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

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Abstract

In June and July of 1981, 29 strains of the cultivated rice species, *Oryza sativa* L., were collected and varietal variations in grain morphology were searched for.

Length, width, thickness, and ratios of length to width, of length to thickness and of width to thickness of unhusked grains were determined to be 9.03 mm, 2.90 mm, 2.07 mm, 3.15, 4.40 and 1.41 in strain level, respectively. Those of the husked grains were determined to be 6.45 mm, 2.43 mm, 1.84 mm, 2.69, 3.55 and 1.33 in the strain averages, respectively.

In accordance with the tripartite classification, 4 strains were ascertained to be a type B (= large or *javanica* type) and 25 strains a type C (= long or *indica* type).

Based on the data obtained in those characters, several patterns were fixed to be varietal variations and strain specificities. In comparison with the data obtained in the present and previous papers, ecotypic and varietal differentiations were discussed on the basis of the values ascertained in geographical localities.

Key Words: Cultivated Rice, Madura, Indonesia, Grain Morphology, Ecotypic Differentiation

Introduction

In June and July of 1981, the writer was in Indonesia for research on agricultural practices under a project, designated as "Ecological Biology and the Promotion of Tropical Primary Industry", supported by a grant from the Japanese Ministry of Education, Science and Culture. Rice cultivated in East Java was studied from several viewpoints. Observations were also made in Middle Java and Bali Islands for extensive comparison. The results obtained in East Java were briefly reported in a previous paper (KATAYAMA, 1983).

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KATAYAMA (1976) discussed the morphology of rice grains distributed in the islands of Indonesia, 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 cultivars of *Oryza sativa* L. are used in lowland and upland fields. Most of them were introduced from Java proper, Bali, India, the Philippines and elsewhere. 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 Island.

Accumulations of complete data on these aspects are unfortunately being for from perfect.

The present experimental series has been made to search for the varietal variations, taking these facts into considerations.

Materials and Methods

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

Thirty grains were used for each strain. Measurements were done for length, width and thickness of the unhusked grains and the husked grains at the largest points of the respective characters. Calculations were done for determining the ratios of length to width, of length to thickness, and of width to thickness.

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

Results

1. Lengths of UHG

The results are given in Table 2. In this table, 6 morphological characters of the unhusked grains are shown. Lengths of UHG for the individual grain level ranged from 10.65 mm (strain Nos. 8 and 10 in Table 1) to 7.45 mm (strain No. 1). In the strain level, the longest (10.07 mm) was obtained in strain No. 18, followed by No. 8 (10.06 mm) and No. 6 (9.91 mm). The shortest (7.69 mm) was noted in No. 1, followed by No. 13 (8.00 mm) and No. 24 (8.02 mm). It was noticeable that the value was particularly small in No. 1. Average and its s. d. through the whole strains (=29 strains) were found to be 9.03 $\pm$ 0.64. The s. d. of each strain, *i.e.*, showing the intra–population's varia-

Table 1. Locality and habitat of the cultivated rice, *Oryza sativa* L., collected in East Java

Collection No.	Date	Place	Detailed locality, habitat, local name and remarks
1	June 28	Galis	Swampy area, near *TAMBAK*.
2	June 29	Gapura	Breeding Station. So called C4.
3	July 2	Gandung	Rice terraces, dominant strain in their areas.
4	July 2	Camplon	Near seashore. Cultivating tobacco, corn and cassava in near farms.
5	July 4	Sampang	Southwest from Sampang. Well managed paddy field.
6	July 4	Sampang	Same locality as above. Near field growing *Miscanthus* sp.
7	July 4	Sampang	Same locality as above. Near pond.
8	July 4	Terenggi	South from Terenggi. Shallow water paddy field.
9	July 4	Terenggi	Same locality as above. Sporadically with No. 8. Long awn.
10	July 4	Terenggi	Same locality as above.
11	July 4	Terenggi	Same locality as above. Sporadically with No.10. Violet long awn.
12	July 4	Terenggi	Same locality as above.
13	July 4	Terenggi	Same locality as above. Red grain. Long awn.
14	July 5	Sampang	*TAMBAK* near Sampang. Red grain. Long awn.
15	July 5	Sampang	Same locality as above.
16	July 5	Kwanyar	Northwest from Kwanyar. Shallow water paddy field.
17	July 6	Bangkalan	*SAWAH TAMBAK*. Medical crop growing in near field.
18	July 6	Socah	Swampy field. Advanced strain growing in near field separated by embankment.
19	July 7	Tragar	Northwest from Kwanyar.
20	July 7	Tragar	Same locality as above.
21	July 7	Tragar	Same locality as above. Red grain.
22	July 7	Tragar	Same locality as above. Red grain.
23	July 7	Tragar	Same locality as above.
24	July 7	Burneh	Southwest from Burneh. Mixed growing with Nos. 25-27.
25	July 7	Burneh	Same locality as above.
26	July 7	Burneh	Same locality as above. Long awn.
27	July 7	Bruneh	Same locality as above.
28	July 14	Jenu	Shallow water paddy field. So called Niara. Black grain.
29	July 15	Lamongan	4 kilometers east from Lamongan. *TAMBAK*. Harvesting at premature stage.

Table 2. Some morphological characters of the unhusked grains

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
1	7.69±0.21	2.91±0.06	1.65±0.17	2.66±0.13	4.72±0.54	1.78±0.19
2	9.59±0.28	2.66±0.13	1.97±0.06	3.61±0.20	4.87±0.19	1.35±0.08
3	9.43±0.34	2.58±0.09	1.91±0.05	3.66±0.20	4.93±0.26	1.35±0.07
4	9.22±0.20	2.63±0.09	1.99±0.06	3.51±0.15	4.63±0.17	1.31±0.07
5	8.60±0.24	3.13±0.10	2.12±0.07	2.75±0.09	4.07±0.22	1.49±0.09
6	9.91±0.31	2.86±0.12	2.13±0.06	3.48±0.18	4.67±0.19	1.35±0.07
7	9.52±0.29	2.78±0.07	2.05±0.06	3.42±0.16	4.65±0.21	1.37±0.06
8	10.06±0.37	2.73±0.14	2.13±0.05	3.69±0.20	4.73±0.18	1.28±0.08
9	8.78±0.30	3.23±0.18	2.21±0.05	2.72±0.13	3.97±0.13	1.46±0.08
10	9.78±0.41	2.76±0.10	2.11±0.07	3.55±0.18	4.64±0.23	1.32±0.07
11	8.27±0.19	3.10±0.10	2.15±0.05	2.67±0.12	3.86±0.11	1.44±0.05
12	9.04±0.40	2.66±0.08	2.03±0.04	3.38±0.13	4.46±0.18	1.32±0.04
13	8.00±0.23	3.39±0.11	2.29±0.06	2.36±0.11	3.50±0.11	1.48±0.08
14	8.60±0.38	3.30±0.12	2.23±0.11	2.61±0.12	3.88±0.22	1.49±0.10
15	8.24±0.26	3.24±0.12	2.16±0.08	2.55±0.11	3.82±0.16	1.50±0.08
16	8.82±0.22	3.27±0.11	2.20±0.11	2.70±0.10	4.02±0.22	1.49±0.09
17	9.66±0.34	2.64±0.14	2.12±0.06	3.66±0.20	4.55±0.19	1.24±0.06
18	10.07±0.17	2.50±0.08	1.62±0.06	4.03±0.14	6.22±0.22	1.55±0.10
19	8.97±0.37	2.92±0.12	2.07±0.07	3.07±0.17	4.34±0.19	1.41±0.08
20	8.23±0.30	2.88±0.11	2.02±0.07	2.86±0.11	4.09±0.15	1.43±0.06
21	9.40±0.38	3.59±0.14	2.26±0.11	2.62±0.15	4.17±0.20	1.60±0.12
22	9.18±0.37	2.85±0.11	2.07±0.06	3.22±0.18	4.43±0.21	1.38±0.06
23	9.51±0.19	2.88±0.13	2.07±0.07	3.31±0.15	4.59±0.17	1.39±0.08
24	8.02±0.23	2.71±0.11	1.93±0.09	2.96±0.11	4.18±0.21	1.41±0.08
25	9.28±0.60	2.51±0.11	2.06±0.08	3.70±0.23	4.50±0.26	1.22±0.07
26	9.44±0.41	2.99±0.12	2.24±0.05	3.16±0.17	4.23±0.20	1.34±0.07
27	9.14±0.48	2.66±0.13	2.04±0.08	3.45±0.24	4.49±0.25	1.31±0.05
28	8.73±0.31	3.06±0.09	2.12±0.07	2.86±0.11	4.13±0.21	1.45±0.05
29	8.61±0.24	2.79±0.07	1.99±0.05	3.09±0.11	4.36±0.14	1.41±0.06

tions, obtained were found to be 0.31 ± 0.10.

2. Widths of UHG

Widths of UHG for the individual grain level ranged from 3.80 mm (No. 21) to 2.30 mm (No. 2). In the strain level, the widest (3.59 mm) was obtained in No. 21, followed by No. 13 (3.39 mm) and No. 14 (3.30 mm). The narrowest (2.50 mm) was noted in No. 18, which was the reversed results of L of UHG, followed by No. 25 (2.51 mm) and No. 3 (2.58 mm). The average and its s. d. through the whole strains were found to be 2.90 ± 0.28. S. d. of each strain were found to be 0.11 ± 0.03.

3. Thicknesses of UHG

Thicknesses of UHG for the individual grain level ranged from 2.45 mm (No. 16) to 1.40 mm (No. 1). The latter strain was the same as in the case of the L of UHG. In the strain level, the thickest (2.29 mm) was obtained in No. 13, followed by No. 21 (2.26 mm) and No. 26 (2.24 mm). The thinnest (1.62 mm) was noted in No. 18, which was the same as in the case of the W (UHG), followed by No. 1 (1.65 mm) and No. 3 (1.91 mm). The average and its s. d. through the whole strains were found to be 2.07 ± 0.15. S. d. of each strain were found to be 0.07 ± 0.03.

4. L/W of UHG

L/W of UHG for the individual grain level ranged from 4.33 (No. 18) to 2.23 (No. 13). In the strain level, the largest (4.03) was obtained in No. 18, which was the same as in the case of the L (UHG), followed by No. 25 (3.70) and No. 8 (3.69). The mallest (2.36) was noted in No. 13, followed by No. 15 (2.55) and No. 14 (2.61). The average and its s. d. through the whole strains were found to be 3.15 ±0.44. S. d. of each strain were found to be 0.15 ± 0.04.

5. L/T of UHG

L/T of UHG for the individual grain level ranged from 6.45 (No. 18) to 3.35 (No. 13). Both of the former and the latter strains were the same as in the cases of L/W (UHG). In the strain level, the largest (6.22) was obtained in No. 18, which was the same as in the cases of the L and L/W (UHG), followed by No. 3 (4.93) and No. 2 (4.87). It was noticed that the value was particularly large in No. 18. The smallest (3.50) was noted in No. 13, which was the same as in the case of L/W (UHG), followed by No. 15 (3.82) and No. 11 (3.86). The average and its s. d. through the whole strains were found to be 4.40 ± 0.48. S. d. of each strain were found to be 0.20 ± 0.07.

6. W/T of UHG

W/T of UHG for the individual grain level ranged from 2.07 (No. 1) to 1.07 (No. 8). In the strain level, the largest (1.78) was obtained in No. 1, followed by No. 21 (1.60) and No. 18 (1.55). The smallest (1.22) was noted in No. 25, followed by No. 17 (1.24) and No. 8 (1.28). The average and its s.d. through the whole strains were found to be 1.41 ± 0.11. S. d. of each strain were found to be 0.08 ± 0.03.

7. Lengths of HG

The results are given in Table 3. In this table, 6 morphological characters of the husked grains are shown. Lengths of HG for the individual grain level ranged from 7.75

Table 3. Some morphological characters of the husked grains

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
1	5.03±0.25	2.15±0.14	1.29±0.18	2.36±0.23	3.95±0.45	1.74±0.25
2	6.92±0.18	2.24±0.10	1.73±0.07	3.10±0.15	4.00±0.18	1.29±0.09
3	6.79±0.20	2.21±0.07	1.72±0.05	3.07±0.14	3.96±0.17	1.29±0.07
4	6.56±0.14	2.19±0.06	1.78±0.04	3.00±0.12	3.69±0.12	1.23±0.04
5	6.15±0.12	2.62±0.07	1.90±0.09	2.35±0.08	3.25±0.16	1.38±0.08
6	7.09±0.24	2.40±0.10	1.91±0.06	2.96±0.15	3.73±0.17	1.26±0.07
7	6.85±0.22	2.37±0.08	1.85±0.06	2.90±0.13	3.71±0.16	1.28±0.04
8	7.12±0.31	2.32±0.10	1.91±0.05	3.08±0.19	3.73±0.18	1.21±0.07
9	6.27±0.24	2.76±0.15	2.00±0.03	2.28±0.12	3.13±0.13	1.38±0.09
10	7.04±0.31	2.30±0.09	1.89±0.08	3.07±0.20	3.70±0.21	1.22±0.08
11	6.10±0.10	2.49±0.14	1.94±0.05	2.45±0.13	3.14±0.08	1.29±0.08
12	6.54±0.25	2.28±0.08	1.80±0.05	2.88±0.14	3.64±0.13	1.27±0.06
13	5.88±0.15	2.90±0.10	2.06±0.06	2.03±0.09	2.85±0.10	1.41±0.08
14	6.08±0.35	2.78±0.11	2.01±0.13	2.20±0.21	3.04±0.21	1.39±0.11
15	5.76±0.18	2.69±0.11	1.93±0.07	2.15+0.11	3.00±0.14	1.40±0.08
16	6.34±0.16	2.75±0.11	1.98±0.12	2.30±0.10	3.22±0.19	1.40±0.10
17	7.03±0.17	2.30±0.13	1.90±0.05	3.06±0.19	3.70±0.13	1.21±0.06
18	6.40±0.23	1.89±0.02	1.35±0.08	3.38±0.11	4.77±0.34	1.41±0.09
19	6.47±0.29	2,50±0.15	1.84±0.08	2.60±0.21	3.52±0.17	1.36±0.11
20	5.93±0.18	2.43±0.07	1.80±0.05	2.45±0.09	3.30±0.10	1.35±0.05
21	6.72±0.26	2.90±0.13	1.98±0.09	2.32±0.15	3.40±0.15	1.47±0.11
22	6.65±0.28	2.42±0.12	1.86±0.07	2.75±0.18	3.59±0.19	1.31±0.08
23	6.85±0.13	2.40±0.07	1.85±0.07	2.86±0.10	3.66±0.22	1.29±0.06
24	5.77±0.20	2.34±0.09	1.64±0.10	2.40±0.10	3.54±0.21	1.43±0.10
25	6.70±0.46	2.21±0.09	1.85±0.10	3.04±0.22	3.64±0.26	1.20±0.08
26	7.03±0.21	2.47±0.10	2.02±0.05	2.85±0.13	3.49±0.14	1.23±0.06
27	6.60±0.40	2.16±0.09	1.82±0.07	3.06±0.19	3.64±0.20	1.19±0.05
28	6.26±0.20	2.43±0.09	1.89±0.08	2.59±0.12	3.32±0.19	1.29±0.08
29	6.19±0.16	2.47±0.06	1.78±0.05	2.51±0.07	3.49±0.08	1.39±0.05

mm (No. 10) to 4.50 mm (No. 1). The former strain and the latter strain were the same as in the cases of L (UHG), and L and T (UHG), respectively. In the strain level, the longest (7.12 mm) was obtained in No. 8, followed by No. 6 (7.09 mm) and No. 10 (7.04 mm). The shortest (5.03 mm) was noted in No. 1, which was also the same as in the case of L (UHG), followed by No. 15 (5.76 mm) and No. 24 (5.77 mm). The average and its s. d. through the whole strains were found to be 6.45 ± 0.48. S. d. of each strain were found to be 0.23 ± 0.08.

8. Widths of HG

Widths of HG for the individual grain level ranged from 3.10 mm (No. 21) to 1.80 mm (No. 1). The former and the latter strains were the same as in the cases of the W (UHG), and L (UHG and HG) and T (UHG), respectively. In the strain level, the widest (2.90 mm) was obtained in Nos. 13 and 21, followed by No. 14 (2.78 mm). These combinations of strains (13 · 14 · 21) were found to be the same as in the case of the W (UHG). The narrowest (1.89 mm) was noted in No. 18, which was the same as in the cases of W and T (UHG), followed by No. 1 (2.15 mm) and No. 27 (2.16 mm). It was noticed that the value was particularly small in No. 18. The average and its s.d. through the whole strains were found to be 2.43 ± 0.24. S. d. of each strain were found to be 0.10 ± 0.03.

9. Thicknesses of HG

Thicknesses of HG for the individual grain level ranged from 2.25 mm (No. 16) to 1.10 mm (No. 1). The former and the latter strains were the same as in the cases of T (UHG), and L (UHG and HG), W (HG) and T (UHG), respectively. In the strain level, the thickest (2.06 mm) was obtained in No. 13, which was the same as in the case of T (UHG), followed by No. 26 (2.02 mm) and No. 14 (2.01 mm). The thinnest (1.29 mm) was noted in No. 1, which was the same as in the cases of the L (UHG and HG), followed by No. 18 (1.35 mm) and No. 24 (1.64 mm). The average and its s. d. through the whole strains were found to be 1.84 ±0.17. S. d. of each strain were found to be 0.07 ± 0.03.

10. L/W of HG

L/W of HG for the individual grain level ranged from 3.51 (No. 18) to 1.88 (No. 13). The both of the former and the latter strains were found to be the same as in the cases of L/W and L/T (UHG). In the strain level, the largest (3.38) was obtained in No. 18, which was the same as in cases of the L, L/W and L/T (UHG), followed by No. 2 (3.10) and No. 8 (3.08). It was noticed that the value of No. 18 was particularly large. The smallest (2.03) was noted in No. 13, which was the same as in the cases of the L/W (UHG) and L/T (UHG), followed by No. 15 (2.15) and No. 14 (2.20). These orders of strains (13 < 15 <14) were found to be the same as in the case of the L/W (UHG). The average and its s. d. through the whole strains were found to be 2.69 ± 0.36. S. d. of each strain were found to be 0.14 ± 0.05.

11. L/T of HG

L/T of HG for the individual grain level ranged from 5.42 (No. 18) to 2.57 (No. 28).

The former strain was found to be the same as in the cases of L/W (UHG and HG) and L/T (UHG). In the strain level, the largest (4.77) was obtained in No. 18, which was the same as in the cases of the L (UHG), L/W (UHG and HG) and L/T (UHG), followed by No. 2 (4.00) and No. 3 (3.96). These orders of strains ($18 > 3 > 2$) were found to be the same as in the case of L/T of UHG. The smallest (2.85) was noted in No. 13, which was the same as in the cases of L/W (UHG and HG) and L/T (UHG), followed by No. 15 (3.00) and No. 14 (3.04). These orders of strains ($13 < 15 < 14$) were found to be the same as in the cases of the L/W (UHG and HG). The average and its s. d. through the whole strains were found to be 3.55 ± 0.37. S. d. of each strain were found to be 0.18 ± 0.07.

12. W/T of HG

W/T of HG for the individual grain level ranged from 2.00 (No. 1) to 1.00 (No. 8). Both of the former and the latter strains were found to be the same as in the case of W/T (UHG). In the strain level, the largest (1.74) was obtained in No. 1, which was the same as in the case of the W/T (UHG), followed by No. 21 (1.47) and No. 24 (1.43). The smallest (1.19) was noted in No. 27, followed by No. 25 (1.20) and Nos. 8 and 17 (1.21). The average and its s. d. through the whole strains were found to be 1.33 ± 0.11. S. d. of each strain were found to be 0.08 ± 0.04.

Discussion

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

1. According to the tripartite classification noted by MATSUO (MATSUO, 1952), the strains used here can be divided into two groups; type B (= large or *javanica* type) --- 4 strains (13.8% of the whole strains), *i.e.*, strain Nos. 9, 14, 16 and 21, type C (= slender or *indica* type) --- 25 strains (86.2% of the whole strains), the remaining strains, type A (= short or *japonica* type) --- none (Fig. 1). Strains collected by the field survey in India (KATAYAMA, 1981) were classified into type A (0% in Group A, 8% in Group B and 5% in the whole groups), type B (22% in Group A, 25% in Group B and 24% in the whole groups) and type C (78% in Group A, 67% in Group B and 71% in the whole groups), respectively. Sikkimese strains showed a large number of type A grains (KATAYAMA, 1974). Strains collected in Nepal were classified into A, B and C types, with the ratios 29%, 11% and 60%, respectively (KURODA and WATABE, 1973). Strains collected in the higher elevations of NEFA (Assam region) resembled to the *japonica* type (= type A) in view of many characters (SHARMA *et al.*, 1971). Strains delivered from Chinsurah, West Bengal, India, were classified into type A (0% in Group A, 2% in Group B and 1% in the whole groups), type B (2% in Group A, 54% in Group B and 28% in the whole groups) and type C (98% in Group A, 44% in Group B and 71% in the whole groups) (KATAYAMA, 1985a). Strains collected in Burma were

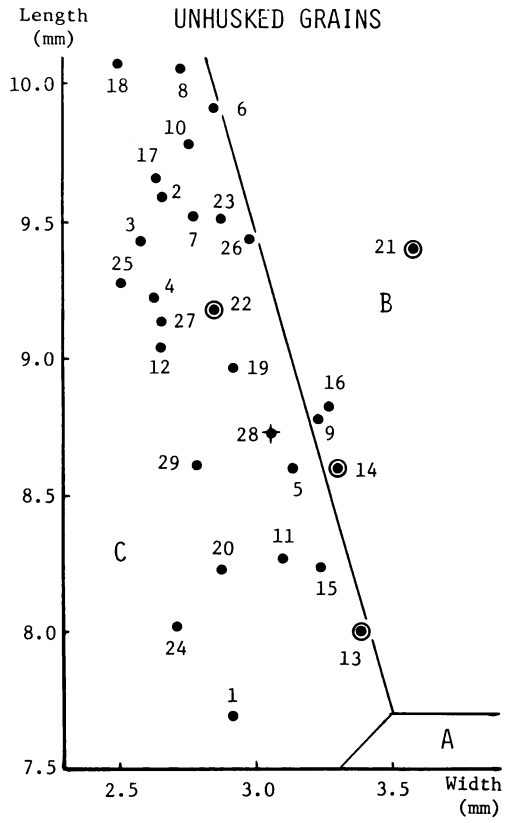

Fig. 1. Relation between length and width of unhusked grains in mm. Vertical axis; length of grain, abscissa; width of grain. Code numbers used in figure correspond to the strain number, which was used in Table 1. ◉; Red grain, ✦; black grain, ●; white grain.

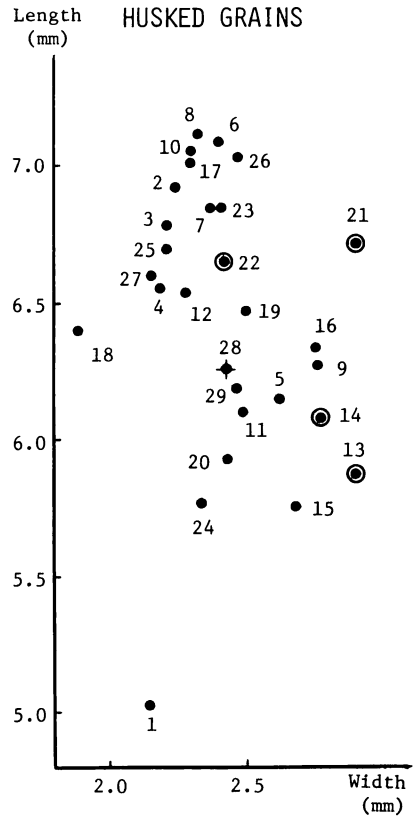

Fig. 2. Relation between length and width of husked grains in mm. Vertical axis; length of grain, abscissa; width of grain. Code numbers used in figure correspond to the strain number, which was used in Table 1. ◉; Red grain, ✦; black grain, ●; white grain.

classified into type B (20%) and type C (80%) (KATAYAMA, 1985b).

Strains collected in the whole of Indonesia were classified into type A – – – 10 strains (4.5%), type B – – – 59 strains (26.0%), and type C – – – 158 strains (69.6%) (NAKAGAMA, 1977). In comparison with the present and the past data in view of strain differentiations, the following facts were ascertained. i) Lengths of the present materials were remarkably longer than that of the whole Indonesia. ii) Widths of the present materials were remarkably narrower than that of the whole Indonesia. iii) Thicknesses of the present materials were nearly the same with that of the whole Indonesia. iv) Variations of length in the present materials were clearly smaller than that of the whole Indonesia. v) Variations of width and thickness in the present materials were nearly the same with that of the whole Indonesia.

In comparison with the data of the whole of Indonesia, the materials of the present study would be located in the portions relatively slender and narrower variations.

2. The variations found in the whole of strains (=29) in view of the strain level were recognized quite large, though they were comparatively smaller than those of the strains obtained in all of Indonesia, *i.e.*, L (10.07 mm in the maximum, 7.69 mm in the minimum and 2.38 mm in the difference), W (3.59 mm, 2.50 mm, 1.09 mm in the same order as above), T (2.29 mm, 1.62 mm, 0.67 mm), L/W (4.03, 2.36, 1.67), L/T (6.22, 3.50, 2.72), W/T (1.78, 1.22, 0.56).

3. Owing to the comparative studies carried out in type A, type B and type C in accordance with the tripartite classification, the following facts were ascertaind. In type A, no strain showed anything. Average values and their s. d. through the whole strains of the respective types were found to be as follows; L of UHG (8.90 ± 0.30 in type B, 9.05 ± 0.67 in type C and 9.03 ±0.64 in the whole strains of both of the types), W of UHG (3.35 ± 0.14, 2.83 ± 0.22 and 2.90 ± 0.28 in the same order), T of UHG (2.23 ± 0.03, 2.04 ± 0.15 and 2.07 ± 0.15), L/W of UHG (2.66 ± 0.45, 3.23 ± 0.42 and 3.15 ± 0.44), L/T of UHG (4.01 ± 0.11, 4.47 ± 0.49 and 4.40 ± 0.48), W/T of UHG (1.51 ± 0.05, 1.40 ± 0.11 and 1.41 ± 0.11), L of HG (6.35 ± 0.23, 6.47 ± 0.51 and 6.45 ± 0.48), W of HG (2.80 ± 0.06, 2.37 ± 0.20 and 2.43 ± 0.24), T of HG (1.99 ± 0.01, 1.81 ± 0.17 and 1.84 ± 0.17), L/W of HG (2.28 ± 0.46, 2.76 ± 0.34 and 2.69 ± 0.36), L/T of HG (3.20 ± 0.13, 3.60 ± 0.37 and 3.55 ± 0.37), W/T of HG (1.41 ± 0.04, 1.32 ± 0.11 and 1.33 ± 0.11), respectively.

In type B, the average values in W, T and W/T (UHG and HG) were found to be larger than the average of the whole materials; the values of L, L/W and L/T (UHG and HG) were found to be the smaller than the average of the whole strains. Type C showed the quite reversed results with that of the type B.

4. A lot of attempts were made for classifying the materials of cultivated rice species in accordance with the data obtained in grain morphology. Especially tripartite classification has been adopted in many investigations. However, it was only for the UHG that it was applied. For the HG, these is no standard method for classification. So, it was attempted for the first time in the present experiment (Fig. 2). Clear tendency was not ascertained here at the present time. As the analysis and conclusion have left several points in questions, further analyses are to be performed sincerely using the larger number of materials, distributing in whole of the world.

5. In previous papers (KATAYAMA, 1985a, 1985b), 7 and 3 sets of strains in the larger and the smaller values were fixed to be in same orders of strain numbers in Chinsurah and Burma, respectively. In the present experiment, in the smaller sets of values, the smallest ones (2.36 in L/W of UHG, 2.03 in L/W of HG and 2.85 in L/T of HG), were found in No. 13, followed by No. 15 (2.55 in L/W of UHG, 2.15 in L/W of HG and 3.00 in L/T of HG) and No. 14 (2.61 in L/W of UHG, 2.20 in L/W of HG and 3.04 in L/T of HG). These orders of strains were finally illustrated in these three characters as $13 < 15 < 14$. These phenomena were found only in one case mentioned above. This fact might reasonably be regarded as a group specificity in Madura rice varieties.

On the other hand, some sets of strains did not show the same strain orders, but

showed the same strain–combination–numbers, which meant the same strain numbers regardless of its orders. For example, in W of UHG, the widest (3.59 mm) was obtained in No. 21, followed by No. 13 (3.39 mm) and No. 14 (3.30 mm). These combinations of strains were finally illustrated as 21 > 13 > 14. In W of HG, the widest (2.90 mm) was obtained in Nos. 13 and 21, followed by No. 14 (2.78 mm). These combinations of strains were finally illustrated as 13 = 21 >14. These combinations of strains were fixed to be the same as in W of UHG and HG, and illustrated as 13 · 14 · 21. These combinations of strains were after all constituted only 2 characters. These phenomena were found in 1 other case, *i.e.*, ② 2 · 3 · 18 in the larger sets of L/T in UHG (18 > 3 > 2) and L/T in HG (18 > 2 > 3).

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