 0.03	0.92 ± 0.03

2. Quotient in width

The values for the individual grain level ranged from 0.96 (No. 1) to 0.65 (No. 3). In the strain level, the largest (0.88) was obtained in No. 1, followed by No. 7 (0.87) and No. 2 (0.85). The smallest (0.70) was noted in No. 3, followed by No. 9 (0.78) and No. 6 (0.79). It was noted that the value was peculiarly small in No. 3. Average and its s.d. through the whole strains were found to be 0.82 ± 0.05 . S.d. of each strain were found to be 0.02 ± 0.01 .

3. Quotient in thickness

The values for the individual grain level ranged from 0.95 (Nos. 2 and 5) to 0.74 (No. 3). In the strain level, the largest (0.90) was obtained in No. 2, followed by Nos. 1, 5, 8 and 11 (0.89). The smallest (0.82) was noted in No. 3, which was the same as in case of the width, followed by No. 4 (0.85) and No. 7 (0.86). Average and its s.d. through the whole strains were found to be 0.87 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

4. Quotient in L/W

The values for the individual grain level ranged from 1.03 (No. 3) to 0.70 (No. 11). In the strain level, the largest (0.99) was obtained in No. 3, followed by No. 9 (0.90) and Nos. 8 and 11 (0.87). It was noted that the value was peculiarly large in No. 3. The smallest (0.81) was noted in Nos. 1, 5 and 7. Average and its s.d. through the whole strains were found to be 0.86 ± 0.05 . S.d. of each strain were found to be 0.03 ± 0.01 .

5. Quotient in L/T

The values for the individual grain level ranged from 0.98 (No. 7) to 0.68 (No. 8). In the strain level, the largest (0.84) was obtained in Nos. 3 and 7, followed by No. 4 (0.83). The smallest (0.76) was noted in No. 5, which was the same as in case of the length, followed by No. 2 (0.78). Average and its s.d. through the whole strains were found to be 0.81 ± 0.02 . S.d. of each strain were found to be 0.03 ± 0.01 .

6. Quotient in W/T

The values for the individual grain level ranged from 1.23 to 0.80 (No. 3). In the strain level, the largest (1.04) was obtained in No. 7, followed by No. 1 (0.99) and No. 4 (0.96). It was noted that the value was peculiarly large in No. 7. The smallest (0.84) was noted in No. 3, which was the same as in cases of the width and the thickness, followed by No. 9 (0.90). It was noted that the value was peculiarly small in No. 3. Average and its s.d. through the whole strains were found to be 0.94 ± 0.05 . S.d. of each strain were found to be 0.04 ± 0.01 .

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

Strain No.	Unhusked		Husked		Quotient	
	Area (mm ²)	Volume (mm ³)	Area (mm ²)	Volume (mm ³)	Area	Volume
1	19.26 \pm 1.18	35.10 \pm 3.08	12.03 \pm 0.63	19.36 \pm 1.45	0.62 \pm 0.03	0.55 \pm 0.03
2	19.53 \pm 1.20	36.79 \pm 2.54	11.72 \pm 0.53	19.90 \pm 1.10	0.60 \pm 0.02	0.54 \pm 0.03
3	20.54 \pm 1.75	31.72 \pm 5.01	9.91 \pm 1.05	12.79 \pm 2.81	0.48 \pm 0.02	0.40 \pm 0.03
4	15.34 \pm 0.90	22.85 \pm 2.02	8.84 \pm 0.50	11.12 \pm 0.99	0.57 \pm 0.01	0.49 \pm 0.02
5	27.02 \pm 1.60	49.57 \pm 4.16	15.02 \pm 1.11	24.43 \pm 2.21	0.56 \pm 0.02	0.49 \pm 0.02
6	19.71 \pm 0.88	33.84 \pm 2.53	10.89 \pm 0.57	16.26 \pm 1.39	0.55 \pm 0.02	0.48 \pm 0.02
7	16.77 \pm 1.70	27.18 \pm 3.33	10.34 \pm 1.03	14.21 \pm 2.36	0.62 \pm 0.02	0.52 \pm 0.04
8	20.81 \pm 1.52	38.23 \pm 3.49	12.02 \pm 1.06	19.54 \pm 1.93	0.58 \pm 0.03	0.51 \pm 0.02
9	24.03 \pm 1.38	39.75 \pm 4.12	13.25 \pm 0.84	19.06 \pm 2.24	0.55 \pm 0.02	0.48 \pm 0.02
10	19.57 \pm 1.12	34.97 \pm 3.16	11.71 \pm 0.92	18.39 \pm 2.22	0.60 \pm 0.02	0.53 \pm 0.03
11	22.28 \pm 1.18	40.85 \pm 2.66	12.89 \pm 0.63	20.88 \pm 1.23	0.58 \pm 0.02	0.51 \pm 0.02

7. Area in unhusked grains

The results are given in Table 2. The practical values for the individual grain level ranged from 30.56 mm² (No. 5) to 13.59 mm² (No. 4). In the strain level, the widest (27.02 mm²) was obtained in No. 5, followed by No. 9 (24.08 mm²) and No. 11 (22.28 mm²). It was noted that the value was peculiarly large in No. 5. The narrowest (15.34 mm²) was noted in No. 4, followed by No. 7 (16.77 mm²) and No. 1 (19.26 mm²). Average and its s.d. through the whole strains were found to be 20.44 ± 3.21 .

The largest (1.75) of s.d. was obtained in No. 3, followed by No. 7 (1.70) and No. 5 (1.60). It was noted that the values were peculiarly large in Nos. 3 and 7. The smallest (0.88) was noted in No. 6, followed by No. 4 (0.90) and No. 10 (1.12). S.d. of each strain were found to be 1.31 ± 0.30 .

8. Volume in unhusked grains

The practical values for the individual grain level ranged from 59.59 mm³ (No. 5) to 19.01 mm³ (No. 3). In the strain level, the largest (49.57 mm³) was obtained in No. 5, which was the same as in case of area of UHG, followed by No. 11 (40.85 mm³) and No. 9 (39.75 mm³). It was noted that the value was peculiarly large in No. 5. These combinations of strains were found to be the same as in case of area of UHG. The smallest (22.85 mm³) was noted in No. 4, which was the same as in case of area of UHG, followed by No. 7 (27.18 mm³) and No. 3 (31.72 mm³). It was noted that the value was peculiarly small in No. 4. These combinations of strains were found to be the same as in case of the thickness. Average and its s.d. through the whole strains were found to be 35.53 ± 7.08 .

The largest (5.01) of s.d. was obtained in No. 3, which was the same as in case of area of UHG, followed by No. 5 (4.16) and No. 9 (4.12). It was noted that the value was peculiarly large in No. 3. The smallest (2.02) was noted in No. 4, followed by No. 6 (2.53) and No. 2 (2.54). S.d. of each strain were found to be 3.28 ± 0.88 .

9. Area in husked grains

The practical values for the individual grain level ranged from 17.40 mm² (No. 5) to 6.30 mm² (No. 3). In the strain level, the widest (15.02 mm²) was obtained in No. 5, which was the same as in cases of area and volume of UHG, followed by No. 9 (13.25 mm²) and No. 11 (12.89 mm²). It was noted that the value was peculiarly large in No. 5. These combinations of strains were found to be the same as in cases of area and volume of UHG. Moreover, these orders of strains were found to be the same as in case of area of UHG. The narrowest (8.84 mm²) was noted in No. 4, which was also the same as in cases of area and volume of UHG, followed by No. 3 (9.91 mm²) and No. 7 (10.34 mm²). It was noted that the value was peculiarly small in No. 4. These combinations of strains were found to be the same as in cases of thickness and volume of UHG. Average and its s.d. through the whole strains were found to be 11.69 ± 1.70 .

The largest (1.11) of s.d. was obtained in No. 5, followed by No. 8 (1.06) and No. 3 (1.05). The smallest (0.50) was noted in No. 4, which was the same as in case of volume of UHG, followed by No. 2 (0.53) and No. 6 (0.57). These combinations of strains were found to be the same as in case of volume of UHG. S.d. of each strain were found to be 0.81 ± 0.24 .

10. Volume in husked grains

The practical values for the individual grain level ranged from 28.95 mm³ (No. 5) to 6.30 mm³ (No. 3). In the strain level, the largest (24.43 mm³) was obtained in No. 5, which was the same as in cases of areas of UHG and HG and volume of UHG, followed by No. 11 (20.88 mm³) and No. 2

(19.90 mm³). It was noted that the value was peculiarly large in No. 5. The smallest (11.12 mm³) was noted in No. 4, which was also the same as in cases of areas of UHG and HG and volume of UHG, followed by No. 3 (12.79 mm³) and No. 7 (14.21 mm³). These combinations of strains were found to be the same as in cases of the thickness, volume of UHG and area of HG. Moreover, these orders of strains were found to be the same as in case of area of HG. Average and its s.d. through the whole strains were found to be 17.81 ± 3.88 .

The largest (2.81) of s.d. was obtained in No. 3, which was the same as in cases of area and volume of UHG, followed by No. 7 (2.36) and No. 9 (2.24). The smallest (0.99) was noted in No. 4, which was the same as in cases of volume of UHG and area of HG, followed by No. 2 (1.10) and No. 11 (1.23). It was noted that the value was peculiarly small in No. 4. S.d. of each strain were found to be 1.81 ± 0.60 .

11. Quotient in areas

The values for the individual grain level ranged from 0.70 (No. 1) to 0.43 (No. 3). In the strain level, the largest (0.62) was obtained in Nos. 1 and 7, followed by Nos. 2 and 10 (0.60). These combinations of strains were found to be the same as in case of the width. The smallest (0.48) was noted in No. 3, which was the same as in cases of the width, thickness and W/T, followed by Nos. 6 and 9 (0.55). It was noted that the value was peculiarly small in No. 3. These combinations of strains were found to be the same as in case of the width. Average and its s.d. through the whole strains were found to be 0.57 ± 0.04 . S.d. of each strain were found to be 0.02 ± 0.01 .

12. Quotient in volumes

The values for the individual grain level ranged from 0.63 (No. 1) to 0.33 (No. 3). In the strain level, the largest (0.55) was obtained in No. 1, which was the same as in case of the width, followed by No. 2 (0.54) and No. 10 (0.53). The smallest (0.40) was noted in No. 3, which was the same as in cases of width, thickness, W/T and quotient of areas, followed by Nos. 6 and 9 (0.48). These combinations of strains were found to be the same as in cases of width and quotient of areas. Moreover, these orders of strains were found to be the same as in case of quotient of areas. Average and its s.d. through the whole strains were found to be 0.50 ± 0.04 . S.d. of each strain were found to be 0.03 ± 0.01 .

PART II. Ranges among the respective characters

1. Quotient in length

Maximum: The results are given in Table 3. In this table, the maximum, the minimum and their range are shown. The largest (0.76) was obtained in No. 1, followed by No. 10 (0.75) and Nos. 8 and 11 (0.74). The smallest (0.70) was noted in No. 3, followed by No. 6 (0.71) and Nos. 4 and 5 (0.72). Average and its s.d. through the whole strains were found to be 0.73 ± 0.02 .

Minimum: The largest (0.68) was obtained in Nos. 1, 4, 8 and 11. The smallest (0.63) was noted in No. 5, followed by No. 3 (0.66). Average and its s.d. through the whole strains were found to be 0.67 ± 0.02 .

Range: The largest (0.09) was obtained in No. 5, followed by Nos. 1 and 10 (0.08). The smallest (0.04) was noted in Nos. 3, 4 and 6. These combinations of strains were found to be the same as in case of the maximum of length. Average and its s.d. through the whole strains were found to be 0.06 ± 0.02 .

Table 3. 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	0.76	0.68	0.08	0.96	0.81	0.15	0.92	0.85	0.07	0.90	0.76	0.14	0.86	0.72	0.14	1.09	0.90	0.19
2	0.73	0.67	0.06	0.88	0.81	0.07	0.95	0.87	0.08	0.87	0.78	0.09	0.83	0.75	0.08	0.99	0.89	0.10
3	0.70	0.66	0.04	0.73	0.65	0.08	0.89	0.74	0.15	1.03	0.92	0.11	0.94	0.75	0.19	0.93	0.80	0.13
4	0.72	0.68	0.04	0.84	0.80	0.04	0.90	0.81	0.09	0.93	0.81	0.14	0.86	0.78	0.08	1.02	0.92	0.10
5	0.72	0.63	0.09	0.86	0.79	0.07	0.95	0.86	0.09	0.87	0.76	0.11	0.81	0.69	0.12	0.98	0.87	0.11
6	0.71	0.67	0.04	0.86	0.76	0.10	0.92	0.79	0.13	0.91	0.81	0.10	0.87	0.75	0.12	1.02	0.82	0.20
7	0.73	0.67	0.06	0.92	0.85	0.07	0.91	0.76	0.15	0.85	0.73	0.12	0.98	0.76	0.22	1.23	0.97	0.26
8	0.74	0.68	0.06	0.85	0.75	0.10	0.94	0.87	0.07	0.94	0.80	0.14	0.84	0.68	0.16	0.99	0.82	0.17
9	0.73	0.67	0.06	0.83	0.76	0.07	0.91	0.79	0.12	0.94	0.85	0.09	0.90	0.75	0.15	0.98	0.86	0.12
10	0.75	0.67	0.08	0.86	0.81	0.05	0.92	0.80	0.12	0.91	0.78	0.13	0.91	0.76	0.15	1.01	0.90	0.11
11	0.74	0.68	0.06	0.87	0.76	0.11	0.92	0.87	0.05	0.95	0.70	0.25	0.86	0.76	0.10	1.00	0.87	0.13

2. Quotient in width

Maximum: The largest (0.96) was obtained in No. 1, which was the same as in case of the maximum of length, followed by No. 7 (0.92) and No. 2 (0.88). It was noted that the value was peculiarly large in No. 1. The smallest (0.73) was noted in No. 3, which was also the same as in case of the maximum of length, followed by No. 9 (0.83) and No. 4 (0.84). It was noted that the value was peculiarly small in No. 3. Average and its s.d. through the whole strains were found to be 0.86 ± 0.06 .

Minimum: The largest (0.85) was obtained in No. 7, followed by Nos. 1, 2 and 10 (0.81). These combinations of strains were found to be the same as in case of the maximum of width. The smallest (0.65) was noted in No. 3, which was the same as in cases of the maxima of length and width, followed by No. 8 (0.75). It was noted that the value was peculiarly small in No. 3. Average and its s.d. through the whole strains were found to be 0.78 ± 0.05 .

Range: The largest (0.15) was obtained in No. 1, which was the same as in cases of maxima of length and width, followed by No. 11 (0.11) and Nos. 6 and 8 (0.10). It was noted that the value was peculiarly large in No. 1. The smallest (0.04) was noted in No. 4, followed by No. 10 (0.05). Average and its s.d. through the whole strains were found to be 0.08 ± 0.03 .

3. Quotient in thickness

Maximum: The largest (0.95) was obtained in Nos. 2 and 5, followed by No. 8 (0.94). The smallest (0.89) was noted in No. 3, which was the same as in cases of the maxima of length and width, and the minimum of width, followed by No. 4 (0.90) and Nos. 7 and 9 (0.91). These combinations of strains were found to be the same as in case of the maximum of width. Average and its s.d. through the whole strains were found to be 0.92 ± 0.02 .

Minimum: The largest (0.87) was obtained in Nos. 2, 8 and 11, followed by No. 5 (0.86). The smallest (0.74) was noted in No. 3, which was the same as in cases of the maxima of length, width and thickness, and the minimum of width, followed by No. 7 (0.76) and Nos. 6 and 9 (0.79). Average and its s.d. through the whole strains were found to be 0.82 ± 0.05 .

Range: The largest (0.15) was obtained in Nos. 3 and 7, followed by No. 6 (0.13). The smallest (0.05) was noted in No. 11, followed by Nos. 1 and 8 (0.07). Average and its s.d. through the whole strains were found to be 0.10 ± 0.03 .

4. Quotient in L/W

Maximum: The largest (1.03) was obtained in No. 3, followed by No. 11 (0.95) and Nos. 8 and 9 (0.94). It was noted that the value was peculiarly large in No. 3. The smallest (0.85) was noted in No. 7, followed by Nos. 2 and 5 (0.87). Average and its s.d. through the whole strains were found to be 0.92 ± 0.05 .

Minimum: The largest (0.92) was obtained in No. 3, which was the same as in case of the maximum of L/W, followed by No. 9 (0.85) and Nos. 4 and 6 (0.81). It was noted that the value was peculiarly large in No. 3. The smallest (0.70) was noted in No. 11, which was the same as in case of the range of thickness, followed by No. 7 (0.73) and Nos. 1 and 5 (0.76). Average and its s.d. through the whole strains were found to be 0.79 ± 0.06 .

Range: The largest (0.25) was obtained in No. 11, followed by Nos. 1, 4 and 8 (0.14). It was noted that the value was peculiarly large in No. 11. These combinations of strains were found to be the same as in case of the minimum of length. The smallest (0.09) was noted in Nos. 2 and 9, followed by No. 6 (0.10). Average and its s.d. through the whole strains were found to be $0.13 \pm$

0.04.

5. Quotient in L/T

Maximum: The largest (0.98) was obtained in No. 7, which was the same as in case of the minimum of width, followed by No. 3 (0.94) and No. 10 (0.91). The smallest (0.81) was noted in No. 5, which was the same as in case of the minimum of length, followed by No. 2 (0.83) and No. 8 (0.84). Average and its s.d. through the whole strains were found to be 0.88 ± 0.05 .

Minimum: The largest (0.78) was obtained in No. 4, followed by Nos. 7, 10 and 11 (0.76). The smallest (0.68) was noted in No. 8, followed by No. 5 (0.69) and No. 1 (0.72). Average and its s.d. through the whole strains were found to be 0.74 ± 0.03 .

Range: The largest (0.22) was obtained in No. 7, which was the same as in cases of the minimum of width and the maximum of L/T, followed by No. 3 (0.19) and No. 8 (0.16). It was noted that the value was peculiarly large in No. 7. The smallest (0.08) was noted in Nos. 2 and 4, followed by No. 11 (0.10). Average and its s.d. through the whole strains were found to be 0.14 ± 0.04 .

6. Quotient in W/T

Maximum: The largest (1.23) was obtained in No. 7, which was the same as in cases of the maximum of L/T, the minimum of width, and the range of L/T, followed by No. 1 (1.09) and Nos. 4 and 6 (1.02). It was noted that the value was peculiarly large in No. 7. The smallest (0.93) was noted in No. 3, which was the same as in cases of the maxima of length, width and thickness, and the minima of width and thickness, followed by Nos. 5 and 9 (0.98). Average and its s.d. through the whole strains were found to be 1.02 ± 0.08 .

Minimum: The largest (0.97) was obtained in No. 7, which was the same as in cases of the maxima of L/T and W/T, the minimum of width, and the range of L/T, followed by No. 4 (0.92) and Nos. 1 and 10 (0.90). It was noted that the value was peculiarly large in No. 7. These combinations of strains were found to be the same as in case of the maximum of W/T. The smallest (0.80) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness and W/T, and the minima of width and thickness, followed by Nos. 6 and 8 (0.82). Average and its s.d. through the whole strains were found to be 0.87 ± 0.05 .

Range: The largest (0.26) was obtained in No. 7, which was the same as in cases of the maxima of L/T and W/T, the minima of width and W/T, and the range of L/T, followed by No. 6 (0.20) and No. 1 (0.19). It was noted that the value was peculiarly large in No. 7. The smallest (0.10) was noted in Nos. 2 and 4, followed by Nos. 5 and 10 (0.11). Average and its s.d. through the whole strains were found to be 0.15 ± 0.05 .

7. Area in unhusked grains

Maximum: The results are given in Table 4. In this table, the maximum, the minimum and their range are shown. The widest (30.56 mm^2) was obtained in No. 5, which was the same as in case of the range of length, followed by No. 9 (26.23 mm^2) and No. 11 (24.80 mm^2). It was noted that the value was peculiarly large in No. 5. The narrowest (17.01 mm^2) was noted in No. 4, which was the same as in case of the range of width, followed by No. 7 (20.58 mm^2) and No. 1 (21.32 mm^2). It was noted that the value was peculiarly small in No. 4. Average and its s.d. through the whole strains were found to be 23.27 ± 3.45 .

Minimum: The widest (23.76 mm^2) was obtained in No. 5, which was the same as in cases of the maximum of area of UHG and the range of length, followed by No. 9 (21.45 mm^2) and No.

Table 4. Ranges of area, volume and quotient in the strain level

Strain No.	Unhusked						Husked						Quotient					
	Area			Volume			Area			Volume			Area			Volume		
	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range	Max.	Min.	Range
1	21.32	17.14	4.18	40.49	29.14	11.35	13.23	10.36	2.87	22.49	16.58	5.91	0.70	0.57	0.13	0.63	0.51	0.12
2	23.49	17.89	5.60	42.37	32.63	9.74	13.75	11.03	2.72	22.57	17.98	4.59	0.64	0.56	0.08	0.59	0.49	0.10
3	23.24	14.62	8.62	41.76	19.01	22.75	11.55	6.30	5.25	18.48	6.30	12.18	0.51	0.43	0.12	0.45	0.33	0.12
4	17.01	13.59	3.42	26.66	19.24	7.42	9.52	8.00	1.52	12.73	9.09	3.64	0.59	0.55	0.04	0.53	0.46	0.07
5	30.56	23.75	6.80	59.59	39.20	20.39	17.40	12.54	4.86	28.95	19.44	9.51	0.60	0.51	0.09	0.53	0.44	0.09
6	22.13	17.89	4.24	39.83	28.62	11.21	11.99	9.28	2.71	18.81	12.99	5.82	0.61	0.52	0.09	0.52	0.44	0.08
7	20.58	13.65	6.93	33.30	19.79	13.51	12.10	8.42	3.68	18.35	10.10	8.25	0.64	0.58	0.06	0.57	0.41	0.16
8	24.51	18.36	6.15	45.34	32.05	13.29	13.92	9.72	4.20	23.66	15.55	8.11	0.62	0.52	0.10	0.55	0.46	0.09
9	26.23	21.45	4.78	47.19	30.81	16.22	15.50	11.60	3.90	23.21	14.36	8.85	0.59	0.52	0.07	0.52	0.43	0.09
10	22.13	17.71	4.42	40.76	27.87	12.89	13.42	9.88	3.54	22.81	14.11	8.70	0.63	0.55	0.08	0.57	0.47	0.10
11	24.80	20.15	4.65	45.60	35.20	10.40	14.16	11.40	2.76	24.07	18.15	5.92	0.63	0.55	0.08	0.56	0.48	0.08

11 (20.15 mm²). It was noted that the value was peculiarly large in No. 5. These orders of strains were found to be the same as in case of the maximum of area of UHG. The narrowest (13.59 mm²) was noted in No. 4, which was the same as in cases of the maximum of area of UHG and the range of width, followed by No. 7 (13.65 mm²) and No. 3 (14.62 mm²). These combinations of strains were found to be the same as in case of the maximum of the thickness. Average and its s.d. through the whole strains were found to be 17.84 ± 3.17 .

Range: The largest (8.62 mm²) was obtained in No. 3, which was the same as in cases of the maximum and the minimum of L/W, followed by No. 7 (6.93 mm²) and No. 5 (6.80 mm²). The smallest (4.18 mm²) was noted in No. 1, followed by No. 6 (4.24 mm²) and No. 10 (4.42 mm²). Average and its s.d. through the whole strains were found to be 5.44 ± 1.55 .

8. Volume in unhusked grains

Maximum: The largest (59.59 mm³) was obtained in No. 5, which was the same as in cases of the maximum and the minimum of area of UHG, and the range of length, followed by No. 9 (47.19 mm³) and No. 11 (45.60 mm³). It was noted that the value was peculiarly large in No. 5. These orders of strains were found to be the same as in cases of the maximum and the minimum of area of UHG. The smallest (26.66 mm³) was noted in No. 4, which was the same as in cases of the maximum and the minimum of area of UHG, and the range of length, followed by No. 7 (33.30 mm³) and No. 1 (40.49 mm³). It was noted that the value was peculiarly small in No. 4. These orders of strains were found to be the same as in case of the maximum of area of UHG. Average and its s.d. through the whole strains were found to be 42.08 ± 8.25 .

Minimum: The largest (39.20 mm³) was obtained in No. 5, which was the same as in cases of the maxima of area and volume of UHG, the minimum of area of UHG, and the range of length, followed by No. 11 (35.20 mm³) and No. 2 (32.63 mm³). It was noted that the value was peculiarly large in No. 5. The smallest (19.01 mm³) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness and W/T, the minima of width, thickness and W/T, followed by No. 4 (19.24 mm³) and No. 7 (19.79 mm³). These combinations of strains were found to be the same as in cases of the maximum of thickness and the minimum of area of UHG. Average and its s.d. through the whole strains were found to be 28.51 ± 6.69 .

Range: The largest (22.75 mm³) was obtained in No. 3, which was the same as in cases of the maximum and the minimum of L/W, and the range of area of UHG, followed by No. 5 (20.39 mm³) and No. 9 (16.22 mm³). It was noted that the values were peculiarly large in Nos. 3 and 5. The smallest (7.42 mm³) was noted in No. 4, which was the same as in cases of the maxima of area and volume of UHG, the minimum of area of UHG, and the range of width, followed by No. 2 (9.74 mm³) and No. 11 (10.40 mm³). These combinations of strains were found to be the same as in case of the range of L/T. Average and its s.d. through the whole strains were found to be 13.56 ± 4.60 .

9. Area in husked grains

Maximum: The widest (17.40 mm²) was obtained in No. 5, which was the same as in cases of the maxima and the minima of both areas and volumes of UHG, and the range of length, followed by No. 9 (15.50 mm²) and No. 11 (14.16 mm²). It was noted that the value was peculiarly large in No. 5. These orders of strains were found to be the same as in cases of the maxima of area and volume of UHG, and the minimum of area of UHG. The narrowest (9.52 mm²) was noted in No. 4, which was the same as in cases of the maxima of area and volume of UHG, the minimum

of area of UHG, and the ranges of width and volume of UHG, followed by No. 3 (11.55 mm²) and No. 6 (11.99 mm²). It was noted that the value was peculiarly small in No. 4. These orders of strains were found to be the same as in cases of the maximum and the range of length. Average and its s.d. through the whole strains were found to be 13.32 ± 2.09 .

Minimum: The widest (12.54 mm²) was obtained in No. 5, which was the same as in cases of the maxima of areas of UHG and HG, and of volume of UHG, and the range of length, followed by No. 9 (11.60 mm²) and No. 11 (11.40 mm²). These orders of strains were found to be the same as in cases of the maxima of areas of UHG and HG, and of volume of UHG, and minimum of area of UHG. The narrowest (6.30 mm²) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness and W/T, the minima of width, thickness, W/T and volume of UHG, followed by No. 4 (8.00 mm²) and No. 7 (8.42 mm²). It was noted that the value was peculiarly small in No. 3. These combinations of strains were found to be the same as in cases of the maximum of thickness, the minima of area and volume of UHG. Moreover, these orders of strains were found to be the same as in cases of the maximum of thickness and the minimum of volume of UHG. Average and its s.d. through the whole strains were found to be 9.87 ± 1.81 .

Range: The largest (5.25 mm²) was obtained in No. 3, which was the same as in cases of the maximum and the minimum of L/W, and the ranges of area and volume of UHG, followed by No. 5 (4.86 mm²) and No. 8 (4.20 mm²). The smallest (1.52 mm²) was noted in No. 4, which was the same as in cases of the maxima of area and volume of UHG, and of area of HG, the minimum of area of UHG, and the range of width, followed by No. 6 (2.71 mm²) and No. 2 (2.72 mm²). It was noted that the value was peculiarly small in No. 4. Average and its s.d. through the whole strains were found to be 3.46 ± 1.08 .

10. Volume in husked grains

Maximum: The largest (28.95 mm³) was obtained in No. 5, which was the same as in cases of the maxima and the minima of area and volume of UHG, the maximum and the minimum of area of HG, and the range of length, followed by No. 11 (24.07 mm³) and No. 8 (23.66 mm³). It was noted that the value was peculiarly large in No. 5. The smallest (12.73 mm³) was noted in No. 4, which was the same as in cases of the maxima of areas of UHG and HG, and of volume of UHG, and the ranges of width, volume of UHG and area of HG, followed by No. 7 (18.35 mm³) and No. 3 (18.48 mm³). It was noted that the value was peculiarly small in No. 4. These combinations of strains were found to be the same as in cases of the maximum of thickness, the minima of areas of UHG and HG, and the minimum of volume of UHG. Moreover, these orders of strains were found to be the same as in case of the minimum of area of UHG. Average and its s.d. through the whole strains were found to be 21.47 ± 4.20 .

Minimum: The largest (19.44 mm³) was obtained in No. 5, which was the same as in cases of the maxima of areas and volumes of UHG and HG, the minima of areas of UHG and HG, the minimum of volume of UHG, and the range of length, followed by No. 11 (18.15 mm³) and No. 2 (17.98 mm³). In other words, No. 5 showed the largest values through the areas and volumes of UHG and HG. It was noted that the value was peculiarly large in No. 5. These combinations of strains were found to be the same as in case of the minimum of volume of UHG. The smallest (6.30 mm³) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness and W/T, the minima of width, thickness, W/T, volume of UHG and area of HG, followed by No. 4 (9.09 mm³) and No. 7 (10.10 mm³). It was noted that the value was peculiarly small in No. 3. These combinations of strains were found to be the same as in cases of the maxima of

thickness and volume of HG, and the minima of areas of UHG and HG and of volume of UHG. Moreover, these orders of strains were found to be the same as in cases of the minima of volume of UHG and of area of HG. Average and its s.d. through the whole strains were found to be 14.06 ± 4.14 .

Range: The largest (12.18 mm^3) was obtained in No. 3, which was the same as in cases of the maximum and the minimum of L/W, and the ranges of areas of UHG and HG and of volume of UHG, followed by No. 5 (9.51 mm^3) and No. 9 (8.85 mm^3). It was noted that the value was peculiarly large in No. 3. These orders of strains were found to be the same as in case of the range of volume of UHG. The smallest (4.59 mm^3) was noted in No. 2, followed by No. 6 (5.82 mm^3) and No. 1 (5.91 mm^3). Average and its s.d. through the whole strains were found to be 7.41 ± 2.48 .

11. Quotient in areas

Maximum: The largest (0.70) was obtained in No. 1, which was the same as in cases of the maxima of length and width, and the range of width, followed by Nos. 2 and 7 (0.64). It was noted that the value was peculiarly large in No. 1. These combinations of strains were found to be the same as in cases of the maximum and the minimum of width. The smallest (0.51) was noted in No. 3, which was the same as in cases of the maxima of length, thickness and W/T, and the minima of width, thickness, W/T, volumes of UHG and HG, and of area of HG, followed by Nos. 4 and 9 (0.59). It was noted that the value was peculiarly small in No. 3. These combinations of strains were found to be the same as in cases of the maxima of width and thickness. Average and its s.d. through the whole strains were found to be 0.62 ± 0.05 .

Minimum: The largest (0.58) was obtained in No. 7, which was the same as in cases of the maxima of L/T and W/T, the minima of width and W/T, and the ranges of L/T and W/T, followed by No. 1 (0.57) and No. 2 (0.56). These combinations of strains were found to be the same as in cases of the maximum and the minimum of width, and the maximum of quotient of areas. The smallest (0.43) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness, W/T and quotient of areas, the minima of width, thickness, W/T, areas of UHG and HG and volume of HG, followed by No. 5 (0.51). It was noted that the value was peculiarly small in No. 3. Average and its s.d. through the whole strains were found to be 0.53 ± 0.04 .

Range: The largest (0.13) was obtained in No. 1, which was the same as in cases of the maxima of length, width and quotient of areas, and range of width, followed by No. 3 (0.12) and No. 8 (0.10). The smallest (0.04) was noted in No. 4, which was the same as in cases of the maxima of areas and volumes of UHG and HG, the minimum of area of UHG, and ranges of width, volume of UHG and area of HG, followed by No. 7 (0.06) and No. 9 (0.07). Average and its s.d. through the whole strains were found to be 0.09 ± 0.03 .

12. Quotient in volumes

Maximum: The largest (0.63) was obtained in No. 1, which was the same as in cases of the maxima of length, width and quotient of areas, and ranges of width and quotient of areas, followed by No. 2 (0.59) and Nos. 7 and 10 (0.57). These combinations of strains were found to be the same as in cases of the maxima and the minima of width and quotient of areas. Moreover, these orders of strains were found to be the same as in case of the maximum of quotient of areas. The smallest (0.45) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness, W/T and quotient of areas, the minima of width, thickness, W/T, volumes of UHG

and HG, area of HG, and quotient of areas, followed by Nos. 6 and 9 (0.52). Average and its s.d. through the whole strains were found to be 0.55 ± 0.05 .

Minimum: The largest (0.51) was obtained in No. 1, which was the same as in cases of the maxima of length, width, quotients of areas and volumes, and the ranges of width and quotient of areas, followed by No. 2 (0.49) and No. 11 (0.48). The smallest (0.33) was noted in No. 3, which was the same as in cases of the maxima of length, width, thickness, W/T and quotient of areas, the minima of width, thickness, W/T, volumes of UHG and HG, area of HG, and quotient of areas, followed by No. 7 (0.41) and No. 9 (0.43). It was noted that the value was peculiarly small in No. 3. Average and its s.d. through the whole strains were found to be 0.45 ± 0.05 .

Range: The largest (0.16) was obtained in No. 7, which was the same as in cases of the maxima of L/T and W/T, the minima of width, W/T and quotient of areas, and the ranges of L/T and W/T, followed by Nos. 1 and 3 (0.12). It was noted that the value was peculiarly large in No. 7. The smallest (0.07) was noted in No. 4, which was the same as in cases of the maxima of areas and volumes of UHG and HG, the minimum of area of UHG, the ranges of width, volume of UHG, area of HG, and quotient of areas, followed by Nos. 6 and 11 (0.08). Average and its s.d. through the whole strains were found to be 0.10 ± 0.03 .

Discussion

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

Comparative values

1. In L/W, the largest (0.99) was obtained in No. 3. This value was attributable to the smallest value (0.70) in width. On the other hand, the smallest (0.81) was noted in No. 1. This value was attributable to the largest value (0.88) in width. In L/T, the largest (0.84) was obtained in No. 7. This value was attributable to nearly the smallest value (0.86) in thickness. On the other hand, the smallest (0.76) was noted in No. 5. This value was attributable to the smallest value (0.67) in length. In W/T, the largest (1.04) was obtained in No. 7. This value was attributable both to nearly the largest value (0.87) in width and nearly the smallest value (0.86) in thickness.

In quotient of areas, the largest (0.62) was obtained in No. 1. This value was attributable to nearly the smallest value (19.26 mm²) in UHG. On the other hand, the smallest (0.48) was noted in No. 3. This value was attributable to nearly the smallest value (9.91 mm²) in HG. In quotient of volumes, any background was not clearly found.

2. Though the values were peculiarly large or small in some characters, the values were found to be the standard level in the other cases on view of the same strains. For example, No. 11 showed nearly the largest value (0.89) in thickness, but showed the middle value (0.81) in width. In the other case, strain No. 9 showed nearly the smallest value (0.78) in width, but showed the middle value (0.70) in length.

In the wild rice collected in northeastern India⁴⁾, though the values were peculiarly large in some characters, the values were found to be very small in the other characters in view of the same strains, and *vice versa*. In the present materials, however, this tendency was not found at all. These differences may partly be attributed to the differences of materials used, and may be concluded as one of the geographical specificities.

In view of area and volume characters, the following facts were ascertained. In general, the larger is the value of one character, the larger is the value of another character.

3. In view of s.d., the following facts were ascertained to some extent. As the values of s.d. of comparative columns were relatively small, the consideration was here done only in area and volume columns. The larger is, in general, s.d. in some character, the larger is s.d. in another character. For example, No. 3 showed the largest s.d. (1.75) in area (UHG), and showed also the largest s.d. (5.01) in volume (UHG). Moreover, in general, the larger is the practical value, the larger is its s.d. For example, No. 5 showed the largest practical value (15.02 mm²) and the largest s.d. (1.11) in area (HG). Some exceptions, however, were found. No. 7 showed 16.77 mm² and 1.70 in the practical value and its s.d., respectively, in area (UHG). The former and the latter were looked upon as nearly the smallest and nearly the largest portions, respectively. These discrepancies may be expected to have something like evolutionary meanings. But it was left inexplicable in the present time.

4. In view of the species specificities, the following facts may appreciably be drawn from the data obtained in this experiment. In general, the extremely large values in area and volume characters were found only in *O. sativa* var. *spontanea*, but the extremely small values were found only in *O. perennis*. These findings proposed an interesting problem concerning species differentiations. The relatively larger values were found in *O. perennis* in view of width, L/T and L/W. However, further clear tendency was not found in comparative characters.

5. In the larger set of areas, the widest (27.02 mm² in UHG and 15.02 mm² in HG) were obtained in No. 5, followed by No. 9 (24.08 mm² and 13.25 mm² in the same order, and so forth) and No. 11 (22.28 mm² and 12.89 mm²). These orders were finally illustrated as $5 > 9 > 11$. These orders of strains were fixed to be the same as those both in UHG and HG. These phenomena were found in other 2 cases, i.e., $4 < 3 < 7$... No. 4 (8.84 mm² and 11.12 mm³), No. 3 (9.91 mm² and 12.79 mm³) and No. 7 (10.34 mm² and 14.21 mm³) in the smaller sets of area (HG) and volume (HG); $3 < 6 = 9$... No. 3 (0.48 and 0.40), Nos. 6 and 9 (0.55 and 0.48) in the smaller sets of quotients of areas and volumes. It may be noticeable that these synchronized orders of strains were found only in area and volume columns but not found in other columns.

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 its orders. Five cases were ascertained, i.e., ① $5 \cdot 9 \cdot 11$ in the larger sets ... area in UHG ($5 > 9 > 11$), volume in UHG ($5 > 11 > 9$) and area in HG ($5 > 9 > 11$); ② $3 \cdot 4 \cdot 7$ in the smaller sets ... thickness ($3 < 4 < 7$), volume in UHG ($4 < 7 < 3$), area in HG ($4 < 3 < 7$) and volume in HG ($4 < 3 < 7$); ③ $1 \cdot 2 \cdot 7$ in the larger sets ... width ($1 > 7 > 2$) and quotient of areas ($1 = 7 > 2$); ④ $3 \cdot 6 \cdot 9$ in the smaller sets ... width ($3 < 9 < 6$), quotient of areas ($3 < 6 = 9$) and quotient of volumes ($3 < 6 = 9$); ⑤ $2 \cdot 4 \cdot 6$ in the smaller sets ... s.d. of volume in UHG ($4 < 6 < 2$) and s.d. of area in HG ($4 < 2 < 6$).

Ranges

1. Though the values were peculiarly 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, strain No. 1 showed the peculiarly large value (0.96) in the maximum of width, but showed nearly the middle value (0.92) in the maximum of thickness. In the other case, No. 5 showed the smallest value (0.63) in the minimum of length, but showed nearly the middle value (0.79) in the minimum of width.

On the other hand, though the values were peculiarly large in some characters, the values were found to be peculiarly small in other characters in view of the same strains, and *vice versa*. For ex-

ample, strain No. 1 showed the peculiarly large value (0.15) in the range of width, but showed nearly the smallest value (0.07) in the range of thickness. In other example, No. 3 showed the smallest value (0.04) in the range of length, but showed the largest value (0.15) in the range of thickness. This phenomena were found in the several character combinations.

In view of area and volume characters, the following facts were ascertained. In general, the larger is the value of the maximum, the larger is the values of the minimum and the range. These tendency was looked upon as same as in case of comparative values. Some disorders, however, were found. For example, No. 11 showed nearly the largest values (24.80 mm², 45.60 mm³, 14.16 mm², 24.07 mm³, 0.63 and 0.56) in the maxima of area (UHG), volume (UHG), area (HG), volume (HG), quotient of areas and quotient of volumes, respectively, but showed nearly the smallest values (4.65 mm², 10.40 mm³, 2.76 mm², 5.92 mm³, 0.08 and 0.08) in the ranges of the characters in the same orders mentioned above, respectively. In other example, No. 3 showed the smallest or nearly the smallest values (14.62 mm², 19.01 mm³, 6.30 mm², 6.30 mm³, 0.43 and 0.33) in the minima of the characters in the same orders, respectively, but showed the largest or nearly the largest values (8.62 mm², 22.75 mm³, 5.25 mm², 12.18 mm³, 0.12 and 0.12) in the ranges of the characters in the same orders, respectively. These tendencies were looked upon as strain specificities of the respective ones.

2. In view of species specificities, the following fact may appreciably be drawn from the data obtained in this experiment. The extremely large values in the area and volume columns, in general, were found in *O. sativa* var. *spontanea* (=annual plant), but extremely small values in these columns were found in *O. perennis* (=perennial plant). It was noticeable that No. 5, collected in pond near Raipur, showed extremely the large values, and strain No. 4, collected in road-side ditch near Konarak, showed extremely smaller values in these columns, respectively. These findings proposed quite an interesting problem concerning the species differentiations. Species-geographical relations were, however, not ascertained in these strains, so far as the data obtained in the previous paper³⁾ and here were taken into account.

3. In the maximum of areas, the widest (30.56 mm² in UHG and 17.40 mm² in HG) were obtained in No. 5, followed by No. 9 (26.23 mm² and 15.50 mm² in the same order, and so forth) and No. 11 (24.80 mm² and 14.16 mm²). These orders of strains were finally illustrated as 5 > 9 > 11. These orders of strains were fixed to be the same as both in UHG and HG. These phenomena were found in other 5 cases, i.e., ① 5 > 9 > 11 ... No. 5 (23.76 mm² and 12.54 mm²), No. 9 (21.45 mm² and 11.60 mm²) and No. 11 (20.15 mm² and 11.40 mm²) in the minima of areas; ② 5 > 11 > 2 ... No. 5 (39.20 mm³ and 19.44 mm³), No. 11 (35.20 mm³ and 18.15 mm³) and No. 2 (32.63 mm³ and 17.98 mm³) in the minima of volumes; ③ 3 > 5 > 9 ... No. 3 (22.75 mm³ and 12.18 mm³), No. 5 (20.39 mm³ and 9.51 mm³) and No. 9 (16.22 mm³ and 8.85 mm³) in the ranges of volumes; ④ 4 < 7 < 1 ... No. 4 (17.01 mm² and 26.66 mm³), No. 7 (20.58 mm² and 33.30 mm³) and No. 1 (21.32 mm² and 40.49 mm³) in the maxima of areas and volumes in UHG; ⑤ 3 < 4 < 7 ... No. 3 (19.01 mm³ and 6.30 mm³), No. 4 (19.24 mm³ and 9.09 mm³) and No. 7 (19.79 mm³ and 10.10 mm³) in the minima of volumes. It may be noticeable that these synchronized orders of strains were clearly found only in area and volume columns, but not found in other columns. Then, it may be concluded that these strains were almost of the stable status in view of the genetic background, so far as these characters were concerned. In other words, *O. sativa* var. *spontanea* were fixed to have been advanced more than that of *O. perennis* in relatively larger values for the evolutionary viewpoints.

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 its orders. For example, in the maximum of W/T, the largest (1.23) was obtained in No. 7, followed by No. 1 (1.09) and No. 4 (1.02).

Finally, these combinations were illustrated as $7 > 1 > 4$. In the minimum of W/T, the largest (0.97) was obtained in No. 7, followed by No. 4 (0.92) and No. 1 (0.90). Finally these combinations were illustrated as $7 > 4 > 1$. These phenomena were found in the other 8 cases, *i.e.*, ① $1 \cdot 4 \cdot 8 \cdot 11 \cdots$ the larger sets of the minimum of length ($1 = 4 = 8 = 11$) and the range of L/W ($11 > 1 = 4 = 8$); ② $1 \cdot 2 \cdot 7 \cdots$ the larger sets of the maximum ($1 > 7 > 2$) and the minimum ($7 > 1 = 2$) of width, the larger sets of the maximum ($1 > 2 = 7$) and the minimum ($7 > 1 > 2$) of quotient of areas, and the larger set of the maximum ($1 > 2 > 7$) of quotient of volumes; ③ $5 \cdot 9 \cdot 11 \cdots$ the larger sets of the maximum ($5 > 9 > 11$) and the minimum ($5 > 9 > 11$) of area (UHG), the larger set of the maximum ($5 > 9 > 11$) of volume (UHG), and the larger sets of the maximum ($5 > 9 > 11$) and the minimum ($5 > 9 > 11$) of volume (HG); ④ $3 \cdot 4 \cdot 6 \cdots$ the smaller sets of the maximum ($3 < 6 < 4$) and the range ($3 = 4 = 6$) of length, and the smaller set of maximum ($4 < 3 < 6$) of area (HG); ⑤ $3 \cdot 4 \cdot 9 \cdots$ the smaller sets of the maxima of width ($3 < 9 < 4$), of thickness ($3 < 4 < 9$), and of quotient of areas ($3 < 4 = 9$); ⑥ $3 \cdot 6 \cdot 8 \cdots$ the smaller sets of the minima of width ($3 < 8 < 6$) and of W/T ($3 < 6 = 8$); ⑦ $3 \cdot 4 \cdot 7 \cdots$ the smaller sets of the maximum ($3 < 4 < 7$) of thickness, the minima of area (UHG) ($4 < 7 < 3$), volume (UHG), area (HG) ($3 < 4 < 7$), and of volume (HG) ($4 < 7 < 3$); ⑧ $2 \cdot 4 \cdot 11 \cdots$ the smaller sets of the ranges of L/T ($2 = 4 < 11$) and of volume (UHG) ($4 < 2 < 11$).

In stricter sense, it was worthy of attention that a few same orders or combinations were found in the characters of comparative columns. These characters were genetically expressed independently upon from each other. However, as the analyses and conclusions have left several points in question, further analysis may be performed sincerely.

Summary

In order to confirm the morphological characters of wild rice collected in the central India, comparison of the unhusked and husked grains for 12 characters and variations ranges also in the same 12 characters were investigated, following the previous papers. The main results obtained here were summarized as follows:

Comparative values of length, width, thickness, L/W, L/T and W/T were measured as 0.70, 0.82, 0.87, 0.86, 0.81 and 0.94 in average values, respectively. Area (UHG), volume (UHG), area (HG), volume (HG), quotient of areas and quotient of volumes were measured as 20.44 mm², 35.53 mm³, 11.69 mm², 17.81 mm³, 0.57 and 0.50 in average values, respectively. The maximum, the minimum and the range of the respective characters in the same orders mentioned above were ascertained as 0.73, 0.67, 0.06; 0.86, 0.78, 0.08; 0.92, 0.82, 0.10; 0.92, 0.79, 0.13; 0.88, 0.74, 0.14; 1.02, 0.87, 0.15; 23.27 mm², 17.84 mm², 5.44 mm²; 42.08 mm³, 28.51 mm³, 13.56 mm³; 13.32 mm², 9.87 mm², 3.46 mm²; 21.47 mm³, 14.06 mm³, 7.41 mm³; 0.62, 0.53, 0.09; 0.55, 0.45, 0.10 in average values, respectively.

Basing on the data obtained in these characters, several patterns were found as strain- or species-specificities.

In area and volume characters, the peculiarly large values were found mainly in *O. sativa* var. *spontanea* (=annual plant). However, these tendencies were not clearly found than those of the wild rice collected in the northeastern India. Strains showing relatively large or small values in the respective characters were tentatively picked-up and grouped into "order" and "combination". These new techniques were fixed to be useful for testing the strain or species differentiations.

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