

On Distribution and Morphology of Cultivated Rice in Kenya

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Introduction

From November in 1984 and from August to September in 1985, the writers were sent to Kenya for collecting the wild and cultivated rices under the project, "Studies on the Distribution and Ecotypic Differentiation of Wild and Cultivated Rice Species in Africa", supported by a Grant from the Ministry of Education, Science and Culture of Japanese Government.

On the distribution of cultivated rice in Kenya, some reports have already been published^{1,3)}. In these trips, various types of cultivated rice, distributed and under cultivation, were collected in Kenya. In this report, only the habitat and record of morphological characters of unhusked grains of the cultivated rice collected in Kenya were described. Based on the analyses of data obtained in the further morphological characters, varietal variations are going to be informed in the following papers.

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Abstract of distribution and habitat of cultivated rice

Geographical distributions and habitats of the cultivated rice collected in Kenya were briefly illustrated in Fig. 1, in which are given the trip-routes and collection-sites, too.

Seed samples were collected in the following districts; Bumala, Busia, Kwale, Mnazini, Hewani, Ngao and Idosowerinage.

Distributions of cultivated rice collected was given in Table 1. In this table, the strain number, the date of collection, the local name, the detailed locality and some informations for the habitat were described.

Nineteen strains of seed samples were collected during the trip in 1985. At that time, cultivated rice had been harvested from most of the fields. Of 19 strains thirteen were collected from farmer's stores. Three strains of seed samples of those were ascertained to be mixed varieties. The other samples were collected from upland fields, rainfed paddy fields and irrigated paddy fields.

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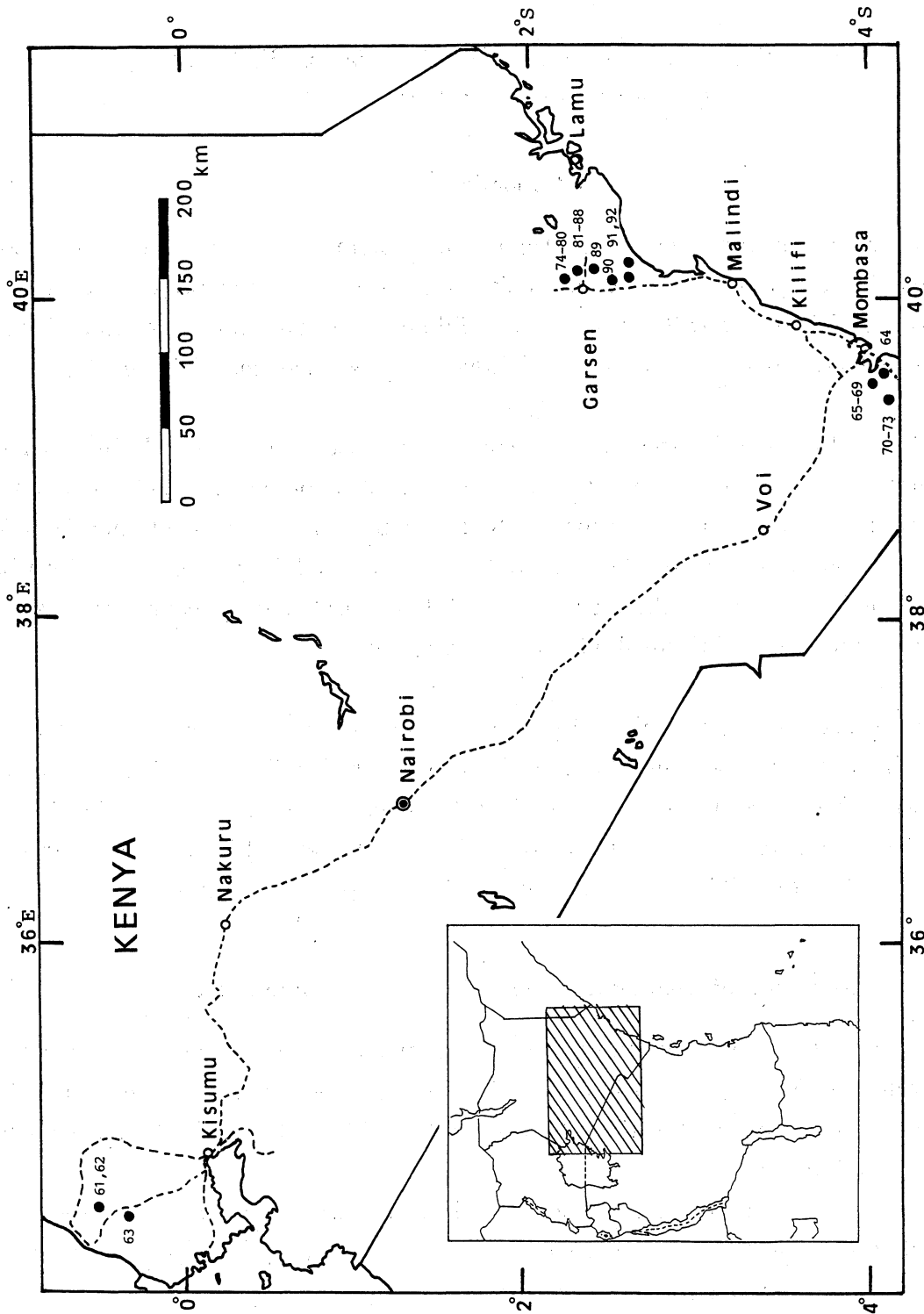


Fig. 1. Map showing several localities where the cultivated rices were collected in Kenya. Dotted lines; routes of observations, filled circles; collection areas, open circles; main towns. Code-numbers used in the figure corresponding to the strain number used in the tables.

Table 1. Distribution and habitat of cultivated rice in Kenya in 1985

Strain No.	Collecting date	Local name	Place, habitat and remarks
61	Sep. 17	Sindano	Tnanka Kona (a) Village, Busia. Collected from farmer's store.
62	Sep. 17	Basmati	The same place as No. 61. Collected from farmer's store.
63	Sep. 17	Daudra-precocce	Bumala. Upland field.
64	Sep. 20	Bi-bi-ya-muhaka	Waa Village, Kwale. Rainfed paddy field.
65	Sep. 20	Moshi wa sigara	Matuga Village, Kwale. Collected from farmer's store. Mixed variety.
66, 67, 68, 69	Sep. 20	—	Samples of Nos. 66~69 were separated from No. 65 in 1985.
70	Sep. 20	Kitumbo	Matuga Village, Kwale. Collected from farmer's store. Mixed variety.
71, 72, 73	Sep. 20	—	Samples of Nos. 71~73 were separated from No. 70 in 1985.
74	Sep. 21	Mtezaminami	Mnazini Village, Tana river. Collected from farmer's store. Mixed variety.
75, 76, 77, 78, 79, 80	Sep. 21	—	} Samples of Nos. 75~80 were separated from No. 74 in 1985.
81	Sep. 22	Gamti	
82	Sep. 22	Asfala	} Samples of Nos. 81~88 were collected from farmer's store in Hewani Village, Tana river.
83	Sep. 22	Bi-bi-ya-muhaka	
84	Sep. 22	Mututudo	
85	Sep. 22	Basmati	
86	Sep. 22	Basmati	
87	Sep. 22	Muriziki	
88	Sep. 22	Mtezaminami	
89	Sep. 22	Sindano	Hewani Village, Tana river. Irrigated paddy field.
90	Sep. 23	Kisuke	Ngao Village, Tana river. Collected from farmer's store.
91	Sep. 23	Fazani	Idosowerinage Village, Tana river. Irrigated paddy field.
92	Sep. 23	Muenosi	Idosowerinage Village, Tana river. Irrigated paddy field.

Identification of individual strains in the mixed varieties were carried out for grain morphology, *i. e.*, shape and size of grain, and colors of hull and pericarp, in 1985. Consequently, number of strains collected were ascertained to be 32 in the total.

Some morphological characters of unhusked grains

Thirty-two strains of cultivated rice, *i. e.*, *Oryza sativa* L., were collected and those were used for morphological investigations of unhusked grains. Eight strains were removed

from the investigations, because their grains were wholly immature or quite few.

Investigations were done for grain-length, grain-width and grain-thickness of unhusked grains, using 20 grains of each strain. Measurements were done at the largest position of the respective characters. Moreover, of the unhusked grains, calculations were done on the ratios of the following components, namely, 'length to width', 'length to thickness' and 'width to thickness', using the average values of the respective characters.

The results are given in Table 2. Lengths of grains were observed to be between 8.40 mm and 10.84 mm. The shortest grain was obtained in strain No. 70. The longest

Table 2. Some morphological characters of unhusked grains collected in Kenya

Strain No.	Length (L) (mm)	Width (W) (mm)	Thickness (T) (mm)	L/W	L/T	W/T
61	9.19±0.23 ¹⁾	2.65±0.05	2.06±0.04	3.47±0.09	4.47±0.12	1.29±0.04
62	9.50±0.33	2.65±0.12	2.02±0.07	3.59±0.11	4.72±0.15	1.32±0.04
63	10.24±0.33	3.05±0.14	2.28±0.05	3.36±0.13	4.49±0.16	1.34±0.05
64	10.56±0.23	3.17±0.08	2.26±0.04	3.34±0.12	4.68±0.11	1.40±0.04
65	9.58±0.50	3.13±0.16	2.12±0.08	3.07±0.09	4.53±0.19	1.48±0.03
70	8.40±0.22	3.88±0.18	2.45±0.11	2.17±0.10	3.44±0.13	1.59±0.08
71	10.38±0.28	3.50±0.06	2.23±0.10	2.97±0.08	4.66±0.16	1.57±0.07
72	9.96±0.50	3.00±0.12	2.14±0.07	3.33±0.17	4.65±0.20	1.40±0.07
73	10.50±0.23	2.87±0.10	1.96±0.07	3.67±0.16	5.38±0.21	1.47±0.08
74	10.26±0.34	2.76±0.08	1.95±0.05	3.72±0.16	5.26±0.18	1.42±0.05
75	10.44±0.31	2.77±0.10	2.02±0.07	3.77±0.14	5.19±0.23	1.38±0.08
76	9.72±0.40	2.87±0.08	1.98±0.06	3.39±0.16	4.91±0.14	1.45±0.06
77	8.72±0.30	3.52±0.11	2.10±0.09	2.48±0.11	4.17±0.21	1.69±0.11
78	8.59±0.25	2.63±0.17	1.75±0.11	3.28±0.17	4.95±0.39	1.51±0.07
79	8.50±0.23	3.55±0.08	2.09±0.07	2.40±0.09	4.07±0.18	1.70±0.08
81	9.94±0.42	2.57±0.05	2.00±0.04	3.87±0.15	4.96±0.19	1.28±0.02
82	9.81±0.31	2.97±0.06	2.03±0.05	3.37±0.12	4.83±0.16	1.46±0.05
83	10.84±0.31	2.89±0.06	2.05±0.07	3.76±0.13	5.31±0.16	1.41±0.05
84	9.73±0.27	3.08±0.13	2.19±0.09	3.16±0.13	4.44±0.20	1.41±0.08
85	9.92±0.33	2.57±0.08	1.96±0.07	3.86±0.16	5.06±0.18	1.31±0.06
86	10.17±0.37	2.75±0.10	2.02±0.06	3.71±0.10	5.05±0.19	1.36±0.05
87	10.08±0.29	2.93±0.08	2.06±0.05	3.45±0.11	4.89±0.15	1.42±0.05
88	10.69±0.29	2.96±0.06	2.08±0.06	3.62±0.13	5.13±0.18	1.42±0.05
89	9.59±0.32	2.82±0.11	2.05±0.07	3.48±0.16	4.69±0.15	1.38±0.05
90	9.25±0.42	3.60±0.12	2.22±0.07	2.57±0.11	4.17±0.20	1.63±0.06
91	9.06±0.43	3.38±0.11	2.01±0.06	2.68±0.11	4.51±0.20	1.68±0.08
92	8.63±0.24	3.54±0.07	2.05±0.05	2.44±0.07	4.22±0.10	1.73±0.04
Grand ²⁾ mean	9.71±0.70	3.04±0.36	2.08±0.13	3.25±0.48	4.70±0.43	1.46±0.13

1) Mean of 20 grains and standard deviation.

2) Mean of means in the respective strains (n=27) and standard deviation.

grain was obtained in No. 83. Average value was found to be 9.71 *mm*. The standard deviations of each strain, *i. e.*, showing intra-strain variation, were noted to be between 0.22 and 0.50.

Widths of grains were observed to be between 2.57 *mm* and 3.88 *mm*. The narrowest grains were obtained in Nos. 81 and 85. The widest grain was obtained in No. 70. Average value was found to be 3.04 *mm*. The standard deviations of each strain were noted to be between 0.05 and 0.18.

Thicknesses of grains were observed to be between 1.75 *mm* and 2.45 *mm*. The thinnest grain was obtained in No. 78. The thickest grain was obtained in No. 70. Average value was found to be 2.08 *mm*. The standard deviations of each strain were noted to be between 0.04 and 0.11.

To make clear the relationships of the three components, *i. e.*, length and width, length and thickness, and width and thickness of unhusked grains, correlation coefficients were calculated. The correlation coefficient between length and width of unhusked grains was ascertained to be -0.47 showing negative correlation at 0.1 % level. The correlation coefficient between length and thickness of unhusked grains was ascertained to be -0.03 showing no significant correlation even at 5 % level. The correlation coefficient between width and thickness of unhusked grains was ascertained to be 0.68 showing significant correlation among them at 0.1 % level. These relations indicated that the longer was the grain-length, the narrower was the grain-width and the wider was the grain-width, the thicker was the grain-thickness, respectively.

Ratios of length to width of unhusked grains were observed to be between 2.17 and 3.87. The smallest value was obtained in No. 70. The largest value was obtained in No. 81. Average value was found to be 3.25. The standard deviation of the whole strains, *i. e.*, showing inter-strain variation, was 0.48.

Ratios of length to thickness of unhusked grains were observed to be between 3.44 and 5.38. The smallest value was obtained in No. 70. The largest value was obtained in No. 73. Average value was found to be 4.70. The standard deviation of the whole strains was 0.43.

Ratios of width to thickness of unhusked grains were observed to be between 1.28 and 1.73. The smallest value was obtained in No. 81. The largest value was obtained in No. 92. Average value was found to be 1.46. The standard deviation of the whole strains was 0.13.

As shown in Fig. 2, based on the data obtained concerning the grain-length and grain-width of unhusked grains, the whole strains used were classified into two grain types, *i. e.*, B (large type) and C (slender type), according to the tripartite classification by Matsuo²⁾. In this figure, code-numbers used are corresponding to the strain number used in Table 2. Nineteen strains of those belonged to the B type and 8 strains to the C type, respectively.

As shown in Table 3, average values of grain-length were found to be 9.77 *mm* in 19 strains belonging to the B type and 9.58 *mm* in 8 strains belonging to the C type,

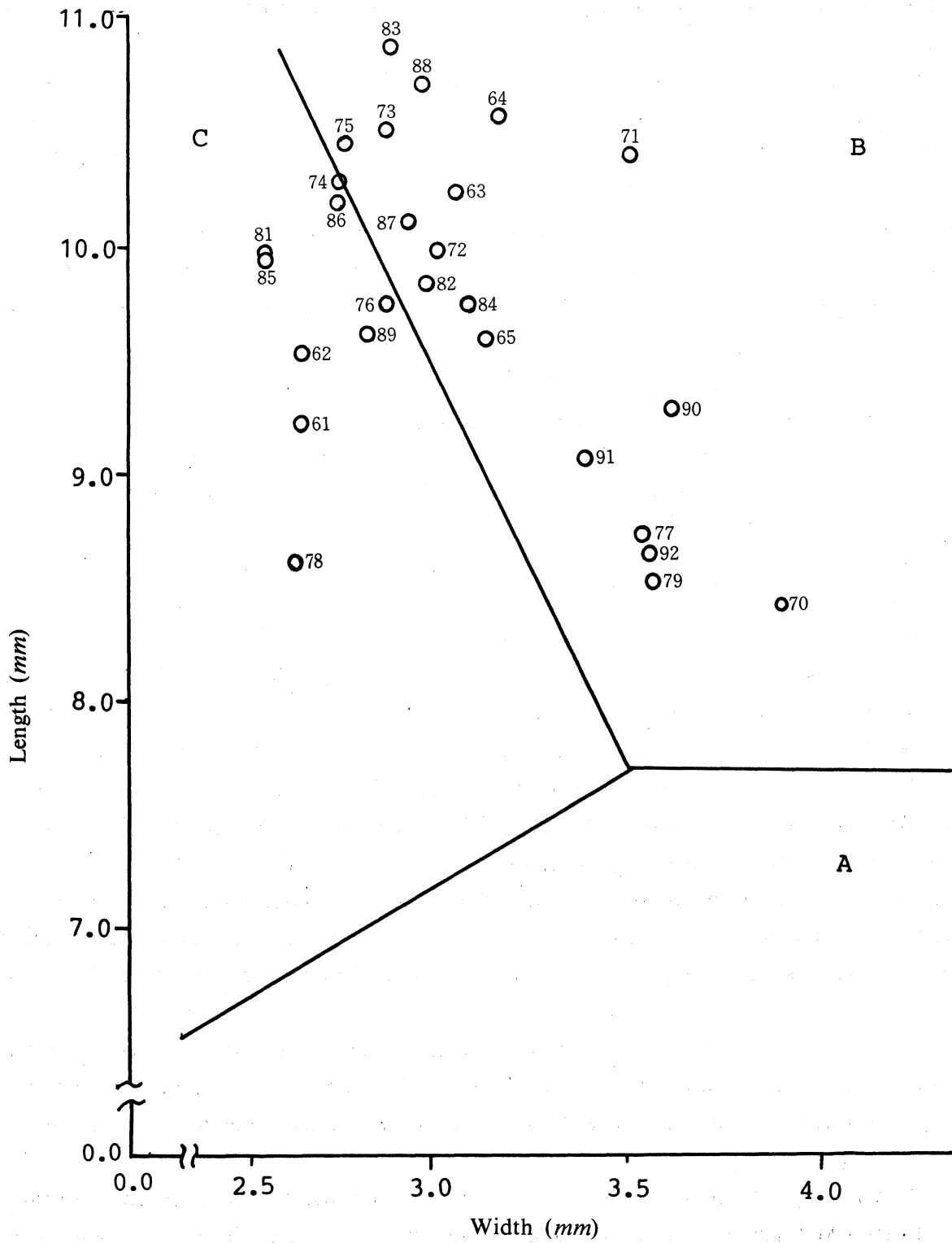


Fig. 2. Classification of grain types of unhusked grains in cultivated rice collected in Kenya according to the tripartite classification by Matsuo²⁾. Vertical axis; length of grain, abscissa; width of grain, open circle; *Oryza sativa* L., respectively. Code-numbers used in figure are corresponding to the strain number used in Table 2.

Table 3. Number of strains and average values of length and width of unhusked grains belonging to the respective grain types

Grain ¹⁾ type	No. of strains	Length (mm)	Width (mm)
B	19	9.77±0.77	3.19±0.32
C	8	9.58±0.47	2.67±0.11

1) For explanation, refer to Fig. 2.

respectively. Average values of grain-width were found to be 3.19 mm in B type and 2.67 mm in C type, respectively. Strains belonging to the C type were remarkably narrow in view of grain-width. In grain-length, standard deviations of the whole strains belonging to the B and the C types, *i. e.*, showing inter-strain variations, were 0.77 in the B type and 0.47 in the C type, respectively. In grain-width, standard deviations of the whole strains belonging to the B and the C types were 0.32 and 0.11, respectively.

Summary

During in November in 1984 and from August to September in 1985, in Kenya, nineteen strains of seed sample including 3 mixed varieties of cultivated rice, *i. e.*, *Oryza sativa* L., were collected. Mixed varieties were identified into 16 strains according to the grain morphology in 1985. Consequently, 32 strains were obtained in the total. Their localities and habitats were reported (Table 1). Locality names are as follows; Bumala, Busia, Kwale, Mnazini, Hewani, Ngao and Idosowerinage.

Of 32 strains twenty-seven were used for morphological investigations of unhusked grains. In average values, length, width and thickness of unhusked grains were 9.71 mm, 3.04 mm and 2.08 mm, respectively. Of unhusked grains, correlation coefficients between length and width, length and thickness, and width and thickness were -0.47, -0.03 and 0.68, respectively. Of unhusked grains, ratios of the following components, namely, 'length to width', 'length to thickness,' and 'width to thickness', were 3.25, 4.70 and 1.46 in average values, respectively.

Using grain-length and grain-width, cultivated rice strains used were classified into two grain types. Nineteen strains belonged to the B type and 8 strains to the C type, respectively.

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摘 要

ケニアにおける栽培稲の分布と形態

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1984年11月と1985年8月から9月にかけて、ケニアにおいて栽培稲の分布と生態について、調査を行ない、3系統の混種を含む19系統の種子標本を採集した。それらは、1985年の形態的調査により、全体として32系統に類別された。それらの分布と生態条件はTable 1に示したとおりである。

32系統のうち27系統を供試して籾の形態的特性を調査した。籾の長さ、幅、厚さは、系統間平均でそれぞれ9.71, 3.04, 2.08 mmであった。これらの形質間には、長さと幅、長さと厚さおよび幅と厚さにそれぞれ-0.47, -0.03, 0.68の相関係数が得られ、籾長が長い系統ほど籾幅が狭く、籾幅の広い系統ほど厚くなる傾向が認められた。長幅比、長厚比、幅厚比は、系統間平均でそれぞれ3.25, 4.70, 1.46であった。籾型の分類により19系統がB型、8系統がC型にそれぞれ分類された。

今後、さらに多くの形態的特性の分析をもとにケニアを含むアフリカ地域における栽培稲の品種分化を検討する。

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