

Grain Morphology of Cultivated Rice, “Pelita”, in Ambon, Indonesia

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Introduction

From October to December in 1974, the writer was sent to Ambon and Kendari, Indonesia, for ecological studies in agriculture. In these districts, several cultivated rices, *O. sativa* L., are used at lowland and upland fields. Most of them are introduced from Java, India, the Philippines and others, but one of them which is commonly called “Pelita” is to be seen in Ambon, in the form of local variety.

In this report, the records of morphological characters of unhusked and husked grains and some comparisons of these in “Pelita” variety have been described.

Material and Method

Grains of “Pelita” variety were collected at Agricultural High School, Passo, Ambon, Indonesia, on 23 October, 1974.

Measurements were done for length, width and thickness of unhusked and husked grains. Fifty grains were used for the measurement. The measurement were done at the largest position of the respective character. Calculations were done for determining the ratios of length to width, of length to thickness and of width to thickness, moreover for comparative values on morphological characters of unhusked and husked grains. Correlation between practical values of unhusked and husked grains and linear regressions between them were also calculated in the whole characters measured by comparing them. Values found in character “comparison” in Tables 1 and 2 were calculated as follows: Character No. 21 the quotient value of No. 11 divided by value of No. 1; No. 22 No. 12 by No. 2; No. 23 No. 13 by No. 3; No. 24 No. 14 by No. 4; No. 25 No. 15 by No. 5; and No. 26 No. 16 by No. 6, respectively.

Results and Discussion

The results of morphological investigations are given in Table 1. In this table, practical values, its standard deviations and these ranges were shown.

I. Practical value

Unhusked grain (Character Nos. 1 to 6)

Length of grain observed was between 9.80 mm and 8.30 mm. Average length was found to be 9.12 mm. Width of grain observed was between 3.60 mm and 2.85 mm.

Table 1. Morphological characters of unhusked and husked grains.

	Character	No.	Average and its standard deviation	Range
Unhusked	Length	1	9.12±0.38 mm	9.80~8.30
	Width	2	3.24±0.17 mm	3.60~2.85
	Thickness	3	2.14±0.10 mm	2.30~1.85
	L/W	4	2.82±0.18	3.30~2.49
	L/T	5	4.28±0.22	4.97~3.82
	W/T	6	1.52±0.07	1.65~1.34
Husked	Length	11	6.56±0.24 mm	7.05~6.05
	Width	12	2.70±0.19 mm	3.05~2.20
	Thickness	13	1.92±0.11 mm	2.10~1.65
	L/W	14	2.44±0.20	3.05~2.11
	L/T	15	3.42±0.21	4.06~2.95
	W/T	16	1.40±0.07	1.60~1.20
Comparison	Length	21	0.72±0.01	0.77~0.69
	Width	22	0.83±0.03	0.93~0.72
	Thickness	23	0.90±0.03	0.95~0.81
	L/W	24	0.86±0.04	1.01~0.78
	L/T	25	0.80±0.03	0.89~0.76
	W/T	26	0.93±0.04	1.02~0.81

Average width was found to be 3.24 mm. In view of classification of rice strains, this strain was detected to be B type or *javanica* variety, according to tripartite classification by Matsuo⁴⁾ and others. Comparing with the data, in which 39 Japanese rice strains were used for morphological characters of grain¹⁾, the followings were ascertained. In Japanese strains belonging to A type or *japonica* variety, average length of grain was observed to be between 7.82 mm and 7.07 mm, the average being 7.47 mm. Average width of grain was observed between 3.69 mm and 3.29 mm, the average being 3.40 mm. The former character of "Pelita" was remarkably larger than that of Japanese strains and the latter character smaller than that of Japanese strains. On the other hand, thickness of Pelita was smaller than that of Japanese strains. Most investigations published for the classification of rice type were done, making use of the length and width characteristic to the grain, but thickness was also useful character for classifying rice varieties²⁾.

The standard deviations of each character, *i.e.*, showing intra-strain's variation, were noted to be relatively small.

Ratios of grain length to grain width, length to thickness and width to thickness were smaller than that of Japanese strains. The standard deviations of three ratios were also relatively small.

Husked grain (Character Nos. 11 to 16)

Valuation-relationships between this strain and Japanese ones were quite similar to the case in the unhusked grains. In view of classification of rice strains, this strain was also detected to be B type or *javanica* variety. Average ratio of length to width was found to be 2.44. This value shows "long grained type" or "long-medium type",

according to the shape and size classification by Kikkawa³⁾ and Nagamatsu⁵⁾, respectively.

Comparison (Character Nos. 21 to 26)

Comparative studies of data reported in the previous chapters have been looked upon as one of the most important characters for ecotypic differentiation in view of evolution. This character means biologically or agronomically the "grain fullness" in its capacity²⁾. In evolutionary and agronomical viewpoints, it may be said that the larger is the ratio of husked to unhusked grains in the respective character, the more advanced is the evolutionary state of respective strain.

Averages and ranges of variation became larger in the order of length, width and thickness of grain. In other words, grain length showed the lowest value but was most stable in view of the grain fullness. On the contrary, grain thickness showed the highest value but was most unstable in view of the grain fullness. And grain width showed intermediate value both in practical value and in its stability. Such tendencies were found to be the same in the Japanese cultivated strains¹⁾ and in wild species in India²⁾. Then, the order found in length, width and thickness in view of practical values and variation ranges are constant in the *Oryza* species.

II. Relations between the respective two characters

Unhusked grain

To make clear the three relationships between length and width, length and thickness, width and thickness, and other three components, *i.e.*, ratios of length to width and of length to thickness, of length to width and of width to thickness, of length to thickness and width to thickness, correlation coefficients and linear regressions between them were calculated and shown in Table 2. Three, 2 and 1 cases showed significances at 0.1%, 5% levels and no significance even at 5% level, respectively. For example, it may be said that the wider is the width of grain, the thicker is the thickness of unhusked grain. These tendencies are found to be quite the same as that of Japanese strains¹⁾.

Husked grain

The same characters as that of the unhusked grains were calculated and shown in Table 2 as to the husked grains. Half of them showed significances at 0.1% level and other half of them no significance even at 5% level, respectively. For example, it means that the wider is the width of grain, the thicker is the thickness of husked grain. These tendencies were also found to be quite similar to that of Japanese strains¹⁾.

In comparison with the data obtained in unhusked and husked grains, the followings could be said. Three correlations, *i.e.*, width and thickness, ratios of length to width and of length to thickness, of length to width and of width to thickness, were highly significant and was constant both in unhusked and husked grains. Other 3 correlations showed reversed results.

Comparison

Correlation coefficients and linear regressions between unhusked and husked grains, *i.e.*, length (Character Nos. 1 and 11), width (Nos. 2 and 12), thickness (Nos. 3 and 13), ratio of length to width (Nos. 4 and 14), of length to thickness (Nos. 5 and 15), of width to thickness (Nos. 6 and 16) were calculated and shown in Table 2. Whole of them showed significances at 0.1% level. For example, it means that the longer is the length of unhusked grain, the longer is the length of husked grain. This tendency was a quite

Table 2. Relations between the respective morphological characters of unhusked and husked grains.

	Character	Ref. No.	Correlation coefficient	Linear regression	O points Y	X
Unhusked	Length and Width	1 & 2	0.3119*	$Y = 0.275X + 0.361$	3.20	9.00
	Length and Thickness	1 & 3	0.2934*	$Y = 0.148X + 1.496$	2.05	9.00
	Width and Thickness	2 & 3	0.5311***	$Y = 0.304X + 1.475$	2.05	3.20
	L/W and L/T	4 & 5	0.8060***	$Y = 0.975X - 0.988$	4.38	2.88
	L/W and W/T	4 & 6	-0.8945***	$Y = -0.877X + 2.653$	1.49	2.88
	L/T and W/T	5 & 6	0.1342	—	—	—
Husked	Length and Width	11 & 12	0.0059	—	—	—
	Length and Thickness	11 & 13	0.2639	—	—	—
	Width and Thickness	12 & 13	0.6696***	$Y = 0.399X + 0.706$	1.85	2.60
	L/W and L/T	14 & 15	0.7393***	$Y = 0.815X + 0.981$	3.48	2.58
	L/W and W/T	14 & 16	-0.5209***	$Y = -0.498X - 1.445$	1.41	2.58
	L/T and W/T	15 & 16	0.0338	—	—	—
Comparison	Length	1 & 11	0.8316***	$Y = 0.504X - 0.836$	6.60	9.00
	Width	2 & 12	0.8249***	$Y = 0.915X + 1.263$	2.60	3.20
	Thickness	3 & 13	0.7302***	$Y = 0.843X + 0.047$	1.85	2.05
	L/W	4 & 14	0.8021***	$Y = 0.845X - 1.754$	2.58	2.88
	L/T	5 & 15	0.8254***	$Y = 0.792X + 0.427$	3.48	4.38
	W/T	6 & 16	0.5536***	$Y = 0.562X - 1.033$	1.41	1.49
Ratio	Length and Width	21 & 22	-0.0649	—	—	—
	Length and Thickness	21 & 23	0.1978	—	—	—
	Width and Thickness	22 & 23	0.2851*	$Y = 0.251X + 1.734$	0.88	0.82
	L/W and L/T	24 & 25	0.4055**	$Y = 0.284X - 1.299$	0.82	0.89
	L/W and W/T	24 & 26	-0.6829***	$Y = -0.728X - 3.869$	0.91	0.89
	L/T and W/T	25 & 26	0.1560	—	—	—

***, **, *: significant at 0.1, 1 and 5% levels, respectively.

the same as that of Japanese strains¹⁾.

Ratio

Correlation coefficients and linear regressions between the respective two characters, *i. e.*, Character Nos. 21 and 22, 21 and 23, 22 and 23, 24 and 25, 24 and 26, 25 and 26, were calculated and shown in also Table 2. One, 1, 1 and 3 components showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. For example, it means that the larger is the ratio of the comparative value of length to width, the smaller is the ratio of the comparative value of width to thickness, which was the same as both in the unhusked and the husked grains.

Summary

Local variety at Ambon, Indonesia, of cultivated rice, *Oryza sativa* L., "Pelita", was used for investigation in morphological characters of unhusked and husked grains.

Eighteen characters were measured and 24 relations between the respective two characters were calculated.

Basing on the data obtained here, the variety "Pelita" was detected to be B type or *javanica* variety. Moreover, it was looked upon considerably advanced variety in this type. Correlation coefficients and linear regressions among 24 cases were calculated. Thirteen, 1, 3 and 7 cases showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively.

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References

- 1) Katayama, T. C. : (Unpublished)
- 2) ----- and Kuroda, T. : *Pre. Rep. Tottori Univ. Sci. Survey 1971*, 2, 19-70 (1974)
- 3) Kikkawa, S. : *Jour. Coll. Agr. Imp. Univ. Tokyo* 3 (2), 1-108 (1912)
- 4) Matsuo, T. : *Natl. Inst. Agr. Sci. Ser. D* 3, 1-111 (in Jap. with Eng. Sum.) (1952)
- 5) Nagamatsu, T. : *Proc. Crop Sci. Soc. Japan* (in Jap.) 14 (2), 132-145 (1942)