Mem. Fac. Agr. Kagoshima Univ., **21**, 17–34, 1985

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

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Received for Publication August 29, 1984

Introduction

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

In the station, many strains of the cultivated rice, *Oryza sativa* L., were collected and studied in view of breeding programme. On the other hand, they were not used for morphological characters. For genetic and breeding purposes, however, varietal variations and the methodologies of them should be ascertained as early as possible.

Taking these facts into account, the author made a trial to accomplish the work, the aim of which was to clarify the varietal variation and the phylogenetic relationships of cultivated-rice-strains (=cultivars), using the relatively primitive and un-advanced ones in India in the previous experimental series. The present experimental series was made to search the varietal variations using the relatively advanced cultivars in India, taking these facts into consideration.

Since 1969, a new strain "Padma" was widely recommended in the several states of India as one part of the high yielding programme[1]. High yielding strains had been recommended in several countries including India. However, it was not possible for them to obtain the exclusive possesion of the whole rice strains because of the economic and technical problems. So, the primitive strains and/or so-called native varieties have been kept in use for a long period. In the field survey, many strains cultivated in the paddy field were directly collected and morphologically studied[3]. It seems to be very important in view of the varietal variations to compare the materials collected in the field[3] and the present materials.

The author is most grateful to Dr. S. Biswas, Rice Research Station, Chinsurah, West Bengal, India, who helped to accomplish his work.

Materials and Methods

One hundred strains of rice cultivars were used in this experiment. They are listed up in Table 1. In this table, collection No., Chinsurah Genetic Stock No. and place of collection (=original

Table 1. List of cultivated rice strains transferred from Rice Research Station, Chinsurah, West Bengal, India

Collection No.	Chinsurah Genetic Stock No.	Local name	Place of collection	Remarks
1	259Nc	Bhasamanik	Birbhum	Aman
2	258Nc	Bubraj II	〃	〃
3	256Nc	Balammota	〃	〃
4	255Nc	Dudkalma (Choto)	〃	〃
5	254Nc	Dadkhani	〃	〃
6	253Nc	Sarubachi	〃	〃
7	252Nc	Laksmisail	Purulia	〃
8	251Nc	Kakursail	〃	〃
9	250Nc	Chburashi	〃	〃
10	249Nc	Dadisail	〃	〃
11	248Nc	Jhulur	〃	〃
12	246Nc	Lakhansail	〃	〃
13	245Nc	Sundarmukhi-2	Birbhum	〃
14	244Nc	Katke	〃	〃
15	243Nc	Sundamukhi	〃	〃
16	242Nc	Sarudhan	〃	〃
17	241Nc	Bhasamanik	〃	〃
18	240Nc	Lalaus	〃	〃
19	239Nc	Dubraj	〃	〃
20	203Nc	Pankhe	Nadia	〃
21	202Nc	Sathi 34–36	〃	〃
22	201Nc	Chinaboro	〃	〃
23	186Nc	Jugol	〃	〃
24	287Nc	Manikkalma	Bankura	〃
25	286Nc	Nagrasail-III	〃	〃
26	285Nc	Kelash	〃	〃
27	284Nc	Chumakati	〃	〃
28	283Nc	Kalamkati	〃	〃
29	282Nc	Madhumalati	〃	〃
30	291Nc	Karticsail	〃	〃
31	280Nc	Nona	〃	〃
32	216Nc	Sungkalma	Birbhum	〃
33	262Nc	Sarunagra	〃	〃
34	263Nc	Laghu	〃	〃
35	264Nc	Dakhinkalma	〃	〃
36	265Nc	Suiakalma	〃	〃
37	266Nc	Assam Aus	〃	〃
38	267Nc	Daharnagra	〃	〃
39	268Nc	Geri Jhingasail	Bakura	〃
40	269Nc	Ourapati	〃	〃
41	273Nc	Sankarkalma	〃	〃
42	272Nc	Nagrasail-I	〃	〃
43	279Nc	Laksmichurah	〃	〃

Table 1. (Continued)

Collection No.	Chinsurah Genetic Stock No.	Local name	Place of collection	Remarks
44	271Nc	Hiramoti	Bakura	Aman
45	278Nc	Sarunagra	〃	〃
46	277Nc	Bhasamanik	〃	〃
47	276Nc	Nabannasail	〃	〃
48	275Nc	Sindurmukhi	〃	〃
49	274Nc	Rupsail	〃	〃
50	270Nc	Boro	〃	〃
51	10069	Jagal	Murshidabad	Aus
52	10058	Gohamabhadri	〃	〃
53	10065	Hejili	〃	〃
54	10064	Hijll	Nadia	〃
55	10063	Harimuda	Murshidabad	〃
56	10057	Foku Bozu	Japan	〃
57	10061	Haribhog	Nadia	〃
58	10068	Jabrokachi	W. Dinajpur	〃
59	10054	Dhupsail	Murshidabad	〃
60	10053	Dhenga	Malda	〃
61	10060	Hakamburi	Japan	〃
62	10056	Fepri	〃	〃
63	10051	Dhairal	Nadia	〃
64	10052	Dheuga	〃	〃
65	10050	Dena	W. Dinajpur	〃
66	10035	Chikan	〃	〃
67	10041	CR–1–45	CRRI*	〃
68	10034	Chandramukhi	Nadia	〃
69	10036	Chitta	Murshidabad	〃
70	10037	Chotasani	Jalpaiguri	〃
71	10032	Chandramani	Nadia	〃
72	10033	Chandramani	〃	〃
73	10040	C. R. –2	CRRI*	〃
74	10042	CR–1–189	〃	〃
75	10028	C. H. 45	Burdwan	〃
76	10030	Chakjamri	〃	〃
77	10029	Chakjamri	Nadia	〃
78	10027	C. H. 4	〃	〃
79	10043	CR–1–1904	CRRI*	〃
80	10044	CR–2–32	〃	〃
81	10045	CR–2–50	〃	〃
82	10031	Chandrakona	Panganas	〃
83	10046	CR–IV–6	CRRI*	〃
84	10047	CR–V–91	〃	〃
85	10048	Dahi	Midnapure	〃
86	10049	Dani	Malda	〃
87	10039	Dr. Chamme-199	〃	〃

Table 1. (Continued)

Collection No.	Chinsurah Gentic Stock No.	Local name	Place of collection	Remarks
88	10013	Baktulsi	Hooghly	Aus
89	10012	Baktulsi	Nadia	〃
90	10015	Bansmugur	〃	〃
91	10014	Banchi	〃	〃
92	10022	Bhutkalmi	Murshidabad	〃
93	10026	Borosani	Jalpaiguri	〃
94	10024	Black Dumra	〃	〃
95	10020	Benamuri	Nadia	〃
96	10023	Bhutmuri	Midnapure	〃
97	10019	Benajhuti	〃	〃
98	10017	Berdhana	〃	〃
99	10018	Berdhana	〃	〃
100	10016	Berdhana	Murshidabad	〃

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place) are mentioned. They have different meanings in view of physiological characters, *i.e.*, *aman* and *aus*, and should be separately considered also in morphological studies. Accordingly, they are divided into two groups in the present experimental series, *i.e.*, Group A — *aman* varieties (strain Nos. 1–50), Group B — *aus* varieties (strain Nos. 51–100). In these materials, high yielding varieties, such as Padma, Katika, Kalamdan, Basmati, BR34, IR-numbered, are not included.

Measurements were done for length, width and thickness of the unhusked and the husked grains. Thirty grains were used for the measurements. The measurements were done at the largest portion 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; 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 the unhusked grains

Group A: The results are given in Table 2. Lengths for the individual grain level ranged from 10.85 mm (strain Nos. 6 and 8) to 5.75 mm (No. 29). In the strain level, the longest (10.50 mm) was obtained in No. 6, followed by No. 25 (10.12 mm) and No. 28 (10.10 mm). It was noticeable that No. 6 showed very large value. The shortest (6.19 mm) was noted in No. 29, followed by No. 22 (7.60 mm) and No. 50 (7.67 mm). It was noticeable that No. 29 showed very small value. Average and its s.d. through the whole strains were found to be 8.96 ± 0.77. The s.d. of each strain, *i.e.*, showing intra-population's variations, obtained were found to be 0.25 ± 0.06.

Group B: Lengths for the individual grain level ranged from 10.30 mm (Nos. 89 and 92) to 6.80 mm (No. 94). In the strain level, the longest (9.69 mm) was obtained in No. 100, followed by No. 92 (9.63 mm) and No. 89 (9.60 mm). The shortest (7.34 mm) was noted in No. 87, followed by

Table 2. Some morphological characters of unhusked grains

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
1	8.92±0.27	2.62±0.12	2.11±0.06	3.41±0.19	4.23±0.17	1.24±0.07
2	9.06±0.30	2.88±0.11	2.16±0.07	3.15±0.14	4.19±0.17	1.34±0.07
3	9.56±0.22	2.77±0.09	2.10±0.05	3.46±0.12	4.55±0.16	1.32±0.06
4	9.21±0.21	2.59±0.12	2.01±0.07	3.57±0.21	4.59±0.12	1.29±0.09
5	8.52±0.22	2.31±0.10	1.91±0.06	3.70±0.18	4.47±0.14	1.21±0.06
6	10.50±0.20	2.36±0.13	1.93±0.12	4.46±0.25	5.48±0.36	1.23±0.12
7	9.17±0.29	2.74±0.13	2.01±0.08	3.36±0.19	4.57±0.19	1.36±0.09
8	10.02±0.42	2.70±0.11	2.02±0.11	3.73±0.24	4.96±0.23	1.34±0.12
9	9.27±0.17	2.56±0.11	2.04±0.07	3.63±0.17	4.56±0.15	1.26±0.07
10	10.00±0.38	2.72±0.08	2.04±0.06	3.69±0.16	4.91±0.22	1.34±0.06
11	9.00±0.25	2.69±0.09	1.95±0.09	3.35±0.17	4.61±0.24	1.39±0.08
12	9.20±0.33	2.65±0.11	2.01±0.08	3.48±0.15	4.58±0.21	1.32±0.07
13	9.78±0.33	2.77±0.10	2.09±0.05	3.53±0.18	4.67±0.13	1.33±0.06
14	9.15±0.31	2.80±0.09	2.10±0.05	3.28±0.14	4.37±0.18	1.34±0.06
15	8.74±0.28	2.60±0.12	1.96±0.10	3.37±0.19	4.48±0.21	1.33±0.17
16	8.92±0.33	2.29±0.06	1.96±0.06	3.89±0.17	4.55±0.16	1.17±0.04
17	8.98±0.24	2.34±0.09	1.97±0.08	3.84±0.14	4.57±0.20	1.19±0.06
18	8.63±0.23	2.94±0.07	2.13±0.08	2.94±0.10	4.05±0.14	1.38±0.07
19	8.92±0.24	2.88±0.08	2.15±0.06	3.10±0.09	4.15±0.14	1.34±0.06
20	7.81±0.28	2.88±0.09	1.95±0.07	2.72±0.12	4.01±0.15	1.48±0.08
21	8.87±0.24	3.32±0.14	2.25±0.06	2.68±0.13	3.95±0.14	1.48±0.09
22	7.60±0.20	3.11±0.11	2.09±0.07	2.45±0.12	3.64±0.13	1.49±0.08
23	8.47±0.24	2.94±0.08	2.05±0.07	2.88±0.11	4.14±0.19	1.44±0.06
24	9.21±0.29	2.79±0.07	2.16±0.07	3.31±0.15	4.27±0.16	1.29±0.07
25	10.12±0.29	2.54±0.08	2.10±0.07	3.99±0.16	4.83±0.19	1.21±0.06
26	8.19±0.13	2.75±0.06	2.05±0.10	2.99±0.07	4.01±0.25	1.34±0.09
27	8.20±0.18	2.85±0.09	2.09±0.07	2.88±0.11	3.92±0.14	1.36±0.07
28	10.10±0.23	2.33±0.05	2.04±0.06	4.34±0.11	4.95±0.19	1.14±0.04
29	6.19±0.22	1.95±0.07	1.78±0.04	3.18±0.14	3.49±0.16	1.10±0.04
30	8.37±0.26	2.49±0.09	1.96±0.07	3.36±0.16	4.27±0.18	1.27±0.07
31	8.79±0.20	2.69±0.11	2.04±0.06	3.26±0.15	4.31±0.15	1.32±0.06
32	8.55±0.23	2.72±0.11	2.00±0.06	3.16±0.17	4.28±0.13	1.36±0.08
33	8.85±0.25	2.32±0.10	2.00±0.05	3.82±0.19	4.44±0.13	1.16±0.06
34	8.25±0.22	2.33±0.06	2.01±0.04	3.55±0.08	4.11±0.10	1.16±0.03
35	10.06±0.34	2.62±0.11	1.92±0.07	3.85±0.21	5.23±0.20	1.37±0.09
36	9.85±0.27	2.64±0.13	2.04±0.05	3.74±0.23	4.82±0.17	1.30±0.07
37	8.80±0.18	2.69±0.10	2.08±0.07	3.27±0.14	4.23±0.15	1.30±0.07
38	9.82±0.23	2.61±0.08	2.08±0.08	3.77±0.14	4.73±0.16	1.26±0.06
39	8.98±0.26	2.44±0.10	2.03±0.05	3.69±0.20	4.43±0.14	1.21±0.06
40	8.32±0.20	2.13±0.07	1.87±0.05	3.92±0.13	4.45±0.14	1.14±0.04
41	9.13±0.20	2.64±0.10	2.08±0.05	3.47±0.12	4.39±0.11	1.27±0.05
42	9.74±0.33	2.54±0.08	2.07±0.06	3.84±0.18	4.71±0.19	1.23±0.05
43	8.39±0.17	2.85±0.09	2.13±0.06	2.94±0.11	3.95±0.13	1.34±0.06
44	8.37±0.18	2.75±0.08	2.09±0.06	3.05±0.10	4.01±0.12	1.32±0.06
45	9.21±0.28	2.39±0.11	2.02±0.05	3.86±0.20	4.56±0.18	1.18±0.05

Table 2. (Continued)

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
46	9.24±0.22	2.43±0.09	2.06±0.04	3.82±0.12	4.48±0.14	1.18±0.05
47	9.02±0.23	2.38±0.08	2.01±0.06	3.80±0.16	4.49±0.15	1.18±0.05
48	8.77±0.24	2.99±0.11	2.14±0.08	2.94±0.13	4.13±0.20	1.40±0.08
49	9.28±0.30	2.48±0.10	2.04±0.07	3.76±0.22	4.55±0.17	1.22±0.07
50	7.67±0.28	2.65±0.11	2.03±0.06	2.92±0.14	3.79±0.15	1.31±0.08
51	8.59±0.32	3.61±0.14	2.41±0.08	2 38±0.13	3.56±0.20	1.51±0.09
52	8.51±0.29	3.45±0.08	2.34±0.07	2.47±0.09	3.64±0.14	1.48±0.05
53	8.96±0.33	3.24±0.10	2.23±0.08	2.77±0.10	4.02±0.18	1.46±0.07
54	8.93±0.30	3.21±0.08	2.22±0.05	2.78±0.09	4.02±0.15	1.45±0.05
55	8.94±0.21	3.65±0.17	2.49±0.07	2.46±0.10	3.59±0.14	1.47±0.09
56	7.55±0.22	3.44±0.11	2.32±0.09	2.20±0.07	3.26±0.15	1.48±0.08
57	9.01±0.33	3.15±0.12	2.21±0.06	2.87±0.12	4.09±0.19	1.43±0.07
58	8.61±0.32	3.58±0.11	2.42±0.09	2.40±0.12	3.56±0.14	1.48±0.08
59	9.09±0.27	3.54±0.13	2.34±0.08	2.57±0.11	3.90±0.19	1.52±0.09
60	8.98±0.25	3.50±0.13	2.34±0.08	2.57±0.09	3.84±0.19	1.49±0.07
61	8.84±0.16	3.04±0.09	2.16±0.06	2.91±0.09	4.09±0.12	1.41±0.06
62	8.84±0.22	3.11±0.09	2.18±0.07	2.85±0.09	4.06±0.17	1.43±0.05
63	8.48±0.19	3.16±0.10	2.19±0.06	2.70±0.09	3.87±0.12	1.44±0.06
64	8.59±0.22	3.48±0.12	2.20±0.06	2.47±0.09	3.90±0.15	1.58±0.08
65	8.64±0.31	3.12±0.12	2.23±0.07	2.77±0.16	3.87±0.16	1.41±0.07
66	8.41±0.28	2.69±0.09	1.96±0.05	3.13±0.14	4.29±0.12	1.37±0.06
67	8.20±0.25	3.69±0.12	2.29±0.08	2.22±0.07	3.59±0.15	1.62±0.06
68	8.57±0.21	3.14±0.10	2.23±0.06	2.73±0.10	3.86±0.15	1.41±0.07
69	8.81±0.22	3.78±0.12	2.37±0.11	2.33±0.07	3.72±0.14	1.60±0.08
70	8.10±0.26	2.94±0.08	2.04±0.08	2.76±0.13	3.97±0.20	1.44±0.06
71	8.91±0.21	2.77±0.08	2.07±0.06	3.22±0.10	4.29±0.16	1.34±0.06
72	8.52±0.24	2.99±0.10	2.08±0.07	2.85±0.11	4.10±0.14	1.44±0.07
73	9.13±0.25	3.32±0.10	2.25±0.06	2.75±0.11	4.06±0.09	1.48±0.06
74	8.00±0.15	3.65±0.13	2.31±0.10	2.20±0.07	3.47±0.15	1.58±0.09
75	8.56±0.24	2.84±0.08	2.18±0.08	3.02±0.13	3.91±0.20	1.30±0.07
76	8.82±0.25	3.24±0.13	2.22±0.05	2.73±0.11	3.98±0.15	1.46±0.06
77	8.21±0.20	2.78±0.10	1.97±0.06	2.96±0.11	4.17±0.17	1.41±0.07
78	8.46±0.18	3.04±0.09	2.06±0.08	2.79±0.10	4.13±0.15	1.48±0.09
79	7.84±0.23	3.50±0.14	2.27±0.12	2.24±0.08	3.46±0.20	1.54±0.09
80	8.60±0.29	3.55±0.08	2.26±0.07	2.42±0.10	3.80±0.15	1.57±0.06
81	7.85±0.20	3.53±0.12	2.29±0.08	2.23±0.11	3.44±0.14	1.54±0.07
82	8.89±0.23	3.23±0.08	2.16±0.05	2.75±0.10	4.12±0.11	1.50±0.05
83	8.22±0.28	3.23±0.14	2.12±0.09	2.56±0.14	3.89±0.20	1.53±0.11
84	7.94±0.24	3.56±0.16	2.35±0.10	2.23±0.14	3.39±0.15	1.52±0.10
85	9.21±0.29	3.36±0.14	2.25±0.05	2.75±0.13	4.10±0.14	1.50±0.06
86	7.74±0.27	2.72±0.12	1.95±0.07	2.85±0.11	3.97±0.16	1.39±0.08
87	7.34±0.25	3.09±0.10	2.07±0.06	2.38±0.08	3.55±0.16	1.49±0.06
88	8.13±0.36	3.09±0.11	2.02±0.05	2.64±0.12	4.03±0.20	1.53±0.07
89	9.60±0.41	2.79±0.13	2.15±0.05	3.45±0.16	4.46±0.21	1.30±0.07
90	8.54±0.25	3.76±0.12	2.35±0.12	2.27±0.09	3.64±0.20	1.61±0.09

Table 2. (Continued)

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
91	7.92±0.36	3.50±0.13	2.32±0.09	2.26±0.10	3.41±0.14	1.51±0.07
92	9.63±0.36	3.32±0.13	2.33±0.06	2.90±0.11	4.14±0.18	1.43±0.07
93	9.12±0.36	2.90±0.16	2.07±0.10	3.15±0.12	4.42±0.21	1.41±0.07
94	7.36±0.30	3.08±0.12	2.10±0.05	2.40±0.13	3.50±0.13	1.47±0.06
95	8.36±0.22	2.72±0.08	2.03±0.05	3.08±0.11	4.13±0.14	1.34±0.06
96	8.13±0.21	2.86±0.12	2.07±0.06	2.84±0.13	3.93±0.11	1.39±0.07
97	9.32±0.33	2.77±0.11	2.02±0.07	3.38±0.18	4.62±0.22	1.38±0.09
98	8.94±0.29	3.64±0.12	2.33±0.09	2.46±0.11	3.83±0.16	1.57±0.07
99	9.07±0.36	3.63±0.12	2.41±0.08	2.50±0.10	3.77±0.16	1.51±0.06
100	9.69±0.28	3.31±0.11	2.19±0.09	2.93±0.08	4.43±0.20	1.51±0.08

No. 94 (7.36 mm) and No. 56 (7.55 mm). Average and its s.d. through the whole strains were found to be 8.57±0.55. S.d. of each strain were found to be 0.27±0.06.

Whole: Average and its s.d. through the whole strains of both of the groups (=100) were found to be 8.77±0.69. S.d. of each strain were found to be 0.26±0.06.

2. Widths of the unhusked grains

Group A: Widths for the individual grain level ranged from 3.60 mm (No. 21) to 1.80 mm (No. 29). The latter was the same as in case of the L. In the strain level, the widest (3.32 mm) was obtained in No. 21, followed by No. 22 (3.11 mm) and No. 48 (2.99 mm). The narrowest (1.95 mm) was noted in No. 29, which was the same as in case of the L, followed by No. 40 (2.13 mm) and No. 16 (2.29 mm). Average and its s.d. through the whole strains were found to be 2.63±0.25. S.d. of each strain were found to be 0.10±0.02.

Group B: Widths for the individual grain level ranged from 4.00 mm (No. 69) to 2.40 mm (No. 86). In the strain level, the widest (3.78 mm) was obtained in No. 69, followed by No. 90 (3.76 mm) and No. 67 (3.69 mm). The narrowest (2.69 mm) was noted in No. 66, followed by Nos. 86 and 95 (2.72 mm). Average and its s.d. through the whole strains were found to be 3.25± 0.32. S.d. of each strain were found to be 0.11±0.02.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 3.00±0.64. S.d. of each strain were found to be 0.10±0.02.

3. Thicknesses of the unhusked grains

Group A: Thicknesses for the individual grain level ranged from 2.40 mm (No. 21) to 1.60 mm (Nos. 6 and 26). In the strain level, the thickest (2.25 mm) was obtained in No. 21, which was the same as in case of the width, followed by Nos. 2 and 24 (2.16 mm). The thinnest (1.78 mm) was noted in No. 29, which was the same as in cases of the length and width, followed by No. 40 (1.87 mm) and No. 5 (1.91 mm). Average and its s.d. through the whole strains were found to be 2.04± 0.08. S.d. of each strain were found to be 0.07±0.02.

Group B: Thicknesses for the individual grain level ranged from 2.65 mm (Nos. 55 and 58) to 1.80 mm (Nos. 77 and 86). In the strain level, the thickest (2.49 mm) was obtained in No. 55, followed by No. 58 (2.42 mm) and No. 99 (2.41 mm). The thinnest (1.95 mm) was noted in No. 86, followed by No. 66 (1.96 mm) and No. 77 (1.97 mm). Average and its s.d. through the whole

strains were found to be 2.21±0.13. S.d. of each strain were found to be 0.07±0.02.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 2.12±0.14. S.d. of each strain were found to be 0.07±0.02.

4. L/W of the unhusked grains

Group A: L/W for the individual grain level ranged from 5.25 (No. 6) to 2.22 (No. 22). In strain level, the largest (4.46) was obtained in No. 6, which was the same as in case of L, followed by No. 28 (4.34) and No. 25 (3.99). The smallest (2.45) was noted in No. 22, followed by No. 21 (2.68) and No. 20 (2.72). Average and its s.d. through the whole strains were found to be 3.44±0.43. S.d. of each strain were found to be 0.15±0.04.

Group B: L/W for the individual grain level ranged from 3.81 (Nos. 89 and 97) to 2.00 (No. 84). In the strain level, the largest (3.45) was obtained in No. 89, followed by No. 97 (3.38) and No. 71 (3.22). The smallest (2.20) was noted in Nos. 56 and 74, followed by No. 67 (2.22). Average and its s.d. through the whole strains were found to be 2.67±0.31. S.d. of each strain were found to be 0.11±0.02.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 3.06±0.54. S.d. of each strain were found to be 0.13±0.04.

5. L/T of the unhusked grains

Group A: L/T for the individual grain level ranged from 6.63 (No. 6), which was the same as in case of the L/W, to 3.22 (No. 29), which was the same as in cases of L and W. In the strain level, the largest (5.48) was obtained in No. 6, which was the same as in cases of L and L/W, followed by No. 35 (5.23) and No. 8 (4.96). The smallest (3.49) was noted in No. 29, which was the same as in cases of L, W and T, followed by No. 22 (3.64) and No. 50 (3.79). Average and its s.d. through the whole strains were found to be 4.40±0.38. S.d. of each strain were found to be 0.17±0.04.

Group B: L/T for the individual grain level ranged from 5.05 (No. 97) to 2.14 (No. 51). In the strain level, the largest (4.62) was obtained in No. 97, followed by No. 89 (4.46) and No. 100 (4.43). The smallest (3.26) was noted in No. 56, followed by No. 84 (3.39) and No. 91 (3.41). Average and its s.d. through the whole strains were found to be 3.90±0.31. S.d. of each strain were found to be 0.16±0.03.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 4.15±0.43. S.d. of each strain were found to be 0.17±0.04.

6. W/T of the unhusked grains

Group A: W/T for the individual grain level ranged from 1.82 (No. 8) to 1.05 (Nos. 1, 4, 33, 40 and 46). In the strain level, the largest (1.49) was obtained in No. 22, followed by Nos. 20 and 21 (1.48). The smallest (1.10) was noted in No. 29, which was the same as in cases of L, W, T and L/T, followed by Nos. 28 and 40 (1.14). Average and its s.d. through the whole strains were found to be 1.29±0.09. S.d. of each strain were found to be 0.07±0.02.

Group B: W/T for the individual grain level ranged from 1.77 (Nos. 69 and 90) to 1.16 (No. 89). In the strain level, the largest (1.62) was obtained in No. 67, followed by No. 90 (1.61) and No. 69 (1.60). The smallest (1.30) was noted in Nos. 75 and 89, followed by Nos. 71 and 95 (1.34). Average and its s.d. through the whole strains were found to be 1.47±0.08. S.d. of each strain were found to be 0.07±0.02.

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

1.38±0.12. S.d. of each strain were found to be 0.07±0.02.

7. Lengths of the husked grains

Group A: The results are given in Table 3. Lengths for the individual grain level ranged from 8.00 mm (No. 6), which was the same as in cases of L/W and L/T of UHG, to 4.00 mm (No. 29), which was the same as in cases of L, W and L/T of UHG. In the strain level, the longest (7.55 mm) was obtained in No. 6, which was the same as in cases of L, L/W and L/T of UHG, followed by No. 28 (7.35 mm) and No. 25 (7.30 mm). The shortest (4.35 mm) was noted in No. 29, which was the same as in cases of L, W, T, L/T and W/T of UHG, followed by No. 20 (5.41 mm) and No. 50 (5.43 mm). Average and its s.d. through the whole strains were found to be 6.38±0.58. S.d. of each strain were found to be 0.17±0.04.

Group B: Lengths for the individual grain level ranged from 7.45 mm (No. 89) to 4.90 mm (No. 87). In the strain level, the longest (6.95 mm) was obtained in No. 89, which was the same as in case of L/W of UHG, followed by No. 92 (6.79 mm) and No. 100 (6.72 mm). The shortest (5.09 mm) was noted in No. 87, which was the same as in case of L of UHG, followed by No. 94 (5.17 mm) and No. 56 (5.35 mm). Average and its s.d. through the whole strains were found to be 6.03±0.39. S.d. of each strain were found to be 0.17±0.04.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 6.21±0.52. S.d. of each strain were found to be 0.17±0.04.

Table 3. Some morphological characters of husked grains

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
1	6.43±0.18	2.23±0.11	1.91±0.04	2.89±0.17	3.37±0.12	1.17±0.06
2	6.33±0.19	2.44±0.10	1.98±0.07	2.60±0.12	3.20±0.12	1.23±0.06
3	6.98±0.15	2.37±0.08	1.91±0.05	2.95±0.13	3.67±0.11	1.25±0.07
4	6.67±0.17	2.18±0.11	1.81±0.08	3.07±0.17	3.69±0.13	1.21±0.09
5	6.06±0.14	1.98±0.09	1.72±0.05	3.07±0.13	3.53±0.11	1.15±0.06
6	7.55±0.25	2.00±0.07	1.71±0.13	3.78±0.15	4.44±0.34	1.18±0.12
7	6.50±0.18	2.35±0.14	1.83±0.08	2.77±0.18	3.56±0.16	1.29±0.09
8	7.07±0.26	2.33±0.08	1.83±0.10	3.04±0.18	3.87±0.17	1.28±0.11
9	6.48±0.13	2.23±0.09	1.85±0.07	2.91±0.13	3.52±0.13	1.21±0.07
10	7.14±0.20	2.35±0.06	1.85±0.06	3.04±0.13	3.87±0.14	1.27±0.06
11	6.19±0.16	2.22±0.07	1.75±0.09	2.79±0.12	3.55±0.18	1.27±0.09
12	6.42±0.20	2.29±0.09	1.85±0.07	2.81±0.12	3.49±0.14	1.24±0.07
13	7.11±0.19	2.41±0.10	1.89±0.05	2.96±0.16	3.76±0.11	1.27±0.07
14	6.41±0.17	2.35±0.11	1.90±0.06	2.73±0.12	3.37±0.14	1.24±0.07
15	6.17±0.12	2.25±0.11	1.75±0.10	2.75±0.12	3.53±0.20	1.29±0.10
16	6.43±0.19	2.04±0.05	1.78±0.05	3.15±0.12	3.61±0.15	1.15±0.05
17	6.40±0.18	2.03±0.05	1.77±0.08	3.15±0.11	3.63±0.19	1.15±0.06
18	6.08±0.18	2.48±0.06	1.91±0.09	2.45±0.09	3.19±0.16	1.30±0.06
19	6.14±0.15	2.43±0.09	1.95±0.08	2.53±0.08	3.16±0.13	1.25±0.07
20	5.41±0.14	2.41±0.08	1.75±0.06	2.25±0.08	3.09±0.14	1.38±0.05
21	6.21±0.13	2.75±0.10	2.09±0.07	2.26±0.08	2.98±0.13	1.32±0.08
22	5.43±0.17	2.61±0.10	1.87±0.08	2.09±0.12	2.91±0.12	1.40±0.08
23	5.96±0.13	2.46±0.08	1.84±0.07	2.43±0.08	3.24±0.13	1.34±0.06

Table 3. (Continued)

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
24	6.40±0.22	2.39±0.09	1.97±0.06	2.68±0.15	3.25±0.10	1.22±0.06
25	7.30±0.26	2.17±0.07	1.92±0.07	3.37±0.15	3.81±0.14	1.13±0.05
26	5.83±0.12	2.36±0.09	1.86±0.12	2.48±0.09	3.15±0.26	1.28±0.13
27	5.76±0.12	2.49±0.07	1.92±0.07	2.32±0.08	3.00±0.10	1.30±0.07
28	7.35±0.14	2.03±0.05	1.84±0.05	3.62±0.11	3.99±0.13	1.10±0.04
29	4.35±0.16	1.79±0.05	1.63±0.05	2.43±0.10	2.68±0.12	1.11±0.05
30	6.10±0.16	2.12±0.09	1.78±0.06	2.88±0.14	3.44±0.15	1.19±0.07
31	6.40±0.18	2.29±0.10	1.85±0.06	2.80±0.15	3.47±0.14	1.24±0.06
32	6.04±0.20	2.30±0.08	1.80±0.06	2.60±0.18	3.38±0.15	1.28±0.08
33	6.33±0.20	2.02±0.06	1.82±0.04	3.14±0.13	3.47±0.13	1.11±0.05
34	5.98±0.16	2.05±0.04	1.83±0.04	2.92±0.11	3.28±0.09	1.12±0.03
35	7.07±0.22	2.19±0.10	1.74±0.08	3.24±0.18	4.06±0.21	1.26±0.09
36	7.06±0.17	2.22±0.08	1.85±0.06	3.18±0.11	3.81±0.14	1.20±0.06
37	6.34±0.13	2.28±0.07	1.89±0.07	2.79±0.11	3.36±0.12	1.21±0.06
38	7.24±0.21	2.26±0.08	1.89±0.08	3.21±0.15	3.84±0.14	1.20±0.07
39	6.36±0.17	2.13±0.08	1.85±0.06	3.00±0.15	3.44±0.12	1.15±0.05
40	5.93±0.15	1.87±0.08	1.72±0.05	3.18±0.13	3.46±0.10	1.09±0.05
41	6.60±0.16	2.20±0 06	1 89±0.05	3.00±0.10	3.49±0.09	1.17±0.04
42	7.03±0.24	2.18±0.07	1.88±0.06	3.22±0.16	3.73±0.13	1.16±0.05
43	5.96±0.12	2.43±0.09	1.96±0.07	2.46±0.10	3.04±0.11	1.24±0.07
44	5.97±0.15	2.35±0.08	1.92±0.05	2.54±0.07	3.11±0.09	1.22±0.04
45	6.61±0.21	2.09±0.07	1.84±0.06	3.17±0.15	3.59±0.14	1.14±0.05
46	6.71±0.14	2.09±0.05	1.87±0.04	3.22±0.08	3.60±0.10	1.12±0.03
47	6.43±0.16	2.10±0.06	1.84±0.05	3.07±0.11	3.52±0.12	1.15±0.05
48	6.24±0.15	2.61±0.13	1.95±0.09	2.40±0.13	3.21±0.18	1.34±0.11
49	6.69±0.18	2.15±0.09	1.86±0.09	3.12±0.18	3.61±0.15	1.16±0.08
50	5.43±0.15	2.32±0.08	1.86±0.07	2.34±0.09	2.92±0.11	1.24±0.07
51	5.94±0.20	3.08±0.11	2.15±0.08	1.93±0.11	2.76±0.14	1.44±0.08
52	5.97±0.16	2.90±0.11	2.08±0.06	2.06±0.10	2.87±0.11	1.40±0.07
53	6.25±0.18	2.75±0.09	2.03±0.06	2.28±0.09	3.09±0.11	1.36±0.05
54	6.23±0.16	2.68±0.09	2.01±0.03	2.33±0.08	3.11±0.10	1.34±0.05
55	6.21±0.19	3.12±0.12	2.24±0.08	1.99±0.08	2.78±0.14	1.39±0.09
56	5.35±0.23	2.94±0.11	2.09±0.08	1.82±0.09	2.56±0.13	1.40±0.07
57	6.31±0.18	2.63±0.09	1.99±0.06	2.41±0.08	3.18±0.13	1.32±0.06
58	5.99±0.20	2.99±0.21	2.18±0.09	2.01±0.17	2.75±0.09	1.37±0.11
59	6.36±0.15	2.97±0.12	2.09±0.07	2.15±0.10	3.05±0.12	1.42±0.07
60	6.12±0.13	2.92±0.13	2.08±0.06	2.10±0.10	2.95±0.09	1.41±0.08
61	6.54±0.12	2.58±0.10	1.97±0.04	2.54±0.09	3.32±0.08	1.31±0.06
62	6.14±0.12	2.66±0.11	1.98±0.06	2.32±0.09	3.11±0.11	1.35±0.06
63	5.97±0.11	2.68±0.11	1.99±0.06	2.23±0.09	3.00±0.09	1.35±0.07
64	5.99±0.15	2.94±0.09	2.03±0.06	2.04±0.06	2.96±0.11	1.45±0.07
65	6.16±0.21	2.65±0.11	2.04±0.06	2.33±0.14	3.02±0.11	1.30±0.06
66	6.03±0.18	2.29±0.05	1.79±0.05	2.64±0.10	3.38±0.10	1.28±0.04
67	5.83±0.18	2.98±0.07	2.06±0.07	1.96±0.07	2.86±0.18	1.45±0.07
68	6.07±0.14	2.66±0.10	2.03±0.07	2.29±0.09	2.99±0.13	1.31±0.08

Table 3. (Continued)

Strain No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
69	6.05±0.14	3.14±0.08	2.14±0.09	1.93±0.06	2.84±0.10	1.47±0.06
70	5.71±0.17	2.46±0.04	1.85±0.06	2.32±0.09	3.09±0.14	1.33±0.04
71	6.37±0.14	2.42±0.07	1.85±0.06	2.65±0.08	3.43±0.14	1.31±0.06
72	5.98±0.12	2.52±0.07	1.87±0.08	2.38±0.07	3.21±0.12	1.35±0.07
73	6.26±0.14	2.85±0.08	2.04±0.06	2.20±0.08	3.07±0.08	1.40±0.06
74	5.66±0.17	2.90±0.14	2.09±0.07	1.96±0.10	2.71±0.11	1.39±0.07
75	5.96±0.14	2.51±0.10	1.98±0.05	2.38±0.13	3.02±0.09	1.27±0.07
76	6.22±0.15	2.79±0.10	2.03±0.05	2.23±0.09	3.08±0.10	1.38±0.05
77	5.86±0.14	2.36±0.07	1.78±0.06	2.48±0.08	3.30±0.13	1.33±0.06
78	5.98±0.17	2.63±0.07	1.85±0.08	2.28±0.09	3.24±0.12	1.42±0.07
79	5.61±0.14	2.80±0.15	2.07±0.11	2.01±0.10	2.72±0.16	1.36±0.09
80	6.10±0.21	2.61±0.15	2.02±0.08	2.34±0.16	3.03±0.12	1.30±0.08
81	5.63±0.14	2.85±0.13	2.06±0.07	1.98±0.10	2.74±0.11	1.39±0.08
82	6.20±0.11	2.69±0.10	1.94±0.05	2.31±0.11	3.20±0.07	1.39±0.06
83	5.81±0.17	2.79±0.12	1.90±0.10	2.09±0.11	3.06±0.22	1.47±0.11
84	5.68±0.16	2.95±0.17	2.12±0.09	1.94±0.14	2.69±0.11	1.40±0.10
85	6.52±0.21	2.76±0.13	2.03±0.05	2.36±0.10	3.22±0.11	1.37±0.06
86	5.58±0.20	2.29±0.09	1.77±0.09	2.44±0.10	3.16±0.15	1.30±0.08
87	5.09±0.10	2.55±0.08	1.89±0.06	2.00±0.07	2.70±0.11	1.35±0.07
88	5.61±0.22	2.54±0.11	1.83±0.06	2.22±0.11	3.09±0.16	1.39±0.08
89	6.95±0.27	2.32±0.10	1.94±0.06	3.00±0.15	3.58±0.18	1.19±0.07
90	5.96±0.18	3.07±0.15	2.04±0.11	1.95±0.12	2.94±0.19	1.51±0.10
91	5.51±0.22	2.95±0.07	2.05±0.09	1.87±0.07	2.70±0.14	1.45±0.07
92	6.79±0.22	2.76±0.11	2.08±0.05	2.46±0.08	3.27±0.13	1.33±0.06
93	6.34±0.17	2.44±0.16	1.88±0.09	2.62±0.14	3.37±0.18	1.30±0.08
94	5.17±0.20	2.63±0.12	1.90±0.05	1.98±0.14	2.72±0.11	1.38±0.07
95	6.00±0.17	2.32±0.08	1.83±0.06	2.59±0.13	3.29±0.11	1.27±0.06
96	5.84±0.14	2.43±0.10	1.87±0.07	2.41±0.11	3.13±0.11	1.30±0.08
97	6.76±0.21	2.33±0.07	1.81±0.07	2.90±0.11	3.75±0.16	1.29±0.06
98	6.11±0.15	3.05±0.10	2.10±0.08	2.01±0.08	2.92±0.13	1.46±0.08
99	6.19±0.20	3.02±0.12	2.16±0.06	2.06±0.09	2.87±0.11	1.40±0.06
100	6.72±0.18	2.70±0.10	1.96±0.08	2.49±0.09	3.43±0.17	1.38±0.08

8. Widths of the husked grains

Group A: Widths for the individual grain level ranged from 3.05 mm (No. 48) to 1.70 mm (No. 29). The latter was the same as in cases of L, W and L/T of UHG and L of HG. In the strain level, the widest (2.75 mm) was obtained in No. 21, which was the same as in cases of W and T of UHG, followed by Nos. 22 and 48 (2.61 mm). The narrowest (1.79 mm) was noted in No. 29, which was the same as in cases of L, W, T, L/T and W/T of UHG and L of HG, followed by No. 40 (1.87 mm) and No. 5 (1.98 mm). Average and its s.d. through the whole strains were found to be 2.25±0.19. S.d. of each strain were found to be 0.08±0.02.

Group B: Widths for the individual grain level ranged from 3.45 mm (No. 58) to 2.10 mm (Nos. 86, 89, 93 and 95). In the strain level, the widest (3.14 mm) was obtained in No. 69, which

was the same as in case of W of UHG, followed by No. 55 (3.12 mm) and No. 51 (3.08 mm). The narrowest (2.29 mm) was noted in Nos. 66 and 86, followed by Nos. 89 and 95 (2.32 mm). Average and its s.d. through the whole strains were found to be 2.72±0.24. S.d. of each strain were found to be 0.11±0.03.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 2.49±0.32. S.d. of each strain were found to be 0.09±0.03.

9. Thicknesses of the husked grains

Group A: Thicknesses for the individual grain level ranged from 2.20 mm (Nos. 19 and 21) to 1.30 mm (Nos. 6 and 26). The latter combinations were the same as in case of T of UHG. In the strain level, the thickest (2.09 mm) was obtained in No. 21, which was the same as in cases of the W and T of UHG and W of HG, followed by No. 24 (1.97 mm) and No. 43 (1.96 mm). The thinnest (1.63 mm) was noted in No. 29, which was the same as in cases of L, W, T, L/T and W/T of UHG, L and W of HG, followed by No. 6 (1.71 mm) and Nos. 5 and 40 (1.72 mm). Average and its s.d. through the whole strains were found to be 1.85±0.08. S.d. of each strain were found to be 0.07±0.02.

Group B: Thicknesses for the individual grain level ranged from 2.40 mm (No. 55) to 1.60 mm (No. 86). The latter was the same as in case of W of UHG. In the strain level, the thickest (2.24 mm) was obtained in No. 55, which was the same as in case of T of UHG, followed by No. 58 (2.18 mm) and No. 99 (2.16 mm). The thinnest (1.77 mm) was noted in No. 86, which was the same as in case of T of UHG, followed by No. 77 (1.78 mm) and No. 66 (1.79 mm). Average and its s.d. through the whole strains were found to be 1.99±0.12. S.d. of each strain were found to be 0.07± 0.02.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 1.92±0.12. S.d. of each strain were found to be 0.07±0.02.

10. L/W of the husked grains

Group A: L/W for the individual grain level ranged from 4.00 (No. 6), which was the same as in cases of L/W and L/T of UHG, and L of HG, to 1.79 (No. 22), which was the same as in case of L/W of UHG. In the strain level, the largest (3.78) was obtained in No. 6, which was the same as in cases of L, L/W and L/T of UHG, L of HG, followed by No. 28 (3.62) and No. 25 (3.37). The smallest (2.09) was noted in No. 22, which was the same as in case of L/W of UHG, followed by No. 20 (2.25) and No. 21 (2.26). Average and its s.d. through the whole strains were found to be 2.86±0.36. S.d. of each strain were found to be 0.13±0.03.

Group B: L/W for the individual grain level ranged from 3.37 (No. 89), which was the same as in case of the length of HG, to 1.67 (No. 58). In the strain level, the largest (3.00) was obtained in No. 89, which was the same as in cases of L/W of UHG and L of HG, followed by No. 97 (2.90) and No. 71 (2.65). The smallest (1.82) was noted in No. 56, which was the same as in case of L/T of UHG, followed by No. 91 (1.87) and No. 51 (1.93). Average and its s.d. through the whole strains were found to be 2.25±0.27. S.d. of each strain were found to be 0.10±0.03.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 2.55±0.44. S.d. of each strain were found to be 0.11±0.03.

11. L/T of the husked grains

Group A: L/T for the individual grain level ranged from 5.58 (No. 6), which was the same as

in cases of L/W and L/T of UHG, L and L/W of HG, to 2.47 (No. 29), which was the same as in cases of L, W and L/T of UHG, L and W of HG. In the strain level, the largest (4.44) was obtained in No. 6, which was the same as in cases of L, L/W and L/T of UHG, L and L/W of HG, followed by No. 35 (4.06) and No. 28 (3.99). The smallest (2.68) was noted in No. 29, which was the same as in cases of L, W, T, L/T and W/T of UHG, L, W and T of HG, followed by No. 22 (2.91) and No. 50 (2.92). Average and its s.d. through the whole strains were found to be 3.46 ± 0.33. S.d. of each strain were found to be 0.14 ± 0.04.

Group B: L/T for the individual grain level ranged from 4.06 (No. 97), which was the same as in case of L/T of UHG, to 2.34 (No. 56). In the strain level, the largest (3.75) was obtained in No. 97, which was the same as in case of L/T of UHG, followed by No. 89 (3.58) and Nos. 71 and 100 (3.43). The smallest (2.56) was noted in No. 56, which was the same as in cases of L/T of UHG and L/W of HG, followed by No. 84 (2.69) and Nos. 87 and 91 (2.70). Average and its s.d. through the whole strains were found to be 3.05 ± 0.25. S.d. of each strain were found to be 0.13 ± 0.03.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 3.25 ± 0.36. S.d. of each strain were found to be 0.13 ± 0.04.

12. W/T of the husked grains

Group A: W/T for the individual grain level ranged from 1.85 (No. 26) to 0.98 (Nos. 4 and 49). In the strain level, the largest (1.40) was obtained in No. 22, which was the same as in case of W/T of UHG, followed by No. 20 (1.38) and Nos. 23 and 48 (1.34). The smallest (1.09) was noted in No. 40, followed by No. 28 (1.10) and Nos. 29 and 33 (1.11). Average and its s.d. through the whole strains were found to be 1.22 ± 0.08. S.d. of each strain were found to be 0.07 ± 0.02.

Group B: W/T for the individual grain level ranged from 1.78 (No. 90) to 1.05 (No. 80). In the strain level, the largest (1.51) was obtained in No. 90, followed by Nos. 69 and 83 (1.47). The smallest (1.19) was noted in No. 89, followed by Nos. 75 and 95 (1.27). Average and its s.d. through the whole strains were found to be 1.37 ± 0.06. S.d. of each strain were found to be 0.07 ± 0.02.

Whole: Average and its s.d. through the whole strains of both of the groups were found to be 1.29 ± 0.10. S.d. of each strain were found to be 0.07 ± 0.02.

Discussion

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

1. According to the classification noted by Matsuo[5], the strains used here can be divided into three groups; type A — 1 strain (1% of the whole), type B — 28 strains (28% of the whole), type C — 71 strains (71% of the whole) (Fig. 1). In detail, 1 and 49 strains belonging to Group A (=*aman*) were classified in B and C as 2% and 98%, respectively. One, 27 and 22 strains belonging to Group B (=*aus*) were classified into A, B and C as 2%, 54% and 44%, respectively. Strains collected by field survey also in India[3] were classified into type A (0% in Group A, 8% in Group B and 5% in the whole), type B (22% in Group A, 25% in Group B and 24% in the whole) and type C (78% in Group A, 67% in Group B and 71% in the whole). Basing on the data obtained here, the following facts were ascertained. The strains belonging to type A were found to be very rare in the whole India. It may be pointed as specific features that Group A and Group B of the present materials showed many strains belonging to type C and type B, respectively.

Sikkimese strains showed many types of A grains[2]. Strains collected in Nepal were classified

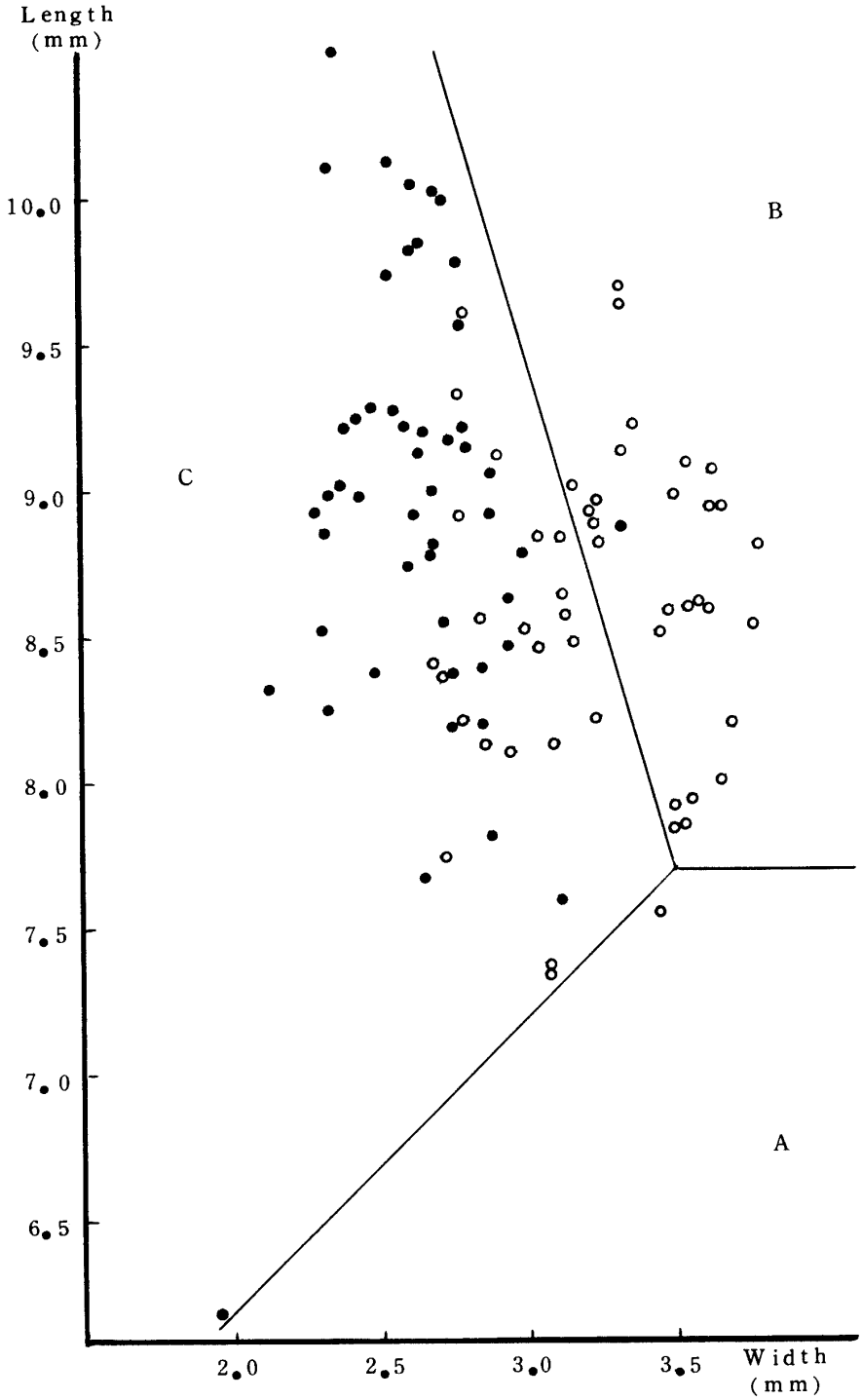

Fig. 1. Relation between length and width of unhusked grains in mm in accordance with tripartite classification. Vertical axis; length of grain, abscissa; width of grain, ●; strain No. 1 to No. 50, ○; strain No. 51 to No. 100.

into A, B and C types as 29%, 11% and 60%, respectively[4]. Strains collected from higher elevations of NEFA (Assam region) were resembling *japonica* types (=A type) in view of many characters[6]. From the several informations mentioned above, it is to be concluded that the strains used in the present experiments were constituted by the whole India, but not represented in the north and the northeastern India.

2. Strain Nos. 6 and 29 showed very long and short lengths, respectively. They are seen as the primitive strains in India. Especially, 6.19 mm shown as average-L-value of No. 29 is looked upon as common in *japonica* but rare in *indica*, respectively.

In comparison with the data obtained in the field survey[3], it was clear that the variations found in the whole strains were remarkably large in the whole characters in the present experiments, *i.e.*, the present experiment···L–10.50 mm～6.19 mm (4.31 mm in difference in view of strain level), W–3.78 mm～1.95 mm (1.83 mm), T–2.49 mm～1.78 mm (0.71 mm), L/W–4.46～2.20 (2.26), L/T–5.48～3.26 (2.22), W/T–1.62～1.10 (0.52); the field survey···L–10.23 mm～7.24 mm (2.99 mm), W–3.56 mm～2.05 mm (1.51 mm), T–2.56 mm～1.91 mm (0.65 mm), L/W–4.24～2.24 (2.00), L/T–5.18～3.18 (2.00), W/T–1.43～1.15 (0.28). It is not clear that these characteristics were found whether by the differences of number of strains used, or by the fundamental differences in view of genetic background. Early solution of this problem is expected in these fields.

3. A lot of attempts have been made for classification of cultivated rice varieties in accordance with the data obtained in grain morphology. Especially, tripartite classification has been adopted by many investigators. However, it has been used only for the unhusked grains. For the husked grains, there have been no standard method for the classification. So, it was attempted for the first time in the present experiments (Fig. 2). Unfortunately, clear tendency has not been ascertained here. As the analyses and conclusions have left several points in question, further analyses are to be performed sincerely.

4. In comparison with Group A and Group B in view of group-averages, the following facts were ascertained. Averages of Group A were remarkably larger than those of Group B in L, L/W and L/T, and smaller in W, T and W/T, in both of UHG and HG, respectively. From these view points, it was assumed that characters ascertained might be of great use as indices in analysing the varietal variations and variation-groups.

In view of s.d., averages of Group A were larger than those of Group B in L/W and L/T of UHG and HG, and smaller in L of UHG and W of UHG and HG, respectively. In the remaining 5 characters, averages in both of the groups were nearly the same. It was necessary follow that the larger is the practical value, the larger is its s.d.

5. In comparisons made in the three types of A, B and C, according to the tripartite classifications[5], the following facts were ascertained. Type A (strain No. 56) showed the general features as follows; the values in W, T and W/T of UHG and HG were found to be larger than average of the whole materials; values of L, L/W and L/T of UHG and HG were found to be smaller than it.

In type B (28 strains, *i.e.*, Nos. 21, 51～55, 57～60, 64, 67, 69, 73, 74, 76, 79～82, 84, 85, 90～92, 98～100), the tendencies were ascertained to be nearly the same as in case of type A, but the value of L of UHG was found to be larger than average of the whole materials.

In type C (the remaining 71 strains), the tendencies were ascertained to be the results reversed to that of type A.

6. In the smaller set of values, the smallests (6.19 mm in L of UHG, 3.49 in L/T of UHG and 2.68 in L/T of HG) were noted in No. 29, followed by No. 22 (7.60 mm in L of UHG, 3.64 in L/T of UHG and 2.91 in L/T of HG) and No. 50 (7.67 mm in L of UHG, 3.79 in L/T of UHG and 2.92 in L/T of HG). These orders of strains were finally illustrated as $29<22<50$. These orders were fixed to be the same as in L of UHG, L/T of UHG and L/T of HG. These phenomena were found in the other 6 cases, *i.e.*, ② $6>28>25$ in HG···No. 6 (7.55 mm in L and 3.78 in L/W), No. 28 (7.35 mm in L and 3.62 in L/W) and No. 25 (7.30 mm in L and 3.37 in L/W) in the larger sets; ③ $87<94<56$ in L···No. 87 (7.34 mm in UHG and 5.09 mm in HG), No. 94 (7.36 mm in UHG and

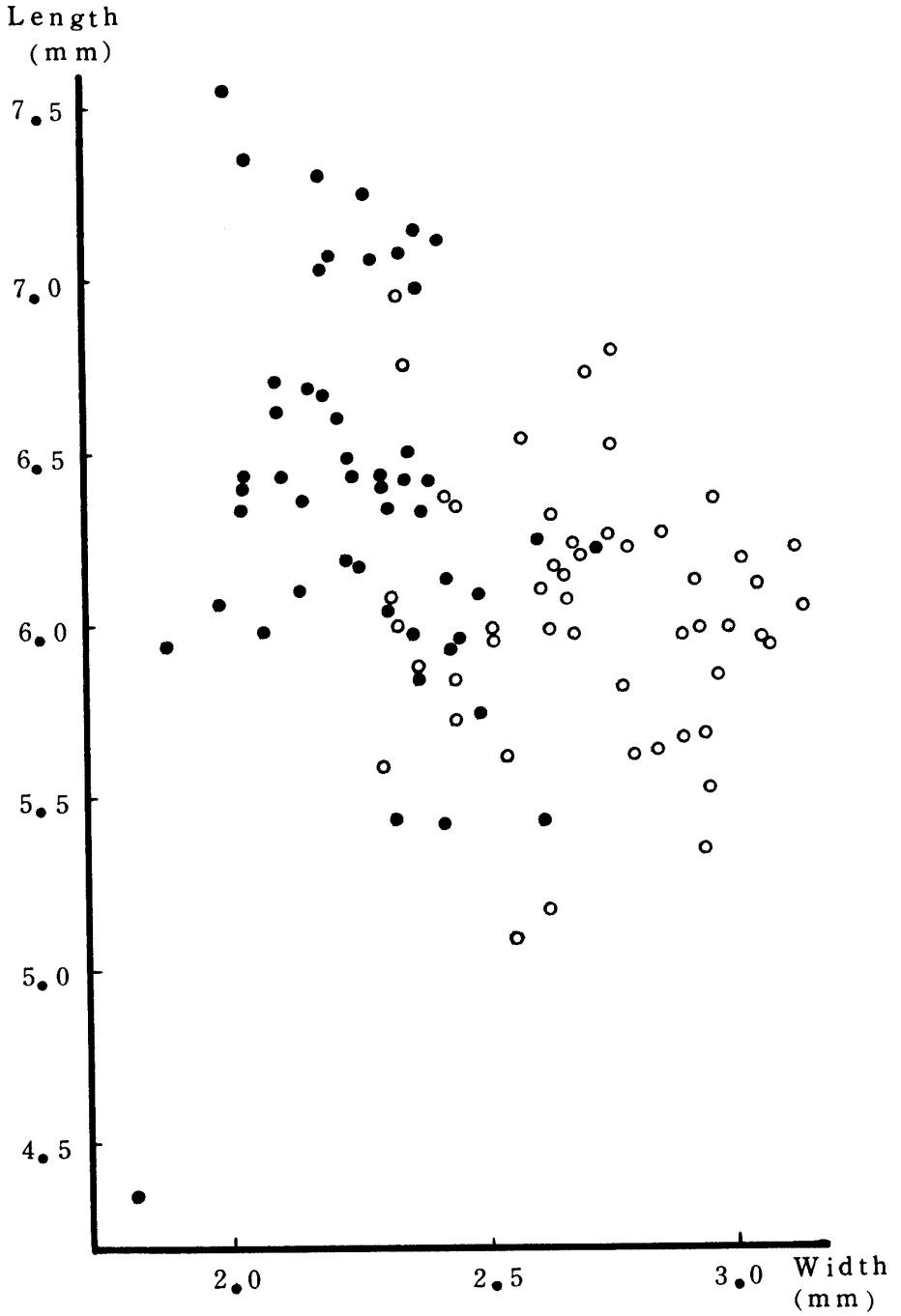

Fig. 2. Relation between length and width of husked grains in mm. Vertical axis; length of grain, abscissa; width of grain, ●; strain No. 1 to No. 50, ○; strain No. 51 to No. 100.

5.17 mm in HG) and No. 56 (7.55 mm in UHG and 5.35 mm in HG) in the smaller sets; ④ 55> 58>99 in T···No. 55 (2.49 mm in UHG and 2.24 mm in HG), No. 58 (2.42 mm in UHG and 2.18 mm in HG) and No. 99 (2.41 mm in UHG and 2.16 mm in HG) in the larger sets; ⑤ 89>97>71 in L/W···No. 89 (3.45 in UHG and 3.00 in HG), No. 97 (3.38 in UHG and 2.90 in HG) and No. 71 (3.22 in UHG and 2.65 in HG) in the larger sets; ⑥ 56<84<91 in L/T···No. 56 (3.26 in UHG and 2.56 in HG), No. 84 (3.39 in UHG and 2.69 in HG) and No. 91 (3.41 in UHG and 2.70 in HG) in the smaller sets; ⑦ 97>89>100 in L/T···No. 97 (4.62 in UHG and 3.75 in HG), No. 89 (4.46 in UHG and 3.58 in HG), No. 100 (4.43 in UHG and 3.43 in HG) in the larger sets.

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 L (UHG), the longest (10.50 mm) was obtained in No. 6, followed by No. 25 (10.12 mm) and No. 28 (10.10 mm). These combinations were finally illustrated as 6>25>28. In L/W (UHG), the largest (4.46) was obtained in No. 6, followed by No. 28 (4.34) and No. 25 (3.99). These combinations were finally illustrated as 6>28>25. These combinations were fixed to be the same as both in L and L/W of UHG, and illustrated as 6·25·28. These combinations were after all constituted in 4 characters, *i.e.*, 6·25·28 in the larger sets···L in UHG (6>25>28), L/W in UHG (6>28>25), L in HG (6>28>25) and L/W in HG (6>28>25). These phenomena were found in the other 16 cases, *i.e.*, ② 67·69·90 in the larger sets···W in UHG (69>90>67) and W/T in UHG (67>90>69); ③ 5·29·40 in the smaller sets···W in HG (29<40<5) and T in HG (29<5=40); ④ 71·89·97 in the larger sets···L/W in HG (89>97>71) and L/T in HG (97>89>71); ⑤ 6·8·15 in the larger sets of s.d.···T in UHG (6>8>15) and W/T in UHG (15>6=8); ⑥ 6·8·26 in the larger sets of s.d.···T in UHG (6>8>26), L/T in UHG (6>26>8), T in HG (6>26>8) and W/T in HG (26>6>8); ⑦ 28·34·46 in the smaller sets of s.d.···W in HG (34<28=46) and W/T in HG (34=46<28); ⑧ 34·41·44 in the smaller sets of s.d.···L/T in HG (34=41=44) and W/T in HG (34<41=44); ⑨ 21·22·48 in the larger sets of W···UHG (21>22>48) and HG (21>22=48); ⑩ 20·21·22 in the smaller sets of L/W···UHG (22<21<20) and HG (22<20<21); ⑪ 28·29·40 in the smaller sets of W/T···UHG (29<28=40) and HG (40<28<29); ⑫ 89·92·100 in the larger sets of L···UHG (100>92>89) and HG (89>92>100); ⑬ 66·86·95 in the smaller sets of W···UHG (66<86=95) and HG (66=86<95); ⑭ 66·77·86 in the smaller sets of T···UHG (86<66<77) and HG (86<77<66); ⑮ 75·89·95 in the smaller sets of W/T···UHG (75=89<95) and HG (89<75=95); ⑯ 26·27·43 in the smaller sets of s.d. of L···UHG (26<43<27) and HG (26=27=43); ⑰ 6·8·15·26 in the larger sets of s.d. of T···UHG (6>8=15=26) and HG (6>26>8=15).

Summary

During the collection trip in India from December in 1978 to January in 1979, 100 strains of the cultivated rice, *Oryza sativa* L., stocked in Rice Research Station, Chinsurah, West Bengal, India, were delivered to the author. In this report, some records on morphological characters of the grains have been described. Those were divided phylogenetically into two groups, *i.e.*, Group A — *aman* varieties, Group B — *aus* varieties. The results obtained here were summarized as follows:

Lengths of the unhusked grains were found to be 8.96 mm, 8.57 mm and 8.77 mm in Group A, Group B and through the whole in average values, respectively. Widths of the unhusked grains were found to be 2.63 mm, 3.25 mm and 3.00 mm in the same order. Thicknesses of the unhusked grains were found to be 2.04 mm, 2.21 mm and 2.12 mm in the same order. L/W of the unhusked grains were found to be 3.44, 2.67 and 3.06 in the same order. L/T of the unhusked grains were found to be 4.40, 3.90 and 4.15 in the same order. W/T of the unhusked grains were found to be 1.29, 1.47 and 1.38 in the same order.

Lengths of the husked grains were found to be 6.38 mm, 6.03 mm and 6.21 mm in the same order. Widths of the husked grains were found to be 2.25 mm, 2.72 mm and 2.49 mm in the same order. Thicknesses of the husked grains were found to be 1.85 mm, 1.99 mm and 1.92 mm in the same order. L/W of the husked grains were found to be 2.86, 2.25 and 2.55 in the same order. L/T of the husked grains were found to be 3.46, 3.05 and 3.25 in the same order. W/T of the husked grains were found to be 1.22, 1.37 and 1.29 in the same order.

In comparison with the data obtained in the previous papers, ecotypic and varietal differentiations were discussed, basing on the values ascertained concerning 12 characters and geographical localities.

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