

Grain Morphology of Wild Rice in African Countries (VII)

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Introduction

On the distribution of wild rice in Africa, some few scientific reports have been published^{1, 2, 4, 5, 27-30)}. Although Africa has been considered to be one of the most important distribution areas of the wild rice in the world, accumulations of complete data on these aspects is far from being perfect. Taking these facts into account, the present study-series were made to ascertain exactly the distribution, and the geographical, seasonal and ecotypic differentiations of wild rice in African areas.

Recently, wild *Oryza* species have frequently been studied from several agronomic viewpoints. For example, Yuan *et al.* (1992)³²⁾ reported a wild rice close to the *japonica* type of *O. sativa*. Xw *et al.* (1993)³¹⁾ studied interspecific superoxide dismutase zymogram of genus *Oryza*. Farooq *et al.* (1992)³³⁾ reported about variabilities in salt tolerance of accession of wild rice species, *Oryza punctata* and *O. officinalis*. Reimers *et al.* (1993)²⁶⁾ studied wild species of *Oryza* in the resistance to rice blast (Bl). These wild rices mentioned above may be used in the wider ranges of agronomy. These are the reasons why wild rice should be studied in the global viewpoints.

The writer made research trips in 8 countries of Africa. In the previous papers, the preliminary and advanced data were published as the results of the first and the second survey-trips made in 1984 and 1985⁷⁻¹³⁾, respectively. In the following papers, the results obtained in the third survey-trip made in 1988 were reported¹⁶⁻¹⁸⁾. Further, in the previous papers, else than these, habitat and the records of the morphological characters of the unhusked grains¹⁹⁾, the husked grains²¹⁾, the comparative data (= husked/unhusked)²²⁾, and grain areas and volumes²³⁾, and correlation coefficients between the practical values of the unhusked and the husked grains and the linear regression between these^{24, 25)} of the wild rices collected in 1984, 1985 and 1988 were described, with the confirmation of the morphological characters of grains, which was to make the strain's specificities more obvious.

In the present paper, the remaining 3 mutual relationships among the 24 characters in view of practical values were mainly described (PART I). And, the summed-up data concerning 27 character-combinations were explained (PART II).

Materials and Methods

190 strains of *Oryza longistaminata* CHEV. et ROEHR., 49 strains of *Oryza breviligulata* CHEV. et ROEHR., 44 strains of *Oryza punctata* KOTSCHY, and 1 strain of *Oryza brachyantha* CHEV. et ROEHR., were used for morphological investigations.

Thirty grains were used for the measurements of each strain. To make clear the relations

between the respective 2 characters of the area and the volume columns on the grain and strain levels, correlation coefficients between the two and linear regression between them were calculated (Tables 1 to 11). Correlation coefficients in the whole character-combinations (=27) were summed-up (Table 12, but only on group level).

In the present paper, the following abbreviations were used, *i.e.*, L (length), W (width), T (thickness), L/W (ratio of length to width), L/T (ratio of length to thickness), W/T (ratio of width to thickness), s.d. (standard deviations), c.c. (correlation coefficient), l.r. (linear regression), d.f. (degree of freedom), UHG (unhusked grain), HG (husked grain).

Results and Discussion

The results are given in Tables 1 to 10, *i.e.*, *O. longistaminata*: Table 1 - Madagascar, Accession Nos.301-313, collected in 1985 and Nos.2001-2047, collected in 1988: Table 2 - Tanzania, No.314 in 1984 and Nos.2048-2083 in 1988: Table 3 - Kenya, Nos.315-324 in 1985: Table 4 - Nigeria, Nos.325-336 in 1984 and Nos.337-382 in 1985: Table 5 - Ivory Coast, Nos.384-390 in 1984: Table 6 - Senegal including Gambia in 1985, Nos.391-441 in Casamance region and Nos.444-455 in northern region; *O. breviligulata*: Table 7 - Nigeria, Nos.328-334 in 1984 and Nos.344-380 in 1985: Table 5 - Ivory Coast, No.383 in 1984: Table 8 - Senegal including Gambia in 1985, Nos.398-442 in Casamance region and Nos.443-456 in northern region; *O. punctata*: Table 9 - Tanzania, Nos.457-459 in 1984 and Nos.2084-2109 in 1988: Table 10 - Kenya, Nos.460-464 in 1984 and Nos.465-474 in 1985; *O. brachyantha*: Table 8 - Senegal, No.475 in 1985.

For summing-up the data, the results mentioned above were used, and are given in Table 11. In this table, 3 morphological character-combinations of the grains were illustrated by the correlation coefficients and the linear regressions of the respective groups; *i.e.*, *O. longistaminata* in the first columns --- 1: Madagascar (**MD** in the tables) collected in 1985 (13 strains); 2: the same, collected in 1988 (47 strains); 3: the same, collected in the both years (60 strains); 5: Tanzania (**TA**) collected in 1988 (36 strains); 6: the same, collected in 1984 and 1988 (37 strains); 7: Kenya (**KE**) collected in 1985 (10 strains); 8: Nigeria (**NI**) collected in 1984 (5 strains); 9: the same, collected in 1985 (29 strains); 10: the same, collected in the both years (34 strains); 11: Ivory Coast (**IV**) collected in 1984 (7 strains); 12: Senegal (**SE**) collected in 1985 in Casamance region (35 strains); 13: the same, collected in 1985 in northern region (7 strains); 14: the same, of the both regions (42 strains); 15: the summed-up data of strains (**SUM**) collected in 1984 and 1985 in the whole countries (107 strains); 16: the summed-up data of strains collected in 1984, 1985 and 1988 in the whole countries (190 strains); *O. breviligulata* in the second columns --- 17: Nigeria (**NI**) collected in 1984 (7 strains); 18: the same, collected in 1985 (17 strains); 19: the same, collected in the both years (24 strains); 21: Senegal (**SE**) collected in 1985 in Casamance region (17 strains); 22: the same, collected in 1985 in northern region (7 strains); 23: the same, of the both regions (24 strains); 24: the summed-up data of strains (**SUM**) collected in 1984 and 1985 in the three countries (49 strains); *O. punctata* in the third columns --- 25: Tanzania (**TA**) collected in 1984 (3 strains); 26: the same, collected in 1988 (26 strains); 27: the same, collected in the both years (29 strains); 28: Kenya (**KE**) collected in 1984 (5 strains); 29: the same, collected in 1985 (10 strains); 30: the same, collected in the both years (15 strains); 31: the summed-up data of strains (**SUM**) collected in 1984 and 1985 in the two countries (18 strains); 32: the summed-up data of strains collected in 1984, 1985 and 1998 in the two countries (44 strains).

Groups 4 (TA, *O. longistaminata* collected in 1984), 20 (IV, *O. breviligulata* collected in 1984) and 33 (SE, *O. brachyantha* collected in 1985) were omitted owing to being only 1 strain each.

Some strains have conceived different meanings in view of physiological, meteorological and phylogenetical characters, and should be separately considered in morphological studies as well. Accordingly, those are divided into two groups, and thereafter are summed-up in the respective countries and groups, in view of the subsequent analyses. 34: East Africa of *O. longistaminata*; 107 strains in the total, i.e., Madagascar (1 [13 strains] and 2 [47 strains]), Tanzania (4 [1 strain] and 5 [36 strains]) and Kenya (7 [10 strains]); 35: West Africa of *O. longistaminata*; 83 strains in the total, i.e., Nigeria (8 [5 strains] and 9 [29 strains]), Ivory Coast (11 [7 strains]), Senegal (12 [35 strains] and 13 [7 strains]).

PART I. Respective character-combination

I. *Oryza longistaminata* CHEV. et ROEHR.

1. Areas of UHG and HG

Correlation coefficient (abbreviated as c.c.) and linear regression (abbreviated as l.r.) of the area of husked grain (HG) on the area of unhusked grain (UHG) in the same strains were calculated, and are shown in the left columns of Tables 1 to 6. In MD (Table 1), 10, 11, 21; 1, 11, 12; 7, 7; 2, 18 and 20 strains showed significances at 0.1% (1985 [abbreviated as 1], 1988 [2], both years [3]), 1% (1, 2, 3) and 5% (2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 84.6, 61.7 and 66.7% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 2), 1, 9, 10; 5, 5; 4, 4; 18 and 18 strains showed significances at 0.1% (1984 [abbreviated as 4], 1988 [5], both years [6]), 1% (5, 6) and 5% (5, 6) levels and no significance even at 5% level (5, 6), respectively. 100.0, 50.0 and 51.4% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 3), 4 (=40.0% of the whole) and 6 (=60.0%) showed significances at 0.1% level and no significance even at 5% level, respectively (7).

In NI (Table 4), 2, 18, 20; 1, 4, 5; 3, 3; 2, 4 and 6 strains showed significances at 0.1% (1984 [abbreviated as 8], 1985 [9], both years [10]), 1% (8, 9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 60.0, 86.2 and 82.4% strains of the whole showed significances in 8, 9 and 10, respectively. In IV (Table 5), 2, 3 and 2 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively (11). 71.4% strains of the whole showed significances. In SE (Table 6), 27, 6, 33; 2, 2; 1, 1; 5, 1 and 6 strains showed significances at 0.1% (Casamance [abbreviated as 12], northern [13], both regions [14] in 1985), 1% (12, 14) and 5% (12, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 85.7% strains of the whole showed significances in the whole of 12, 13 and 14 groups.

In SUM, 70, 90, 35, 55; 8, 24, 17, 7; 7, 18, 11, 7; 22, 58, 44 and 14 strains showed significances at 0.1% [1984 and 1985 in the whole countries (107 strains), abbreviated as 15, 1984, 1985 and 1988 in the whole countries (190 strains), abbreviated as 16, East Africa in the whole years (107 strains), abbreviated as 34, West Africa in the whole years (83 strains), abbreviated as 35], 1% (15, 16, 34, 35) and 5% (15, 16, 34, 35) levels and no significance even at 5% level (15, 16, 34, 35), respectively. 79.4, 69.5, 58.9 and 83.1% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of West Africa (35) showed higher significances than those of East Africa (34).

In the group level (Table 11), the whole groups (=13) showed significances at 0.1% level.

Table 1. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Madagascar, *O. longistaminata*, 301-313 in 1985 and 2001-2027 in 1988

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
301	0.9500***	Y=0.485X+2.052	0.8190***	Y=0.319X+5.963	0.9449***	Y=2.500X-0.955
302	0.5863***	Y=0.319X+4.069	0.5308**	Y=0.256X+4.909	0.8130***	Y=0.905X-0.049
303	0.2059	—	0.1598	—	0.9349***	Y=0.974X-0.098
304	0.5075**	Y=0.463X+2.491	0.2370	—	0.8818***	Y=1.432X-0.335
305	0.9784***	Y=0.989X-9.776	0.9633***	Y=0.644X-6.336	0.9042***	Y=0.872X-0.024
306	0.9555***	Y=0.444X+3.492	0.9654***	Y=0.437X+2.003	0.1572	—
307	0.8978***	Y=0.654X-0.737	0.9413***	Y=0.607X-2.153	0.7322***	Y=0.708X+0.117
308	0.8776***	Y=-0.733X+26.662	0.8998***	Y=0.379X+0.895	0.8910***	Y=0.093X+0.358
309	0.9896***	Y=0.421X+2.490	0.7941***	Y=0.327X+3.946	0.4502*	Y=0.618X+0.114
310	0.7746***	Y=0.806X-4.469	0.2860	—	0.9686***	Y=1.286X-0.259
311	0.9156***	Y=0.700X-3.383	0.8379***	Y=0.563X-4.191	0.8945***	Y=1.007X-0.106
312	0.0155	—	0.0106	—	0.9523***	Y=0.951X-0.090
313	0.9984***	Y=1.967X-25.092	0.8267***	Y=0.807X-9.021	0.8660***	Y=2.500X-0.948
Average	0.9105***	Y=0.577X-0.306	0.9257***	Y=0.543X-2.404	0.9605***	Y=1.037X-0.117
2001	0.5493**	Y=0.329X+4.254	0.2367	—	0.8432***	Y=0.837X-0.002
2002	0.5059**	Y=0.342X+3.905	0.2954	—	0.8789***	Y=0.957X-0.082
2003	0.7163***	Y=0.446X+2.353	0.6457***	Y=0.279X+5.063	0.8397***	Y=0.854X-0.024
2004	0.1812	—	0.2941	—	0.8996***	Y=0.782X-0.001
2005	0.5577**	Y=0.335X+3.554	0.4358*	Y=0.189X+5.706	0.8358***	Y=0.971X-0.098
2006	0.2158	—	0.4451*	Y=0.197X+5.718	0.9342***	Y=0.961X-0.087
2007	0.5370**	Y=0.298X+4.960	0.6116***	Y=0.211X+6.944	0.8791***	Y=1.050X-0.129
2008	0.5771***	Y=0.529X+1.105	0.2151	—	0.8980***	Y=1.022X-0.132
2009	0.3161	—	0.2817	—	0.9136***	Y=1.008X-0.144
2010	0.1432	—	0.3074	—	0.8747***	Y=0.783X+0.003
2011	0.3453	—	0.4446*	Y=0.241X+4.877	0.8933***	Y=0.776X+0.013
2012	0.4684**	Y=0.248X+5.242	0.3769*	Y=0.161X+7.193	0.8334***	Y=0.779X+0.000
2013	0.5460**	Y=0.328X+4.272	0.4409*	Y=0.224X+6.108	0.7714***	Y=1.003X-0.124
2014	0.3287	—	0.6978***	Y=0.511X-1.587	0.9382***	Y=0.835X-0.014
2015	0.4094*	Y=0.376X+2.897	0.6428***	Y=0.436X+0.469	0.9559***	Y=0.863X-0.014
2016	0.0745	—	0.0927	—	0.8599***	Y=0.979X-0.088
2017	0.6589***	Y=0.438X+3.271	0.6239***	Y=0.395X+3.076	0.7692***	Y=0.831X-0.009
2018	0.4373*	Y=0.226X+6.819	0.5184**	Y=0.263X+7.049	0.8120***	Y=0.640X+0.119
2019	0.5037**	Y=0.304X+5.860	0.6153***	Y=0.328X+5.605	0.7231***	Y=0.693X+0.083
2020	0.8588***	Y=0.338X+3.755	0.7818***	Y=0.329X+3.171	0.7126***	Y=0.690X+0.074
2021	0.2840	—	0.3406	—	0.9579***	Y=0.871X-0.015
2022	0.2806	—	0.6829***	Y=0.479X-0.036	0.9100***	Y=0.870X-0.017
2023	0.0676	—	0.3298	—	0.7740***	Y=0.769X+0.030
2024	0.6934***	Y=0.551X-0.135	0.6047***	Y=0.323X+2.840	0.7720***	Y=0.793X+0.016
2025	0.3953*	Y=0.272X+5.427	0.4623*	Y=0.266X+5.184	0.8584***	Y=0.865X-0.031
2026	0.6597***	Y=0.321X+4.299	0.7669***	Y=0.322X+3.933	0.9100***	Y=0.795X+0.035
2027	0.4820**	Y=0.228X+5.290	0.5695**	Y=0.264X+4.650	0.8995***	Y=0.835X+0.003

(Continued)

Table 1. (Continued)

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
2028	-0.2138	—	0.0139	—	0.8760***	Y=0.836X-0.018
2029	0.7336***	Y=0.391X+2.315	0.6681***	Y=0.323X+2.665	0.7446***	Y=0.910X-0.042
2030	0.4579*	Y=0.223X+5.823	0.4515*	Y=0.226X+5.885	0.8695***	Y=0.785X+0.014
2031	0.4299*	Y=0.275X+4.411	0.6242***	Y=0.299X+3.301	0.9184***	Y=0.733X+0.043
2032	0.6524***	Y=0.303X+4.289	0.6722***	Y=0.236X+5.802	0.9100***	Y=0.934X-0.048
2033	0.5244**	Y=0.348X+3.239	0.6276***	Y=0.393X+1.326	0.8483***	Y=0.771X+0.024
2034	0.1266	—	0.1964	—	0.9188***	Y=0.989X-0.105
2035	0.3754*	Y=0.135X+7.200	0.5437**	Y=0.219X+5.827	0.7961***	Y=0.763X+0.023
2036	0.2303	—	0.4106*	Y=0.150X+8.958	0.8484***	Y=0.743X+0.042
2037	0.3347	—	0.3867*	Y=0.175X+7.628	0.8921***	Y=0.868X-0.025
2038	0.3749*	Y=0.375X+3.595	0.5328**	Y=0.335X+3.670	0.8620***	Y=0.806X+0.005
2039	0.5317**	Y=0.339X+4.579	0.6624***	Y=0.384X+3.015	0.8598***	Y=1.027X+0.118
2040	0.6487***	Y=0.482X+2.114	0.5962***	Y=0.343X+4.289	0.7325***	Y=0.868X+0.035
2041	0.5782***	Y=0.482X+2.213	0.6503***	Y=0.411X+2.793	0.8915***	Y=0.893X-0.031
2042	0.1816	—	0.3021	—	0.9301***	Y=0.831X-0.001
2043	0.5993***	Y=0.344X+4.591	0.8390***	Y=0.391X+2.803	0.9290***	Y=0.888X-0.028
2044	0.5336**	Y=0.462X+2.520	0.7097***	Y=0.342X+4.715	0.6150***	Y=0.523X+0.171
2045	0.2842	—	0.5095**	Y=0.171X+1.071	0.9291***	Y=0.854X-0.035
2046	-0.0841	—	0.2476	—	0.9540***	Y=0.865X-0.044
2047	-0.2008	—	0.0789	—	0.9429***	Y=0.881X-0.025
Average	0.6257***	Y=0.501X+1.407	0.9638***	Y=0.437X+0.718	-0.3615*	Y=-0.815X+0.953
Average of both groups	0.7017***	Y=0.511X+1.173	0.9504***	Y=0.469X-0.128	-0.1600	—

d.f.; 28, 11, 45 and 58 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

Table 2. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Tanzania, *O. longistaminata*, 314 in 1984 and 2048-2083 in 1988

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
314	0.9499***	Y=0.600X-0.492	0.9404***	Y=0.596X-4.156	0.5212**	Y=0.933X-0.046
2048	0.1836	—	0.4014*	Y=0.221X+10.377	0.8787***	Y=0.860X-9.596
2049	0.3866*	Y=0.275X+6.423	0.2621	—	0.9441***	Y=1.003X-0.113
2050	0.3160	—	0.3169	—	0.9388***	Y=1.062X-0.127
2051	0.8659***	Y=0.412X+4.385	0.9426***	Y=0.478X-1.105	0.8521***	Y=0.710X+0.048
2052	0.6112***	Y=0.424X+3.706	0.6840***	Y=0.452X+2.119	0.8877***	Y=0.949X-0.062
2053	0.3495	—	0.7601***	Y=0.265X+7.619	0.8059***	Y=0.658X+0.090
2054	0.4662**	Y=0.212X+7.660	0.5667**	Y=0.197X+8.843	0.8146***	Y=0.806X-0.001
2055	0.7162***	Y=0.367X+4.105	0.5543**	Y=0.219X+7.746	0.8586***	Y=0.709X+0.070
2056	0.4961**	Y=0.439X+0.614	0.6542***	Y=0.394X-0.700	0.9570***	Y=0.790X+0.000

(Continued)

Table 2. (Continued)

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
2057	0.7104***	Y=0.511X+0.760	0.6990***	Y=0.405X+1.835	0.9252***	Y=0.952X-0.065
2058	0.1852	—	0.5729***	Y=0.186X+9.661	0.9080***	Y=0.725X+0.053
2059	0.3692*	Y=0.251X+6.965	0.5631**	Y=0.302X+5.908	0.9320***	Y=0.898X-0.042
2060	0.2652	—	0.4185*	Y=0.175X+8.690	0.8973***	Y=0.892X-0.051
2061	0.0120	—	0.1605	—	0.8479***	Y=0.828X-0.016
2062	0.1834	—	0.3674*	Y=0.182X+8.710	0.9171***	Y=0.869X-0.035
2063	0.0318	—	0.3529	—	0.9430***	Y=1.043X-0.124
2064	0.0995	—	0.2051	—	0.8729***	Y=0.740X+0.047
2065	0.6121***	Y=0.347X+4.394	0.8023***	Y=0.382X+3.082	0.8628***	Y=0.814X+0.015
2066	0.3968*	Y=0.239X+5.251	0.3339	—	0.9196***	Y=1.130X-0.170
2067	0.2550	—	0.6038***	Y=0.270X+8.363	0.8909***	Y=0.795X+0.030
2068	0.2500	—	0.4363*	Y=0.214X+7.393	0.8929***	Y=0.976X-0.093
2069	0.0836	—	0.2260	—	0.9123***	Y=0.939X-0.093
2070	0.5548**	Y=0.511X+1.728	0.6696***	Y=0.421X+2.179	0.8496***	Y=1.021X-0.123
2071	0.2852	—	0.4850**	Y=0.267X+5.331	0.8719***	Y=0.831X-0.020
2072	0.2995	—	0.3707*	Y=0.264X+6.648	0.9389***	Y=0.911X-0.056
2073	0.6092***	Y=0.418X+2.144	0.4736**	Y=0.315X+2.881	0.8920***	Y=1.114X-0.176
2074	0.4621*	Y=0.209X+6.991	0.5538**	Y=0.194X+8.412	0.9220***	Y=0.852X-0.026
2075	0.3232	—	0.5404**	Y=0.285X+5.844	0.8692***	Y=0.697X+0.067
2076	0.5801***	Y=0.582X+0.184	0.6711***	Y=0.439X+1.524	0.9214***	Y=0.833X-0.006
2077	0.5525**	Y=0.299X+5.791	0.5898***	Y=0.281X+6.775	0.9016***	Y=0.901X-0.043
2078	0.5719***	Y=0.329X+5.048	0.7048***	Y=0.362X+4.090	0.8268***	Y=0.805X+0.016
2079	0.1221	—	0.3531	—	0.9487***	Y=0.885X-0.047
2080	-0.0926	—	0.1315	—	0.7328***	Y=0.741X+0.051
2081	0.2177	—	0.2672	—	0.9234***	Y=0.966X-0.089
2082	0.5641**	Y=0.527X+0.533	0.6043***	Y=0.421X+0.812	0.8351***	Y=0.781X+0.016
2083	0.6448***	Y=0.387X+3.641	0.5758***	Y=0.200X+7.367	0.7724***	Y=0.861X-0.032
Average	0.7779***	Y=0.375X+3.965	0.8115***	Y=0.345X+3.936	0.9731***	Y=1.021X-0.118
Average of both groups	0.7915***	Y=0.389X+3.689	0.8261***	Y=0.367X+3.255	0.9674***	Y=1.024X-0.119

d.f.; 28, 34 and 35 in strain, the first and second averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

In the summed-up group, the whole of **15**, **16**, **34** and **35** showed no significance even at 0.1% level.

2. Volumes of UHG and HG

C.c. and l.r. of the volume of HG on the volume of UHG in the same strains were calculated, and are shown in the central columns of Tables 1 to 6. In **MD** (Table 1), 8, 19, 27; 1, 5, 6; 9, 9; 4, 14 and 18 strains showed significances at 0.1% (**1, 2, 3**), 1% (**1, 2, 3**) and 5% (**2, 3**) levels and no significance even at 5% level (**1, 2, 3**), respectively. 69.2, 70.2 and 70.0% strains of the whole showed significances in **1, 2** and **3**, respectively. In **TA** (Table 2), 1, 14, 15; 7, 7; 5, 5; 10 and 10 strains showed significances at 0.1% (**4, 5, 6**), 1% (**5, 6**) and 5% (**5, 6**) levels and no significance even at 5% level (**5, 6**), respectively. 100.0, 72.2 and 73.0% strains of the whole

Table 3. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Kenya in 1985, *O. longistaminata*, 315-324

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
315	0.2592	—	0.6083***	Y=0.341X+3.974	0.9264***	Y=0.796X+0.013
316	-0.0026	—	0.1802	—	0.9260***	Y=0.872X-0.033
317	-0.1565	—	0.2026	—	0.9611***	Y=0.811X-0.006
318	0.3146	—	0.5967***	Y=0.255X+6.987	0.9880***	Y=0.815X-0.001
319	0.2024	—	0.1222	—	0.8813***	Y=0.923X-0.065
320	0.9489***	Y=0.433X+2.744	0.7336***	Y=0.515X-2.236	0.6847***	Y=0.938X-0.079
321	0.8430***	Y=1.377X-19.545	0.8338***	Y=0.811X-14.062	0.9998***	Y=0.873X-0.028
322	0.9073***	Y=0.738X-3.974	0.6897***	Y=0.430X+0.628	0.4063*	Y=0.406X+0.220
323	0.1335	—	0.4568*	Y=0.309X+5.647	0.8992***	Y=0.876X-0.034
324	0.8133***	Y=0.336X+5.070	0.6379***	Y=0.154X+11.194	0.9900***	Y=1.500X-0.380
Average	0.9714***	Y=0.591X-0.814	0.9806***	Y=0.465X-0.563	0.9345***	Y=0.918X-0.059

d.f.; 28 and 8 in strain and average, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

showed significances in 4, 5 and 6, respectively, in which the first figure was the same as in case of the former item. In KE (Table 3), 6, 1 and 3 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively (7). 70.0% strains of the whole showed significances.

In NI (Table 4), 3, 17, 20; 3, 3; 1, 5, 6; 1, 4 and 5 strains showed significances at 0.1% (8, 9, 10), 1% (9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 86.2 and 85.3% strains of the whole showed significances in 8, 9 and 10, respectively, in which the second figure was the same as in case of the former item. In IV (Table 5), 1, 3, 1 and 2 strains showed significances at 0.1%, 1%, and 5% levels and no significance even at 5% level, respectively (11). 71.4% strains of the whole showed significances, which was the same as in case of the former item. In SE (Table 6), 29, 5, 34; 2, 2; 4, 2 and 6 strains showed significances at 0.1% (12, 13, 14) and 1% (12, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 88.6, 71.4 and 85.7% strains of the whole showed significances in 12, 13 and 14, respectively, in which the last figure was the same as in case of the former item.

In SUM, 70, 103, 48, 55; 9, 21, 13, 8; 8, 22, 15, 7; 20, 44, 31 and 13 strains showed significances at 0.1% (15, 16, 34, 35), 1% (15, 16, 34, 35) and 5% (15, 16, 34, 35) levels and no significance even at 5% level (15, 16, 34, 35), respectively. 81.3, 76.8, 71.0 and 84.3% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noted that strains of West Africa (35) showed relatively higher significances than those of East Africa (34), which was nearly the same as in case of the former item.

In the group level (Table 11), the whole groups (=13) and the whole of the summed-up groups (=4) showed significances at 0.1% level, which was the same as in case of the former item.

Table 4. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Nigeria. *O. longistaminata*, 325-336 in 1984 and 337-382 in 1985

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
325	0.0575	—	0.3228	—	0.9205***	Y = 0.966X - 0.086
326	0.5549**	Y = 0.359X + 4.134	0.7492***	Y = 0.353X + 4.030	0.8965***	Y = 0.840X - 0.004
327	0.1347	—	0.3753*	Y = 0.311X + 5.728	0.8801***	Y = 0.741X + 0.046
335	0.8564***	Y = 0.506X + 2.218	0.9019***	Y = 0.478X + 1.422	0.9257***	Y = 1.008X - 0.080
336	0.8833***	Y = 0.513X + 2.304	0.8538***	Y = 0.354X + 9.480	0.8416***	Y = 1.162X - 0.174
Average	0.9981***	Y = 0.612X - 0.993	0.9983***	Y = 0.549X - 2.817	0.8818*	Y = 1.432X - 0.335
337	0.8669***	Y = 0.438X + 2.778	0.9132***	Y = 0.225X + 9.267	0.4677**	Y = 0.500X + 0.160
338	0.8313***	Y = 0.642X - 2.120	0.9306***	Y = 0.519X - 2.454	0.9887***	Y = 1.012X - 0.102
339	-0.5859***	Y = -0.204X + 15.722	-0.5163**	Y = -0.134X + 18.691	0.9435***	Y = 0.935X - 0.090
340	0.6073***	Y = 0.261X + 5.708	0.5466**	Y = 0.426X + 1.858	0.8903***	Y = 1.217X - 0.215
341	0.9056***	Y = 0.676X - 2.371	0.9417***	Y = 0.436X + 0.895	0.5530**	Y = 0.343X + 0.268
342	0.9888***	Y = 0.433X + 2.746	0.9151***	Y = 0.226X + 8.509	0.7727***	Y = 1.375X - 0.313
343	0.8096***	Y = 0.811X - 4.378	0.4773**	Y = 0.211X + 9.248	0.8936***	Y = 1.069X - 0.128
345	0.8095***	Y = 0.804X - 4.484	0.8259***	Y = 0.459X + 0.770	0.8534***	Y = 0.688X + 0.078
346	0.0899	—	0.3053	—	0.9069***	Y = 0.853X - 0.031
348	0.9646***	Y = 1.042X - 11.340	0.9031***	Y = 0.631X - 6.973	-0.9950***	Y = -0.192X + 0.559
349	0.4171*	Y = 0.201X + 6.842	0.4210*	Y = 0.355X + 3.731	0.9767***	Y = 0.804X + 0.016
352	0.3887*	Y = 0.209X + 6.061	0.4257*	Y = 0.210X + 6.318	0.8213***	Y = 0.842X - 0.015
354	0.1367	—	0.4102*	Y = 0.263X + 6.031	0.8706***	Y = 0.824X - 0.003
355	0.5548**	Y = 0.265X + 6.126	0.7541***	Y = 0.298X + 6.257	0.7987***	Y = 0.726X + 0.068
357	0.7470***	Y = 0.743X - 4.069	0.9371***	Y = 0.858X - 15.133	0.8901***	Y = 1.118X - 0.162
358	0.8558***	Y = 0.553X + 0.556	0.8233***	Y = 0.402X + 3.163	0.8378***	Y = 0.929X - 0.045
360	0.7427***	Y = 0.332X + 4.825	0.6865***	Y = 0.259X + 7.594	0.8920***	Y = 1.024X - 0.106
362	0.7316***	Y = 1.050X - 8.810	0.4298*	Y = 0.616X - 3.495	0.9900***	Y = 1.075X - 0.143
364	0.8941***	Y = 0.760X - 3.417	0.7114***	Y = 0.313X + 5.546	0.5850***	Y = 0.407X + 0.253
365	0.4935**	Y = 0.635X - 1.830	0.0510	—	0.9345***	Y = 1.008X - 0.103
369	0.5176**	Y = 0.671X - 3.175	0.6099***	Y = 0.226X + 8.427	0.8273***	Y = 0.932X - 0.073
371	0.2577	—	0.3907*	Y = 0.165X + 8.180	0.8609***	Y = 0.639X + 0.103
373	0.3697*	Y = 0.213X + 6.624	0.3550	—	0.9238***	Y = 1.344X - 0.293
375	0.7825***	Y = 0.291X + 5.950	0.7259***	Y = 0.267X + 6.370	0.8557***	Y = 1.136X - 0.186
377	0.6897***	Y = 0.454X + 2.550	0.8262***	Y = 0.406X + 2.735	0.8908***	Y = 0.810X + 0.021
378	0.5416**	Y = 0.273X + 6.141	0.7734***	Y = 0.657X - 7.296	0.8680***	Y = 1.405X - 0.326
379	0.8796***	Y = 0.730X - 3.772	0.9603***	Y = 0.689X - 9.159	0.3287	—
381	0.6186***	Y = 0.219X + 7.947	0.6231***	Y = 0.186X + 11.105	0.8395***	Y = 1.074X - 0.138
382	0.1223	—	-0.2843	—	0.9045***	Y = 1.000X - 0.080
Average	0.8772***	Y = 0.456X + 2.174	0.8202***	Y = 0.341X + 4.095	0.9621***	Y = 1.159X - 0.188
Average of both groups	0.9541***	Y = 0.557X + 0.125	0.9355***	Y = 0.480X - 0.621	0.9523***	Y = 1.186X - 0.202

d.f.: 28, 3, 27 and 32 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

Table 5. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Ivory Coast in 1984, *O. longistaminata* (384-390) and *O. breviligulata* (383)

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
384	0.8550***	Y=0.541X+0.108	0.8980***	Y=0.487X-1.223	0.8527***	Y=0.827X-0.015
385	0.2615	—	0.4975**	Y=0.334X+3.172	0.8990***	Y=0.799X-0.006
386	0.4314*	Y=0.117X+7.731	0.1908	—	0.9047***	Y=1.032X-0.127
387	0.4295*	Y=0.294X+6.130	-0.0837	—	0.8826***	Y=0.913X-0.046
388	0.3797*	Y=0.164X+7.649	0.3716*	Y=0.168X+9.014	0.8975***	Y=0.985X-0.102
389	0.5973***	Y=0.497X+1.888	0.5610**	Y=0.354X+4.358	0.8568***	Y=0.937X-0.069
390	0.2971	—	0.5085**	Y=0.254X+7.166	0.8606***	Y=0.852X-0.020
Average	0.9656***	Y=0.780X-3.979	0.9537***	Y=0.599X-4.229	-0.8304*	Y=-2.118X+1.667
383	0.8452***	Y=0.430X+5.790	0.8992***	Y=0.522X+1.840	0.7722***	Y=0.768X+0.071

d.f.; 28 and 5 in strain and the average, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

Table 6. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Senegal in 1985, *O. longistaminata*, 391-441 in Casamance region and 444-455 in northern region

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
391	0.7208***	Y=0.383X+3.529	0.8961***	Y=0.286X+5.677	0.9273***	Y=0.840X-0.009
392	-0.0264	—	0.8321***	Y=0.204X+9.570	0.9025***	Y=0.837X+0.005
393	0.7921***	Y=0.210X+7.281	0.9086***	Y=0.934X-15.765	0.6543***	Y=0.688X+0.079
394	0.4058*	Y=0.195X+7.178	-0.3300	—	0.9105***	Y=0.936X-0.066
395	0.8927***	Y=0.371X+4.018	0.9540***	Y=0.379X+2.772	0.7498***	Y=0.659X+0.094
396	0.5429**	Y=0.454X+2.427	0.6589***	Y=0.750X-8.659	0.8474***	Y=0.866X-0.014
397	0.6045***	Y=0.305X+4.887	0.6099***	Y=0.291X+4.989	0.8314***	Y=1.115X-0.167
399	0.3051	—	0.6367***	Y=0.398X+1.493	0.9115***	Y=0.769X+0.015
400	0.8645***	Y=0.430X+3.106	0.7441***	Y=0.285X+6.817	0.9298***	Y=1.587X-0.439
401	0.5769***	Y=0.318X+4.984	0.6595***	Y=0.236X+7.179	0.7404***	Y=0.764X+0.022
402	0.9254***	Y=0.591X+0.067	0.8094***	Y=0.301X+6.148	0.4082*	Y=0.500X+0.180
406	0.6227***	Y=0.230X+6.905	0.4757**	Y=0.171X+9.916	0.8668***	Y=0.850X-0.022
407	0.8486***	Y=0.452X+2.849	0.9905***	Y=0.497X-0.979	0.3273	—
408	0.9589***	Y=0.637X-1.406	0.9694***	Y=0.452X+0.455	0.9010***	Y=0.784X+0.021
409	0.9268***	Y=0.609X-0.895	0.8819***	Y=0.424X+2.059	0.0000	—
411	0.6226***	Y=0.379X+4.351	0.6269***	Y=0.346X+5.063	0.9730***	Y=1.091X-0.142
412	0.1091	—	-0.1347	—	0.9121***	Y=0.898X-0.022
414	0.7212***	Y=0.526X+0.810	0.5337**	Y=0.178X+11.723	0.7334***	Y=0.941X-0.073
416	-0.1031	—	0.2328	—	0.8107***	Y=0.630X+0.012
419	0.6210***	Y=0.347X+4.902	0.7988***	Y=0.597X-4.176	0.9274***	Y=1.214X-0.234
420	0.8835***	Y=1.245X-13.624	0.8406***	Y=0.816X-10.210	0.7112***	Y=0.781X+0.042

(Continued)

Table 6. (Continued)

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
423	0.9692***	Y=0.812X-5.143	0.9973***	Y=0.574X-3.570	0.5042**	Y=0.324X+0.288
424	0.7731***	Y=0.347X+4.888	0.9280***	Y=0.271X+7.035	0.7163***	Y=1.577X-0.431
426	-0.9671***	Y=-0.360X+14.464	-0.6388***	Y=-0.855X+28.962	0.9998***	Y=1.139X-0.205
427	0.9350***	Y=0.466X+3.770	0.9204***	Y=0.442X+4.425	0.6621***	Y=0.779X+0.066
429	0.8988***	Y=0.384X+6.072	0.7355***	Y=0.336X+9.758	0.8905***	Y=1.190X-0.180
431	0.9139***	Y=0.687X-1.620	0.9697***	Y=0.646X-4.684	0.7319***	Y=0.643X+0.116
433	0.0894	—	-0.1050	—	0.9501***	Y=1.065X-0.128
434	0.4932**	Y=0.340X+5.062	0.7446***	Y=0.375X+3.857	0.9907***	Y=0.896X-0.040
435	0.9349***	Y=0.546X+0.064	0.9682***	Y=0.420X+0.937	0.7847***	Y=0.365X+0.254
436	0.8555***	Y=0.568X-0.028	0.8804***	Y=0.381X+2.678	0.8649***	Y=0.886X-0.029
437	0.9062***	Y=0.630X-1.455	0.9096***	Y=0.359X+2.371	0.6176***	Y=1.235X-0.246
439	0.8759***	Y=0.608X-1.336	0.8450***	Y=0.758X-9.507	0.9297***	Y=1.278X-0.240
440	0.9300***	Y=0.858X-5.328	0.8210***	Y=0.455X+0.469	0.9707***	Y=0.875X-0.022
441	0.6561***	Y=0.655X-2.537	0.6264***	Y=0.476X-1.398	0.9474***	Y=0.923X-0.059
Average	0.8905***	Y=0.705X-2.953	0.9357***	Y=0.684X-7.243	0.9471***	Y=1.266X-0.253
444	0.9299***	Y=0.458X+2.682	0.9187***	Y=0.590X-4.231	0.1065	—
447	0.1051	—	-0.2512	—	0.9799***	Y=1.213X-0.214
449	0.7314***	Y=0.397X+7.275	0.7929***	Y=0.652X-5.243	0.8150***	Y=1.091X-0.118
451	0.9463***	Y=0.466X+2.120	0.9311***	Y=0.410X+2.240	0.8337***	Y=0.811X+0.016
452	0.8878***	Y=0.262X+7.736	0.1172	—	0.8542***	Y=1.500X-0.400
454	0.9768***	Y=0.467X+2.581	0.9625***	Y=0.314X+5.906	0.8439***	Y=1.750X-0.559
455	0.8432***	Y=0.637X-2.036	0.9277***	Y=0.601X-5.904	0.6901***	Y=0.333X+0.275
Average	0.9914***	Y=0.733X-3.758	0.9694***	Y=0.644X-6.721	0.9224**	Y=1.253X-0.244
Average of both groups	0.9435***	Y=0.705X-2.982	0.9519***	Y=0.639X-5.872	0.9449***	Y=1.267X-0.253

d.f.; 28, 33, 5 and 40 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

3. Quotients of area and volume

C.c. and l.r. of the quotient of volume on the quotient of area in the same strains were calculated, and are shown in the right columns of Tables 1 to 6. In **MD** (Table 1), 11, 47, 58; 1, 1; 1 and 1 strains showed significances at 0.1% (1, 2, 3) and 5% (1, 3) levels and no significance even at 5% level (1, 3), respectively. 92.3, 100.0 and 98.3% strains of the whole showed significances in 1, 2 and 3, respectively, which were the highest values through the former 3 items. In **TA** (Table 2), 36, 36; 1 and 1 strains showed significances at 0.1% (5, 6) and 1% (4, 6) levels, respectively. In other words, the whole strains (=37) (4, 5, 6) showed significances. In **KE** (Table 3), 9 and 1 strains showed significances at 0.1% and 5% levels, respectively (7). The whole strains (=10) showed significances, which was a particular phenomenon.

In **NI** (Table 4), 5, 26, 31; 2, 2; 1 and 1 strains showed significances at 0.1% (8, 9, 10) and 1% (9, 10) levels and no significance even at 5% level (9, 10), respectively. 100.0, 96.0 and 97.1% strains of the whole showed significances in 8, 9 and 10, respectively, which were the

Table 7. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Nigeria, *O. breviligulata*, 328-334 in 1984 and 344-380 in 1985

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
328	0.9661***	Y=0.582X+1.486	0.9353***	Y=0.484X+4.940	0.8479***	Y=1.099X-0.137
329	0.9433***	Y=0.626X+0.032	0.8937***	Y=0.561X-0.333	0.9558***	Y=1.145X-0.161
330	0.9252***	Y=0.551X+1.880	0.9501***	Y=0.455X+5.551	0.7347***	Y=0.741X+0.088
331	0.8782***	Y=0.484X+3.291	0.8794***	Y=0.435X+5.960	0.8007***	Y=0.800X+0.061
332	0.6010***	Y=0.375X+7.029	0.7468***	Y=0.483X+1.795	0.8986***	Y=1.058X-0.112
333	0.9049***	Y=0.572X+1.276	0.7491***	Y=0.396X+11.074	0.7005***	Y=1.024X-0.073
334	0.7509***	Y=0.426X-4.998	0.5839***	Y=0.348X+10.013	0.9143***	Y=1.131X-0.138
Average	0.9426**	Y=0.523X+2.579	0.9635**	Y=0.608X-4.316	0.9250**	Y=0.925X-0.022
344	0.0126	—	0.2959	—	0.9799***	Y=1.156X-0.186
347	0.8705***	Y=0.579X+0.931	0.8785***	Y=0.447X+5.043	0.8867***	Y=1.021X-0.083
350	0.8862***	Y=0.542X+2.685	0.8826***	Y=0.566X+0.456	0.6749***	Y=0.835X+0.045
351	0.4568*	Y=0.321X+7.253	0.8378***	Y=0.517X+0.192	0.9306***	Y=0.883X-0.012
353	0.9508***	Y=0.516X+2.706	0.9127***	Y=0.403X+7.110	0.7081***	Y=0.893X-0.013
356	0.8067***	Y=0.392X+6.848	0.6804***	Y=0.285X+14.505	0.9220***	Y=1.213X-0.221
359	0.9278***	Y=0.509X+3.374	0.8405***	Y=0.428X+6.866	0.8815***	Y=1.093X-0.127
361	0.6649***	Y=0.367X+7.683	0.6895***	Y=0.438X+5.210	0.9381***	Y=1.169X-0.193
363	0.5004**	Y=0.344X+8.495	0.7505***	Y=0.562X-2.235	0.9507***	Y=1.193X-0.199
366	0.5106**	Y=0.307X+10.553	0.5228**	Y=0.361X+11.531	0.8979***	Y=1.226X-0.218
367	0.9191***	Y=0.596X+0.681	0.9539***	Y=0.585X-0.859	0.8273***	Y=0.918X-0.014
368	0.8354***	Y=0.459X+3.857	0.9051***	Y=0.471X+2.750	0.9054***	Y=0.777X+0.063
370	0.8708***	Y=0.499X+3.196	0.8385***	Y=0.491X+3.200	0.7052***	Y=0.761X+0.089
372	0.9256***	Y=0.662X-1.387	0.9273***	Y=0.560X-0.381	0.7590***	Y=1.063X-0.096
374	0.8619***	Y=0.453X+4.850	0.8417***	Y=0.515X+1.385	0.8926***	Y=0.930X-0.034
376	0.8537***	Y=0.543X+1.294	0.7482***	Y=0.487X+1.171	0.8244***	Y=1.146X-0.162
380	0.6101***	Y=0.429X+5.758	0.7084***	Y=0.477X+4.230	0.9485***	Y=1.193X-0.189
Average	0.9844***	Y=0.582X+0.882	0.9834***	Y=0.480X+2.976	0.8909***	Y=1.402X-0.322
Average of both groups	0.9764***	Y=0.565X+1.348	0.9793***	Y=0.508X+1.590	0.8553***	Y=1.119X-0.146

d.f.; 28, 5, 15 and 22 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

highest values through the former 3 items. In IV (Table 5), the whole strains (=7) showed significances at 0.1% level (11), which was a particular phenomenon. In SE (Table 6), 31, 6, 37; 1, 1; 1, 1; 2, 1 and 3 strains showed significances at 0.1% (12, 13, 14), 1% (12, 14) and 5% (12, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 94.3, 85.7 and 92.9% strains of the whole showed significances in 12, 13 and 14, respectively, which were the highest values through the former 3 items.

In SUM, 95, 178, 103, 75; 4, 4, 1, 3; 3, 3, 2, 1; 5, 5, 1 and 4 strains showed significances at 0.1% (15, 16, 34, 35), 1% (15, 16, 34, 35) and 5% (15, 16, 34, 35) levels and no significance even at 5% level (15, 16, 34, 35), respectively. 95.3, 97.4, 99.1 and 95.2% strains of the whole showed

Table 8. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Senegal in 1985, *O. breviligulata*, 398-442 in Casamance region and 443-456 in northern region; *O. brachyantha*, 475

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
398	0.4997**	Y=0.136X+11.683	0.7510***	Y=0.271X+11.696	0.8853***	Y=0.909X-0.022
403	0.9066***	Y=0.526X+2.404	0.8564***	Y=0.485X+3.112	0.8773***	Y=1.319X-0.273
404	0.8519***	Y=0.422X+5.765	0.7813***	Y=0.489X+3.057	0.7948***	Y=1.239X-0.228
405	0.9020***	Y=0.524X+2.202	0.9056***	Y=0.532X+0.549	0.8900***	Y=0.896X-0.009
410	0.9022***	Y=0.587X+0.525	0.9735***	Y=0.695X-8.739	0.8321***	Y=1.154X-0.177
413	0.9007***	Y=0.758X-3.518	0.8251***	Y=0.636X-4.019	0.8564***	Y=0.895X-0.007
415	0.8068***	Y=0.477X+3.978	0.8357***	Y=0.431X+6.435	0.6347***	Y=0.571X+0.201
417	0.9052***	Y=1.021X-9.478	0.9807***	Y=1.010X-22.049	-0.0458	-
418	0.7887***	Y=0.541X+2.531	0.8622***	Y=0.699X-5.420	0.9523***	Y=0.982X-0.035
421	0.8012***	Y=0.701X-1.907	0.8212***	Y=0.680X-6.277	0.9355***	Y=1.193X-0.191
422	0.0369	-	0.4785**	Y=0.279X+10.986	0.8660***	Y=0.625X+0.149
425	0.6430***	Y=0.375X+7.481	0.6750***	Y=0.437X+5.910	0.8150***	Y=1.033X-0.099
428	0.2704	-	0.5978***	Y=0.176X+4.830	0.9492***	Y=1.313X-0.309
430	0.9053***	Y=0.449X+4.083	0.8940***	Y=0.424X+5.440	0.8160***	Y=1.055X-0.098
432	0.8621***	Y=0.596X+0.457	0.8981***	Y=0.683X-5.982	0.9162***	Y=1.093X-0.122
438	-0.3906*	Y=-0.160X+2.000	-0.6941***	Y=-0.143X+29.629	0.9597***	Y=1.068X-0.118
442	0.6004***	Y=0.443X+3.862	0.8110***	Y=0.581X-3.140	0.9507***	Y=0.954X-0.065
Average	0.9522***	Y=0.776X-4.347	0.9753***	Y=0.726X-8.820	0.9556***	Y=1.492X-0.380
443	0.5720***	Y=0.459X+4.345	0.6131***	Y=0.552X+0.196	0.9304***	Y=1.173X-0.179
445	0.8833***	Y=0.496X+3.580	0.8665***	Y=0.409X+7.426	0.8427***	Y=0.964X-0.052
446	0.7645***	Y=0.417X+5.059	0.7235***	Y=0.415X+6.476	0.8745***	Y=1.253X-0.222
448	0.7956***	Y=0.443X+4.396	0.7879***	Y=0.448X+5.296	0.8965***	Y=1.053X-0.097
450	0.7831***	Y=0.484X+3.986	0.7532***	Y=0.377X+9.966	0.8214***	Y=0.769X+0.073
453	0.8569***	Y=0.494X+2.939	0.8735***	Y=0.459X+3.335	0.8919***	Y=0.932X-0.038
456	0.5877***	Y=0.376X+5.767	0.7711***	Y=0.564X-2.194	0.9491***	Y=1.145X-0.164
Average	0.9662***	Y=0.565X+1.283	0.9397**	Y=0.520X+1.109	0.9515***	Y=1.175X-0.177
Average of both groups	0.9478***	Y=0.724X-2.997	0.9692**	Y=0.682X-6.924	0.9510***	Y=1.478X-0.369
475	0.6818***	Y=0.596X+1.258	0.8131***	Y=0.711X-2.352	0.7139***	Y=1.024X-0.081

d.f.; 28, 15, 5 and 22 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

significances in 15, 16, 34 and 35, respectively, which were the highest levels through the former 3 items. It was noticed that strains of East Africa (34) showed higher significances than those of West Africa (35), which was a result remarkably reversed to the former two items.

In the group level (Table 11), 8, 1, 3 and 1 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, 15 and 35, 16, and 34 showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively.

Table 9. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Tanzania, *O. punctata*, 457-459 in 1984 and 2084-2109 in 1988

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
457	0.7992***	Y=0.186X+6.734	0.6834***	Y=0.248X+7.042	0.7717***	Y=0.992X-0.065
458	0.3794*	Y=0.285X+4.829	0.1546	—	0.7013***	Y=1.163X-0.176
459	0.4765**	Y=0.260X+5.637	0.3745*	Y=0.143X+9.307	0.4989**	Y=0.732X+0.071
Average	0.7360	—	0.9277	—	0.3273	—
2084	-0.0487	—	0.2493	—	0.8890***	Y=0.709X+0.065
2085	0.5860***	Y=0.365X+4.416	0.6480***	Y=0.407X+3.293	0.6954***	Y=0.677X+0.095
2086	-0.0148	—	0.0858	—	0.9343***	Y=0.947X-0.089
2087	0.5824***	Y=0.376X+3.569	0.4882**	Y=0.327X+4.506	0.8780***	Y=0.976X-0.084
2088	0.3687*	Y=0.241X+5.925	0.6261***	Y=0.363X+4.052	0.8301***	Y=0.683X+0.092
2089	0.6454***	Y=0.736X-1.752	0.6708***	Y=0.520X-0.522	0.9002***	Y=0.777X+0.032
2090	0.4450*	Y=0.303X+3.692	0.4705**	Y=0.257X+4.260	0.8365***	Y=0.745X+0.050
2091	-0.0469	—	0.1810	—	0.9421***	Y=0.781X+0.019
2092	0.1589	—	0.3064	—	0.8421***	Y=0.687X+0.056
2093	0.4017*	Y=0.251X+4.949	0.3563	—	0.8553***	Y=0.904X-0.064
2094	0.3650*	Y=0.236X+4.856	0.6880***	Y=0.369X+1.956	0.8678***	Y=0.627X+0.100
2095	0.5072**	Y=0.281X+4.907	0.5786***	Y=0.367X+3.584	0.8890***	Y=0.853X-0.021
2096	0.5080**	Y=0.315X+4.191	0.5689**	Y=0.272X+5.138	0.9257***	Y=0.846X-0.006
2097	-0.0010	—	0.1062	—	0.9169***	Y=0.723X+0.054
2098	0.4427*	Y=0.471X+1.427	0.5074**	Y=0.398X+1.687	0.8685***	Y=0.800X+0.019
2099	0.6772***	Y=0.496X+1.483	0.7418***	Y=0.571X-1.184	0.8203***	Y=0.788X+0.034
2100	0.1657	—	0.1483	—	0.8694***	Y=0.706X+0.075
2101	0.0438	—	0.0223	—	0.9188***	Y=0.930X-0.061
2102	0.4450*	Y=0.327X+3.778	0.2676	—	0.9136***	Y=1.123X-0.175
2103	0.4766**	Y=0.295X+4.413	0.4939**	Y=0.264X+4.984	0.9370***	Y=0.942X-0.065
2104	0.1746	—	0.2278	—	0.9278***	Y=0.865X-0.023
2105	0.1687	—	0.0140	—	0.9136***	Y=0.934X-0.068
2106	0.9823***	Y=0.597X+0.201	0.5137**	Y=0.244X+5.091	0.9424***	Y=0.871X-0.030
2107	0.4432*	Y=0.285X+4.446	0.6301***	Y=0.374X+2.972	0.8693***	Y=0.711X+0.076
2108	0.1321	—	0.3323	—	0.8017***	Y=0.668X+0.069
2109	0.5770***	Y=0.482X+1.567	0.4594*	Y=0.269X+4.385	0.9027***	Y=0.944X-0.074
Average	0.8158***	Y=0.528X+1.065	0.8569***	Y=0.516X-0.384	0.1168	—
Average of both groups	0.8768***	Y=0.544X+0.856	0.9089***	Y=0.552X-1.112	0.1139	—

d.f.; 28, 1, 24 and 27 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

4. Comparison of character-combinations

Through the 3 items, significant strains and groups were found as 82.1% (32/39), 77.3% (109/141), 78.3% (141/180), 100.0% (3/3), 74.1% (80/108), 74.8% (83/111), 70.0% (21/30), 80.0% (12/15), 89.7% (78/87), 88.2% (90/102), 81.0% (17/21), 89.5% (94/105), 81.0% (17/21),

Table 10. Correlation coefficient and linear regression of three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X); collected in Kenya, *O. punctata*, 460-464 in 1984 and 465-474 in 1985

Accession No.	Area		Volume		Quotient	
	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
460	0.5447**	Y=0.155X+6.108	0.4738**	Y=0.157X+6.625	0.8413***	Y=1.102X-0.178
461	0.4233*	Y=0.219X+5.167	0.2447	—	0.6415***	Y=1.364X-0.347
462	0.7342***	Y=0.335X+3.886	0.7634***	Y=0.250X+5.067	0.8792***	Y=1.239X-0.258
463	0.4342*	Y=0.168X+7.310	-0.0277	—	0.9447***	Y=1.401X-0.310
464	0.8082***	Y=0.419X+2.650	0.8825***	Y=0.555X-0.784	0.4873**	Y=0.503X+0.231
Average	0.9972***	Y=0.638X-0.917	0.9466*	Y=0.780X-7.310	0.5976	—
465	0.5813***	Y=0.255X+4.628	0.5637**	Y=0.255X+4.379	0.8087***	Y=0.825X-0.017
466	0.8649***	Y=0.419X+2.718	0.6229***	Y=0.347X+3.525	-0.0647	—
467	0.6996***	Y=0.311X+4.353	0.6497***	Y=0.235X+4.889	0.6094***	Y=0.937X-0.107
468	0.8783***	Y=0.735X-1.091	0.7050***	Y=0.448X+1.024	0.0362	—
469	0.5559**	Y=0.321X+3.194	0.3780*	Y=0.114X+5.832	0.6528***	Y=0.989X-0.126
470	0.6993***	Y=0.359X+2.903	0.4015*	Y=0.126X+7.832	0.8833***	Y=1.351X-0.278
471	0.8227***	Y=0.449X+2.082	0.5296**	Y=0.223X+6.220	0.7423***	Y=1.257X-0.236
472	0.6587***	Y=0.382X+3.079	0.6524***	Y=0.279X+4.032	0.5646**	Y=0.652X+0.081
473	0.6304***	Y=0.447X+2.372	0.6026***	Y=0.323X+3.253	0.7013***	Y=0.683X+0.044
474	0.3476	—	0.2886	—	0.9160***	Y=0.460X+0.191
Average	0.9000***	Y=0.431X+2.272	0.8671**	Y=0.361X+2.325	0.7037*	Y=0.774X+0.015
Average of both groups	0.9217***	Y=0.474X+1.631	0.8550***	Y=0.456X+0.262	0.5773*	Y=0.783X+0.014

d.f.; 28, 3, 8 and 13 in strain, the first, second and third averages, respectively

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

88.1% (111/126), 85.4% (274/321), 81.2% (463/570), 76.3% (245/321) and 87.6% (218/249) in the order of the group Nos. 1 to 16 and 34 and 35, respectively. 30.0% difference between the maximum (4) and the minimum (7) was found. Any remarkable locality difference was not found through the whole groups. In comparison with the former data shown in the previous papers^{24, 25)}, the present data (3 items) were looked upon as relatively of high significances than those of the former 24 character-combinations.

In comparison with the 15 and 16 groups, the 1st (area) and the 2nd (volume) showed the larger significances in 15 than those in 16. In the 3rd (quotient), comparatively larger significance was found in 16 than those in 15. In comparison with the 34 and 35 groups, the 1st and the 2nd showed the higher significances in 35 than those in 34. The 3rd showed the reversed result.

In case of the other wild rices, *O. sativa* var. *spontanea* and *O. perennis* collected in the northeastern India (= Assam), using 17 strains⁴⁾, 98.0% items (50/51) showed significant relations through the whole cases. In comparison with those data and the present one, there was no noticeable difference between them. In case of *O. longistaminata* collected in Ethiopia, it showed significances in 100.0% (3/3) in the same items¹⁴⁾. It may be said that the materials were collected in an area which was relatively narrow and showing in possession of small in-

Table 11. Group averages of the three components; area of husked grain (Y) on area of unhusked grain (X), volume of husked grain (Y) on volume of unhusked grain (X), and quotient of volume (Y) on quotient of area (X). Group marks were noted in the text.

Country	Group mark	Area		Volume		Quotient	
		Correlation coefficient	Linear regression	Correlation coefficient	Linear regression	Correlation coefficient	Linear regression
MD	1	0.9105***	Y=0.577X-0.306	0.9257***	Y=0.543X-2.404	0.9605***	Y=1.037X-0.117
	2	0.6257***	Y=0.501X+1.407	0.9638***	Y=0.437X+0.718	-0.3615*	Y=-0.815X+0.953
	3	0.7017***	Y=0.511X+1.173	0.9504***	Y=0.469X-0.128	-0.1600	-
TA	5	0.7779***	Y=0.375X+3.965	0.8115***	Y=0.345X+3.936	0.9731***	Y=1.021X-0.118
	6	0.7915***	Y=0.389X+3.689	0.8261***	Y=0.367X+3.255	0.9674***	Y=1.024X-0.119
KE	7	0.9714***	Y=0.591X-0.814	0.9806***	Y=0.465X-0.563	0.9345***	Y=0.918X-0.059
NI	8	0.9981***	Y=0.612X-0.993	0.9983***	Y=0.549X-2.817	0.8818*	Y=1.432X-0.335
	9	0.8772***	Y=0.456X+2.174	0.8202***	Y=0.341X+4.095	0.9621***	Y=1.159X-0.188
IV	10	0.9541***	Y=0.557X+0.125	0.9355***	Y=0.480X-0.621	0.9523***	Y=1.186X-0.202
	11	0.9656***	Y=0.780X-3.979	0.9537***	Y=0.599X-4.229	-0.8304*	Y=-2.118X+1.667
SE	12	0.8905***	Y=0.705X-2.953	0.9357***	Y=0.684X-7.243	0.9471***	Y=1.266X-0.253
	13	0.9914***	Y=0.733X-3.758	0.9694***	Y=0.644X-6.721	0.9224**	Y=1.253X-0.244
	14	0.9435***	Y=0.705X-2.982	0.9519***	Y=0.639X-5.872	0.9449***	Y=1.267X-0.253
SUM	15	0.8808***	Y=0.559X+0.150	0.9442***	Y=0.548X-2.842	0.4406***	Y=0.669X+0.093
	16	0.8981***	Y=0.531X+0.726	0.9387***	Y=0.495X-1.005	0.2178*	Y=0.363X+0.270
NI	17	0.9426**	Y=0.523X+2.579	0.9635**	Y=0.608X-4.316	0.9250**	Y=0.925X-0.022
	18	0.9844***	Y=0.582X+0.882	0.9834***	Y=0.480X+2.976	0.8909***	Y=1.402X-0.322
	19	0.9764***	Y=0.565X+1.348	0.9793***	Y=0.508X+1.590	0.8553***	Y=1.119X-0.146
SE	21	0.9522***	Y=0.776X-4.347	0.9753***	Y=0.726X-8.820	0.9556***	Y=1.492X-0.380
	22	0.9662***	Y=0.565X+1.283	0.9397**	Y=0.520X+1.109	0.9515***	Y=1.175X-0.177
	23	0.9478***	Y=0.724X-2.997	0.9692***	Y=0.682X-6.924	0.9510***	Y=1.478X-0.369
SUM	24	0.9632***	Y=0.621X-0.281	0.9709***	Y=0.554X-0.839	0.9297***	Y=1.390X-0.314
TA	25	0.7360	-	0.9277	-	0.3273	-
	26	0.8158***	Y=0.528X+1.065	0.8569***	Y=0.516X-0.384	0.1168	-
	27	0.8768***	Y=0.544X+0.856	0.9089***	Y=0.552X-1.112	0.1139	-
KE	28	0.9972***	Y=0.638X-0.917	0.9466*	Y=0.780X-7.310	0.5976	-
	29	0.9000***	Y=0.431X+2.272	0.8671**	Y=0.361X+2.325	0.7037*	Y=0.774X+0.015
	30	0.9217***	Y=0.474X+1.631	0.8550***	Y=0.456X+0.262	0.5773*	Y=0.783X+0.014
SUM	31	0.9109***	Y=0.495X+1.391	0.8432***	Y=0.501X-0.577	0.6115*	Y=0.901X-0.050
	32	0.8902***	Y=0.477X+1.719	0.8532***	Y=0.456X+0.708	0.3370*	Y=0.366X+0.275

d.f.; 28 in strain level; 11, 45, 58, 34, 35, 8, 3, 27, 32, 5, 33, 5, 40, 105, 188; 5, 15, 22, 15, 5, 22, 47; 1, 24, 27, 3, 8, 13, 16 and 42 in the order of group mark from Nos.1 to 32, omitted Nos.4, 20 and 33 owing to 1 strain each.

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

tra-population-variations showing relatively high significances. And so it might be attributed to these differences between them.

II. *Oryza breviligulata* CHEV. et ROEHR.

1. Areas of UHG and HG

C.c. and l.r. of the area of HG on the area of UHG in the same strains were calculated, and

are shown in the left columns of Tables 5, 7 and 8. In **NI** (Table 7), 7, 13, 20; 2, 2; 1, 1; 1 and 1 strains showed significances at 0.1% (17, 18, 19), 1% (18, 19) and 5% (18, 19) levels and no significance even at 5% level (18, 19), respectively. 100.0, 94.1 and 95.8% strains of the whole showed significances in 17, 18 and 19, respectively. In **IV** (Table 5), 1 strain (=100.0%) showed significance at 0.1% level (20). In **SE** (Table 8), 13, 7, 20; 1, 1; 1, 1; 2 and 2 strains showed significances at 0.1% (21, 22, 23), 1% (21, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 23), respectively. 88.2, 100.0 and 91.7% strains of the whole showed significances in 21, 22 and 23, respectively.

In **SUM** (1984 and 1985 in the three countries [49 strains], abbreviated as 24), 41, 3, 2 and 3 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In the group level (Table 11), 5 and 1 groups showed significances at 0.1% and 1% levels, respectively. In the summed-up group, it showed significance at 0.1% level.

2. Volumes of UHG and HG

C.c. and l.r. of the volume of HG on the volume of UHG in the same strains were calculated, and are shown in the central columns of Tables 5, 7 and 8. In **NI** (Table 7), 7, 15, 22; 1, 1; 1 and 1 strains showed significances at 0.1% (17, 18, 19) and 1% (18, 19) levels and no significance even at 5% level (18, 19), respectively. 100.0, 94.1 and 95.8% strains of the whole showed significances in 17, 18 and 19, respectively, which were quite the same as in case of the former item. In **IV** (Table 5), 1 strain (=100.0%) showed significance at 0.1% level, which was the same as in case of the former item (20). In **SE** (Table 8), 16, 7, 23; 1 and 1 strains showed significances at 0.1% (21, 22, 23) and 1% (21, 23) levels, respectively. The whole strains (=24 in 21, 22 and 23) showed significances, which was a particular phenomenon.

In **SUM**, 46, 2 and 1 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. 98.0% strains of the whole showed significances. In the group level (Table 11), 4 and 2 groups showed significances at 0.1% and 1% levels, respectively. In the summed-up group, it showed significance at 0.1% level, which was the same as in case of the 1st item.

3. Quotients of area and volume

C.c. and l.r. of the quotient of volume on the quotient of area in the same strains were calculated, and are shown in the right columns of Tables 5, 7 and 8. In **NI** (Table 7), 7, 17 and 24 strains showed significances at 0.1% level (17, 18, 19), respectively. The whole strains (=24 in 17, 18 and 19) showed significances at 0.1% level, which was a particular phenomenon. In **IV** (Table 5), 1 strain (=100.0%) showed significance at 0.1% level, which was the same as in cases of the former two items (20). In **SE** (Table 8), 16, 7, 23; 1 and 1 strains showed significances at 0.1% level (21, 22, 23) and no significance even at 5% level (21, 23), respectively. 94.1, 100.0 and 95.8% strains of the whole showed significances in 21, 22 and 23, respectively.

In **SUM**, 48 and 1 strains showed significances at 0.1% level and no significance even at 5% level, respectively. 98.0% strains of the whole showed significances, which was quite the same as in case of the second item. In the group level (Table 11), 5 and 1 groups showed significances at 0.1% and 1% levels, respectively, which were quite the same as in case of the first item. In the summed-up group, it showed significance at 0.1% level, which was the same as in cases of the first and the second items.

4. Comparison of character-combinations

Through the 3 items, significant strains and groups were found as 100.0% (21/21), 96.1%

(49/51), 97.2% (70/72), 100.0% (3/3), 94.1% (48/51), 100.0% (21/21), 95.8% (69/72) and 96.6% (142/147) in the order of the group **Nos.17 to 24**, respectively. There were no remarkable difference through the whole items. In other words, no locality specificity was confirmed.

III. *Oryza punctata* KOTSCHY

1. Areas of UHG and HG

C.c. and l.r. of the area of HG on the area of UHG in the same strains were calculated, and are shown in the left columns of Tables 9 and 10. In **TA** (Table 9), 1, 6, 7; 1, 3, 4; 1, 7, 8; 10 and 10 strains showed significances at 0.1% (25, 26, 27), 1% (25, 26, 27) and 5% (25, 26, 27) levels and no significance even at 5% level (26, 27), respectively. 100.0, 61.5 and 61.5% strains of the whole showed significances in 25, 26 and 27, respectively. In **KE** (Table 10), 2, 8, 10; 1, 1, 2; 2, 2; 1 and 1 strains showed significances at 0.1% (28, 29, 30), 1% (28, 29, 30) and 5% (28, 30) levels and no significance even at 5% level (29, 30), respectively. 100.0, 90.0 and 93.3% strains of the whole showed significances in 28, 29 and 30, respectively.

In **SUM**, 11, 17; 3, 6; 3, 10; 1 and 11 strains showed significances at 0.1% (1984 and 1985 in the two countries [18 strains], abbreviated as 31, 1984, 1985 and 1988 in the two countries [44 strains], abbreviated as 32), 1% (31, 32) and 5% (31, 32) levels and no significance even at 5% level (31, 32), respectively. 94.4 and 75.0% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 11), 5 and 1 groups showed significances at 0.1% level and no significance even at 5% level, respectively. In the summed-up group, both of 31 and 32 showed significances at 0.1% level.

2. Volumes of UHG and HG

C.c. and l.r. of the volume of HG on the volume of UHG in the same strains were calculated, and are shown in the central columns of Tables 9 and 10. In **TA** (Table 9), 1, 7, 8; 6, 6; 1, 1, 2; 1, 12 and 13 strains showed significances at 0.1% (25, 26, 27), 1% (26, 27) and 5% (25, 26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 53.9 and 55.2% strains of the whole showed significances in 25, 26 and 27, respectively. In **KE** (Table 10), 2, 5, 7; 1, 2, 3; 2, 2; 2, 1 and 3 strains showed significances at 0.1% (28, 29, 30), 1% (28, 29, 30) and 5% (29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 60.0, 90.0 and 80.0% strains of the whole showed significances in 28, 29 and 30, respectively, in which the second figure was the same as in case of the former item.

In **SUM**, 8, 15; 3, 9; 3, 4; 4 and 16 strains showed significances at 0.1% (31, 32), 1% (31, 32) and 5% (31, 32) levels and no significance even at 5% level (31, 32), respectively. 77.8 and 63.6% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 11), 3, 1, 1, and 1 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, both of 31 and 32 showed significances at 0.1% level, which were the same as in case of the former item.

3. Quotients of area and volume

C.c. and l.r. of the quotient of volume on the quotient of area in the same strains were calculated, and are shown in the right columns of Tables 9 and 10. In **TA** (Table 9), 2, 26, 28; 1 and 1 strains showed significances at 0.1% (25, 26, 27) and 1% (25, 27) levels, respectively. The whole strains (=29) in 25, 26 and 27 showed significances, which was a particular phenomenon. In **KE** (Table 10), 4, 7, 11; 1, 1, 2; 2 and 2 strains showed significances at 0.1% (28, 29, 30) and 1% (28, 29, 30) levels and no significance even at 5% level (29, 30), respectively. 100.0, 80.0 and 86.7% strains of the whole showed significances in 28, 29 and 30,

respectively, in which the first figure was the same as in case of the first item.

In **SUM**, 13, 39; 3, 3; 2 and 2 strains showed significances at 0.1% (**31, 32**) and 1% (**31, 32**) levels and no significance even at 5% level (**31, 32**), respectively. 88.9 and 95.5% strains of the whole showed significances in **31** and **32**, respectively. In the group level (Table 11), 2 and 4 groups showed significances at 5% level and no significance even at 5% level, respectively. In the summed-up group, both of **31** and **32** showed significances at 5% level.

4. Comparison of character-combinations

Through the 3 items, significant strains and groups were found as 88.9% (8/9), 71.8% (56/78), 73.6% (64/87), 86.7% (13/15), 86.7% (26/30), 86.7% (39/45), 87.0% (47/54) and 78.0% (103/132) in the order of the group **Nos.25** to **32**, respectively. The strains of **KE (28, 29, 30)** showed the higher significant levels than those of **TA (25, 26, 27)**.

In comparison with **31** and **32**, the first (area) and the second (volume) showed larger significances in **31** than those in **32**. In the third (quotient), comparatively larger significance was found in **32** than those in **31**. The tendency was looked upon as the same one as in case of *O. longistaminata*.

IV. *Oryza brachyantha* CHEV. et ROEHR.

C.c. and l.r. of the area of HG on the area of UHG, of the volume of HG on the volume of UHG and of the quotient of volume on the quotient of area in the same strains were calculated, and are shown in the left, central and right columns of Table 8, respectively. The whole of the items (=3) showed significances at 0.1% level.

PART II. The summed-up data of the whole character-combinations

Basing on the results obtained in the previous papers^{24, 25)} and the present experiments, the following problematic items concerning the correlation coefficients in the whole cases (=27) are to be explained here.

I. *Oryza longistaminata* CHEV. et ROEHR.

1. C.c. of the respective character-combinations in the strain level were fixed to be significant in 248 cases out of the 351 character-combinations (=13 strains x 27 character-combinations), abbreviated as 248/351=70.7%, and the averages and their s.d. through the whole combinations within the groups were found to be 9.19 ± 2.07 (**MD 1**), $662/1,269=52.2\%$, 24.52 ± 14.37 (**2**), $910/1,620=56.2\%$, 33.70 ± 15.79 (**3**), $20/27=74.1\%$, 0.74 ± 0.44 (**TA 4**), $527/972=54.2\%$, 19.52 ± 9.74 (**5**), $547/999=54.8\%$, 20.26 ± 9.83 (**6**), $158/270=58.5\%$, 5.85 ± 1.98 (**KE 7**), $86/135=63.7\%$, 3.19 ± 1.19 (**NI 8**), $540/783=69.0\%$, 20.00 ± 4.46 (**9**), $626/918=68.2\%$, 23.19 ± 5.21 (**10**), $106/189=56.1\%$, 3.93 ± 2.34 (**IV 11**), $685/945=72.5\%$, 25.37 ± 5.25 (**SE 12**), $143/189=75.7\%$, 5.30 ± 1.21 (**13**) and $828/1,134=73.0\%$, 30.67 ± 5.75 (**14**), respectively. It was noticed that **Nos.2** and **5** showed 100.0% significances in the combination No.27.

In the summed-up groups, those were $1,986/2,889=68.7\%$, 73.56 ± 15.34 (**15**), $3,175/5,130=61.9\%$, 117.59 ± 37.48 (**16**), $1,615/2,889=55.9\%$, 59.82 ± 26.24 (East **34**) and $1,560/2,241=69.6\%$, 57.78 ± 12.25 (West **35**), respectively. It may be noticed that the strains of West Africa (**35**) showed remarkably higher significances than those of East Africa (**35**).

2. The whole combinations were divided into 2 groups, i.e., the group I (combination Nos.1 ~ 18) and the group II (Nos.19 ~ 27). Significant combinations were accounted, and averages and their s.d. through the whole combinations within the groups were found to be as follows; $158/234=67.5\%$, 8.78 ± 2.32 & $90/117=76.9\%$, 10.00 ± 1.05 (**MD 1, I & II**), $381/846=45.0\%$, 21.17

± 15.81 & $281/423=66.4\%$, 31.22 ± 7.25 (**2**, I & II), $539/1,080=49.9\%$, 29.94 ± 17.37 & $371/540=68.7\%$, 41.22 ± 7.73 (**3**, I & II), $11/18=61.1\%$, 0.61 ± 0.49 & $9/9=100.0\%$, 1.00 ± 0.00 (**TA 4**, I & II), $305/648=47.1\%$, 16.94 ± 10.37 & $222/324=68.5\%$, 24.67 ± 5.46 (**5**, I & II), $316/666=47.5\%$, 17.56 ± 10.40 & $231/333=69.4\%$, 25.67 ± 5.46 (**6**, I & II), $100/180=55.6\%$, 5.56 ± 1.98 & $58/90=64.4\%$, 6.44 ± 1.83 (**KE 7**, I & II), $50/90=55.6\%$, 2.78 ± 1.18 & $36/45=80.0\%$, 4.00 ± 0.67 (**NI 8**, I & II), $327/522=62.6\%$, 18.17 ± 4.14 & $213/261=81.6\%$, 23.67 ± 2.26 (**9**, I & II), $377/612=61.6\%$, 20.94 ± 4.72 & $249/306=81.4\%$, 27.67 ± 2.58 (**10**, I & II), $60/126=47.6\%$, 3.33 ± 2.45 & $46/63=73.0\%$, 5.11 ± 1.52 (**IV 11**, I & II), $412/630=65.4\%$, 22.89 ± 4.69 & $273/315=86.7\%$, 30.33 ± 1.33 (**SE 12**, I & II), $89/126=70.6\%$, 4.94 ± 1.27 & $54/63=85.7\%$, 6.00 ± 0.67 (**13**, I & II) and $501/756=66.3\%$, 27.83 ± 4.97 & $327/378=86.5\%$, 36.33 ± 1.33 (**14**, I & II), respectively.

In the summed-up groups, those were found as follows; $1,207/1,926=62.7\%$, 67.06 ± 14.35 & $779/963=80.9\%$, 86.56 ± 6.38 (**15**, I & II), $1,893/3,420=55.4\%$, 105.17 ± 38.62 & $1,282/1,710=75.0\%$, 142.44 ± 17.49 (**16**, I & II), $955/1,926=49.6\%$, 53.06 ± 28.17 & $660/963=68.5\%$, 73.33 ± 14.27 (**34**, I & II) and $938/1,494=62.8\%$, 52.11 ± 10.92 & $622/747=83.3\%$, 69.11 ± 4.36 (**35**, I & II), respectively. It was ascertained that the values were remarkably larger in the group II than those of the group I through the whole groups. It was noticed that the strains of West Africa (**35**) showed higher significances than those of East Africa (**34**) in the both groups I and II.

3. Moreover, group I was redivided into 6 sub-groups as follows; sub-group 1 (combination Nos.1 ~ 3), sub-2 (Nos.4 ~ 6), sub-3 (Nos.7 ~ 9), sub-4 (Nos.10 ~ 12), sub-5 (Nos.13 ~ 15) and sub-6 (Nos.16 ~ 18). Significant combinations were accounted as follows in the order from sub-1 to sub-6; **MD 1** --- $17/39=43.6\%$, $32/39=82.1\%$, $23/39=59.0\%$, $31/39=79.5\%$, $24/39=61.5\%$, $31/39=79.5\%$, **2** --- $29/141=20.6\%$, $103/141=73.1\%$, $18/141=12.8\%$, $108/141=76.6\%$, $13/141=9.2\%$, $110/141=78.0\%$, **3** --- $46/180=25.6\%$, $135/180=75.0\%$, $41/180=22.8\%$, $139/180=77.2\%$, $37/180=20.6\%$, $141/180=78.3\%$, **TA 4** --- $2/3=66.7\%$, $2/3=66.7\%$, $3/3=100.0\%$, $2/3=66.7\%$, $0/3=0.0\%$, $2/3=66.7\%$, **5** --- $24/108=22.2\%$, $79/108=73.2\%$, $25/108=23.2\%$, $79/108=73.2\%$, $23/108=21.3\%$, $75/108=69.4\%$, **6** --- $26/111=23.4\%$, $81/111=73.0\%$, $28/111=25.2\%$, $81/111=73.0\%$, $23/111=20.7\%$, $77/111=69.4\%$, **7** --- $15/30=50.0\%$, $21/30=70.0\%$, $12/30=40.0\%$, $20/30=66.7\%$, $9/30=30.0\%$, $23/30=76.7\%$, **NI 8** --- $8/15=53.3\%$, $10/15=66.7\%$, $6/15=40.0\%$, $11/15=73.3\%$, $4/15=26.7\%$, $11/15=73.3\%$, **9** --- $44/87=50.6\%$, $63/87=72.4\%$, $53/87=60.9\%$, $61/87=70.1\%$, $42/87=48.3\%$, $64/87=73.6\%$, **10** --- $52/102=51.0\%$, $73/102=71.6\%$, $59/102=57.8\%$, $72/102=70.6\%$, $46/102=45.1\%$, $75/102=73.5\%$, **IV 11** --- $5/21=23.8\%$, $14/21=66.7\%$, $5/21=23.8\%$, $17/21=81.0\%$, $2/21=9.5\%$, $17/21=81.0\%$, **SE 12** --- $63/105=60.0\%$, $83/105=79.1\%$, $59/105=56.2\%$, $79/105=75.2\%$, $48/105=45.7\%$, $80/105=76.2\%$, **13** --- $14/21=66.7\%$, $17/21=81.0\%$, $10/21=47.6\%$, $16/21=76.2\%$, $17/21=81.0\%$, $15/21=71.4\%$, **14** --- $77/126=61.1\%$, $100/126=79.4\%$, $69/126=54.8\%$, $95/126=75.4\%$, $65/126=51.6\%$, $95/126=75.4\%$, respectively.

In the summed-up groups, they were shown as follows; **15** --- $168/321=52.4\%$, $242/321=75.4\%$, $171/321=53.3\%$, $237/321=73.8\%$, $146/321=45.5\%$, $243/321=75.7\%$, **16** --- $221/570=38.8\%$, $424/570=74.4\%$, $214/570=37.5\%$, $424/570=74.4\%$, $182/570=31.9\%$, $428/570=75.1\%$, **34** --- $87/321=27.1\%$, $237/321=73.8\%$, $81/321=25.2\%$, $240/321=74.8\%$, $69/321=21.5\%$, $241/321=75.1\%$, **35** --- $134/249=53.8\%$, $187/249=75.1\%$, $133/249=53.4\%$, $184/249=73.9\%$, $113/249=45.4\%$, $187/249=75.1\%$, respectively.

4. It was clearly ascertained that subs-2, -4 and -6, i.e., ratio columns, showed the higher significances in comparison with those of subs-1, -3 and -5. The former and the latter aver-

ages and their s.d. through the respective sub-groups were found as follows; **MD 1** --- 94/117=80.3%, 10.44 ± 1.71 & 64/117=54.7%, 7.11 ± 1.52 , **2** --- 321/423=75.9%, 35.67 ± 8.31 & 60/423=14.2%, 6.67 ± 3.20 , **3** --- 415/540=76.9%, 46.11 ± 8.63 & 124/540=23.0%, 13.78 ± 2.44 , **TA 4** --- 6/9=66.7%, 0.67 ± 0.47 & 5/9=55.6%, 0.56 ± 0.49 , **5** --- 233/324=71.9%, 25.89 ± 6.33 & 72/324=22.2%, 8.00 ± 3.86 , **6** --- 239/333=71.8%, 26.56 ± 6.15 & 77/333=23.1%, 8.56 ± 4.06 , **KE 7** --- 64/90=71.1%, 7.11 ± 0.88 & 36/90=40.0%, 4.00 ± 1.49 , **NI 8** --- 32/45=71.1%, 3.56 ± 0.69 & 18/45=40.0%, 2.00 ± 1.05 , **9** --- 188/261=72.0%, 20.89 ± 3.38 & 139/261=53.3%, 15.44 ± 2.82 , **10** --- 220/306=71.9%, 24.44 ± 3.24 & 157/306=51.3%, 17.44 ± 3.10 , **IV 11** --- 48/63=76.2%, 5.33 ± 1.70 & 12/63=19.1%, 1.33 ± 1.05 , **SE 12** --- 242/315=76.8%, 26.89 ± 1.73 & 170/315=54.0%, 18.89 ± 3.00 , **13** --- 48/63=76.2%, 5.33 ± 0.94 & 41/63=65.1%, 4.56 ± 1.42 , **14** --- 290/378=76.7%, 32.22 ± 1.62 & 211/378=55.8%, 23.44 ± 2.87 , respectively.

In the summed-up groups, they were shown as follows; **15** --- 722/963=75.0%, 80.22 ± 5.71 & 485/963=50.4%, 53.89 ± 5.69 , **16** --- 1,276/1,710=74.6%, 141.78 ± 14.85 & 617/1,710=36.1%, 68.56 ± 9.02 , **34** --- 718/963=74.6%, 79.78 ± 11.57 & 237/963=24.6%, 26.33 ± 5.01 , **35** --- 558/747=74.7%, 62.00 ± 4.52 & 380/747=50.9%, 42.22 ± 4.73 , respectively. It might be attributed to the gene actions. And those fixed differences might be seen as specificities of the characters or character-combinations.

5. The respective strains showed significant correlations in the ranges between 27 and 7. It was noticed that the strain No.426 showed significances in 27/27 combinations (=100.0% in the whole character-combinations), followed by Nos.338 and 455 (26/27=96.3%). On the other hand, No.303 showed significances only in 7/27 combinations (=25.9%), followed by Nos.319, 2011 and 2023 (9/27=33.3%). Average values and their s.d. through the whole strains within the respective groups were found to be as follows; 19.08 ± 5.34 (**MD 1**), 14.09 ± 2.40 (**2**), 15.17 ± 3.87 (**3**), 20 (**TA 4**), 14.64 ± 2.61 (**5**), 14.78 ± 2.71 (**6**), 15.80 ± 4.42 (**KE 7**), 17.20 ± 4.17 (**NI 8**), 18.62 ± 3.21 (**9**), 18.41 ± 3.41 (**10**), 15.14 ± 2.10 (**IV 11**), 19.57 ± 2.99 (**SE 12**), 20.43 ± 2.77 (**13**) and 19.71 ± 2.97 (**14**), respectively.

In the summed-up groups, they were shown as follows; 18.56 ± 3.85 (**15**), 16.71 ± 3.94 (**16**), 15.09 ± 3.58 (**34**) and 18.80 ± 3.35 (**35**), respectively. It was noticed that strains of West Africa (**35**) showed remarkably higher significances than those of East Africa (**34**).

6. Significant correlations were analysed in the positive or the negative statuses as well as in the degrees of the respective statuses. Significant correlations were accounted as follows in the order of 0.1% levels (positive, negative and the whole), of 1% levels (positive, negative and the whole) and of 5% levels (positive, negative and the whole); **MD 1** --- 140 (56.5%), 46 (18.6%), 186 (75.0%), 28 (11.3%), 10 (4.0%), 38 (15.2%), 15 (6.1%), 9 (3.6%), 24 (9.7%), **2** --- 231 (34.9%), 77 (11.6%), 308 (46.5%), 144 (21.8%), 33 (5.0%), 177 (26.7%), 153 (23.1%), 24 (3.6%), 177 (26.7%), **3** --- 371 (40.8%), 123 (13.5%), 494 (54.3%), 172 (18.9%), 43 (4.7%), 215 (23.6%), 168 (18.5%), 33 (3.6%), 201 (22.1%), **TA 4** --- 15 (75.0%), 0 (0.0%), 15 (75.0%), 2 (10.0%), 1 (5.0%), 3 (15.0%), 1 (5.0%), 1 (5.0%), 2 (10.0%), **5** --- 212 (40.2%), 54 (10.3%), 266 (50.5%), 95 (18.0%), 31 (5.9%), 126 (23.9%), 115 (21.8%), 20 (3.8%), 135 (25.6%), **6** --- 227 (41.5%), 54 (9.9%), 281 (51.4%), 97 (17.7%), 32 (5.9%), 129 (23.6%), 116 (21.2%), 21 (3.8%), 137 (25.1%), **KE 7** --- 86 (54.4%), 22 (13.9%), 108 (68.4%), 19 (12.0%), 4 (2.5%), 23 (14.6%), 18 (11.4%), 9 (5.7%), 27 (17.1%), **NI 8** --- 43 (50.0%), 5 (5.8%), 48 (55.8%), 19 (22.1%), 4 (4.7%), 23 (26.7%), 11 (12.8%), 4 (4.7%), 15 (17.4%), **9** --- 294 (54.4%), 89 (16.5%), 383 (70.9%), 60 (11.1%), 25 (4.6%), 85 (15.7%), 54 (10.0%), 18 (3.3%), 72 (13.3%), **10** --- 337 (53.8%), 94 (15.0%), 431 (68.9%), 79 (12.6%), 29 (4.6%), 108 (17.3%), 65 (10.4%),

22 (3.5%), 87 (13.9%), **IV 11** --- 33 (31.1%), 9 (8.5%), 42 (39.6%), 30 (28.3%), 9 (8.5%), 39 (36.8%), 21 (19.8%), 4 (3.8%), 25 (23.6%), **SE 12** --- 396 (57.8%), 103 (15.0%), 499 (72.9%), 65 (9.5%), 25 (3.7%), 90 (13.1%), 68 (9.9%), 28 (4.1%), 96 (14.0%), **13** --- 90 (62.9%), 20 (14.0%), 110 (76.9%), 6 (4.2%), 5 (3.5%), 11 (7.7%), 13 (9.1%), 9 (6.3%), 22 (15.4%), **14** --- 486 (58.7%), 123 (14.9%), 609 (73.5%), 71 (8.6%), 30 (3.6%), 101 (12.2%), 81 (9.8%), 37 (4.5%), 118 (14.3%), respectively.

In the summed-up groups, those were shown as follows: **15** --- 1,097 (55.2%), 294 (14.8%), 1,391 (70.0%), 229 (11.5%), 83 (4.2%), 312 (15.7%), 201 (10.1%), 82 (4.1%), 283 (14.3%), **16** --- 1,540 (48.5%), 425 (13.4%), 1,965 (61.9%), 468 (14.7%), 147 (4.6%), 615 (19.4%), 469 (14.8%), 126 (4.0%), 595 (18.7%), **34** --- 684 (42.4%), 199 (12.3%), 883 (54.7%), 288 (17.8%), 79 (4.9%), 367 (22.7%), 302 (18.7%), 63 (3.9%), 365 (22.6%), **35** --- 856 (54.9%), 226 (14.5%), 1,082 (69.4%), 180 (11.5%), 68 (4.4%), 248 (15.9%), 167 (10.7%), 63 (4.0%), 230 (14.7%), respectively.

It might be a noticeable phenomenon that about 70% of them showed significant combinations at 0.1% level. It might have meant an instance of the biological actions, which were extremely called "all or nothing".

7. The positive and the negative combinations in the total were accounted as follows; **MD 1** -- 183 (73.8%) as positive, 65 (26.2%) as negative, 248 (100.0%) as total, **2** --- 528 (79.8%), 134 (20.2%), 662, **3** --- 711 (78.1%), 199 (21.9%), 910, **TA 4** --- 18 (90.0%), 2 (10.0%), 20, **5** --- 422 (80.1%), 105 (19.9%), 527, **6** --- 440 (80.4%), 107 (19.6%), 547, **KE 7** --- 123 (77.9%), 35 (22.2%), 158, **NI 8** --- 73 (84.9%), 13 (15.1%), 86, **9** --- 408 (75.6%), 132 (24.4%), 540, **10** --- 481 (76.8%), 145 (23.2%), 626, **IV 11** --- 84 (79.3%), 22 (20.8%), 106, **SE 12** --- 529 (77.2%), 156 (22.8%), 685, **13** --- 109 (76.2%), 34 (23.8%), 143, **14** --- 638 (77.1%), 190 (22.9%), 828, respectively.

In the summed-up groups, those were shown as follows; **15** --- 1,527 (76.9%), 459 (23.1%), 1,986, **16** --- 2,477 (78.0%), 698 (22.0%), 3,175, **34** --- 1,274 (78.9%), 341 (21.1%), 1,615, **35** --- 1,203 (77.1%), 357 (22.9%), 1,560, respectively.

8. Negative correlations were found in the strain level in some combinations, though positive correlations were found in the most strains in the same character-combinations, and *vice versa*. Three cases were found, *i.e.*, strain No.381, combination 15·16, strain No.308, combination 3·13, and strain No.339, combination 32·34. In the previous papers, 6 and 2 cases were found in cases of *O. sativa* collected in Madura¹⁵⁾ and Fiji²⁰⁾, respectively. Unfortunately, those unnatural facts and discrepancies are not to be fully explained at the present time. Those phenomena may be attributed to the actions of the respective genes which were concerned through the whole events.

II. *Oryza breviligulata* CHEV. et ROEHR.

1. C.c. of the respective character-combinations in the strain level were fixed to be significant in 127 cases out of 189 character-combinations (=7 strains x 27 character-combinations), abbreviated as 127/189=67.2%, and averages and their s.d. through the whole combinations within the groups were found to be 4.70 ± 2.27 (**NI 17**), $311/459=67.8\%$, 11.52 ± 5.25 (**18**), $438/648=67.6\%$, 16.22 ± 7.16 (**19**), $18/27=66.7\%$, 0.67 ± 0.47 (**IV 20**), $311/459=67.8\%$, 11.52 ± 4.29 (**SE 21**), $120/189=63.5\%$, 4.44 ± 2.73 (**22**), $431/648=66.5\%$, 15.96 ± 6.71 (**23**), respectively. In the summed-up group (**24**), those were found to be $887/1,323=67.1\%$, 32.85 ± 14.04 .

2. The whole combinations were divided into 2 groups, *i.e.*, the group I (combination Nos.1 ~ 18) and the group II (Nos.19 ~ 27). Significant correlations were accounted, and averages and their s.d. through the whole combinations within the groups were found to be as follows; 64/126=50.8%, 3.56 ± 1.95 & 63/63=100.0%, 7.00 ± 0.00 (**NI 17**, I & II), 166/306=54.3%, 9.22 ± 4.97 & 145/153=94.8%, 16.11 ± 1.20 (**18**, I & II), 230/432=53.2%, 12.78 ± 6.37 & 208/216=96.3%, 23.11 ± 1.20 (**19**, I & II), 9/18=50.0%, 0.50 ± 0.50 & 9/9=100.0%, 1.00 ± 0.00 (**IV 20**, I & II), 169/306=55.2%, 9.39 ± 3.64 & 142/153=92.8%, 15.78 ± 1.23 (**SE 21**, I & II), 57/126=45.2%, 3.17 ± 2.50 & 63/63=100.0%, 7.00 ± 0.00 (**22**, I & II), 226/432=52.3%, 12.56 ± 5.66 & 205/216=94.9%, 22.78 ± 1.23 (**23**, I & II), respectively. In the summed-up group (**24**, I & II), those were found to be 465/882=52.7%, 25.83 ± 12.05 & 422/441=95.7%, 46.89 ± 2.28 , respectively. It was ascertained that the values were remarkably larger in the group II than those of the group I through the whole groups.

3. Moreover, the group I was redivided into the 6 sub-groups as follows; sub-group 1 (combination Nos.1 ~ 3), sub-2 (Nos.4 ~ 6), sub-3 (Nos.7 ~ 9), sub-4 (Nos.10 ~ 12), sub-5 (Nos.13 ~ 15) and sub-6 (Nos.16 ~ 18). Significant correlations were accounted as follows in the order from sub-1 to sub-6; **NI 17** --- 5/21=23.8%, 15/21=71.4%, 5/21=23.8%, 15/21=71.4%, 10/21=47.6%, 14/21=66.7%, **18** --- 22/51=43.1%, 38/51=74.5%, 18/51=35.3%, 35/51=68.6%, 9/51=17.7%, 44/51=86.3%, **19** --- 27/72=37.5%, 53/72=73.6%, 23/72=31.9%, 50/72=69.4%, 19/72=26.4%, 58/72=80.6%, **IV 20** --- 0/3=0.0%, 3/3=100.0%, 1/3=33.3%, 2/3=66.7%, 0/3=0.0%, 3/3=100.0%, **SE 21** --- 23/51=45.1%, 33/51=64.7%, 21/51=41.2%, 33/51=64.7%, 24/51=47.1%, 35/51=68.6%, **22** --- 3/21=14.3%, 15/21=71.4%, 1/21=4.8%, 17/21=81.0%, 8/21=38.1%, 13/21=61.9%, **23** --- 26/72=36.1%, 48/72=66.7%, 22/72=30.6%, 50/72=69.4%, 32/72=44.4%, 48/72=66.7%, respectively. In the summed-up group (**24**), those were found to be 53/147=36.1%, 104/147=70.8%, 46/147=31.3%, 102/147=69.4%, 51/147=34.7%, 109/147=74.2%, respectively.

4. It was clearly ascertained that subs-2, -4 and -6, *i.e.*, ratio columns, showed the higher significances in comparison with those of subs-1, -3 and -5. The former and the latter averages and their s.d. through the respective sub-groups were found as follows; **NI 17** --- 44/63=69.8%, 4.89 ± 1.52 & 20/63=31.8%, 2.22 ± 1.32 , **18** --- 117/153=76.5%, 13.00 ± 3.89 & 49/153=32.0%, 5.44 ± 2.41 , **19** --- 161/216=74.5%, 17.89 ± 5.00 & 69/216=31.9%, 7.67 ± 1.94 , **IV 20** --- 8/9=88.9%, 0.89 ± 0.31 & 1/9=11.1%, 0.11 ± 0.31 , **SE 21** --- 101/153=66.0%, 11.22 ± 4.26 & 68/153=44.4%, 7.56 ± 1.26 , **22** --- 45/63=71.4%, 5.00 ± 2.00 & 12/63=19.1%, 1.33 ± 1.33 , **23** --- 146/216=67.6%, 16.22 ± 5.69 & 80/216=37.0%, 8.89 ± 2.18 , respectively. In summed-up group (**24**), those were found as 315/441=71.4%, 35.00 ± 10.62 & 150/441=34.0%, 16.67 ± 3.13 . Those differences found between the 2 groups might be seen as specificities of the characters or the character-combinations.

5. The respective strains showed significant correlations in the ranges between 22 and 15. It was noticeable that the strain Nos.331, 350, 367 and 438 showed significances in 22/27 combinations (=81.5% in the whole character-combinations), followed by Nos.368, 422 and 432 (21/27=77.8%). On the other hand, Nos.415, 418 and 425, which were all collected in Senegal, showed significances only in 15/27 combinations (=55.6%), followed by Nos.344, 347 and 376 (16/27=59.3%), the whole of which were collected in Nigeria. Average values and their s.d. through the whole strains within the respective groups were found as follows; 18.14 ± 1.73 (**NI 17**), 18.29 ± 1.87 (**18**), 18.25 ± 1.83 (**19**), 18 (**IV 20**), 18.29 ± 2.05 (**SE 21**), 17.14 ± 1.46 (**22**), 17.96 ± 1.97 (**23**), respectively. In the summed-up group (**24**), those were shown as 18.10

± 1.89 . It was noticed that their ranges (from 22 to 15) were remarkably smaller than those of *O. longistaminata* (from 27 to 7). It showed one of the species specificities.

6. Significant correlations were analysed in the positive or the negative statuses as well as in the degrees of the respective statuses. Significant correlations were accounted as follows in the order of 0.1% levels (positive, negative and the whole), of 1% levels (positive, negative and the whole) and of 5% levels (positive, negative and the whole); **NI 17** --- 86 (67.7%), 10 (7.9%), 96 (75.6%), 13 (10.2%), 5 (3.9%), 18 (14.2%), 8 (6.3%), 5 (3.9%), 13 (10.2%), **18** --- 191 (61.4%), 35 (11.3%), 226 (72.7%), 28 (9.0%), 7 (2.3%), 35 (11.3%), 31 (10.0%), 19 (6.1%), 50 (16.1%), **19** --- 277 (63.2%), 45 (10.3%), 322 (73.5%), 41 (9.4%), 12 (2.7%), 53 (12.1%), 39 (8.9%), 24 (5.5%), 63 (14.4%), **IV 20** --- 13 (72.2%), 1 (5.6%), 14 (77.8%), 1 (5.6%), 1 (5.6%), 2 (11.1%), 1 (5.6%), 1 (5.6%), 2 (11.1%), **SE 21** --- 194 (62.4%), 35 (11.3%), 229 (73.6%), 30 (9.7%), 19 (6.1%), 49 (15.8%), 23 (7.4%), 10 (3.2%), 33 (10.6%), **22** --- 80 (66.7%), 17 (14.2%), 97 (80.8%), 8 (6.7%), 3 (2.5%), 11 (9.2%), 9 (7.5%), 3 (2.5%), 12 (10.0%), **23** --- 274 (63.6%), 52 (12.1%), 326 (75.6%), 38 (8.8%), 22 (5.1%), 60 (13.9%), 32 (7.4%), 13 (3.0%), 45 (10.4%), respectively. In the summed-up group (**24**), those were found to be 564 (63.6%), 98 (11.1%), 662 (74.6%), 80 (9.0%), 35 (4.0%), 115 (13.0%), 72 (8.1%), 38 (4.3%), 110 (12.4%), respectively.

It might be a noticeable phenomenon that about three fourths of them (74.6%) showed significant combinations at 0.1% level. It might have meant an instance of the biological actions, which were extremely called "all or nothing".

7. The positive and the negative combinations in the total were accounted as follows; **NI 17** --- 107 (84.3%) as positive, 20 (15.8%) as negative, 127 (100.0%) as total, **18** --- 250 (80.4%), 61 (19.6%), 311, **19** --- 357 (81.5%), 81 (18.5%), 438, **IV 20** --- 15 (83.3%), 3 (16.7%), 18, **SE 21** --- 247 (79.4%), 64 (20.6%), 311, **22** --- 97 (80.8%), 23 (19.2%), 120, **23** --- 344 (79.8%), 87 (20.2%), 431, respectively. In the summed-up group (**24**), those were found to be 716 (80.7%), 171 (19.3%), 887, respectively.

8. Negative correlations were found in the strain level in some combinations, though positive correlations were found in the most strains in the same character-combinations, and *vice versa*. Three cases were found, *i.e.*, strain No.350, combination 5·6, strain No.438, combination 11·13, strain No.422, combination 22·23. It was an interesting and important phenomenon concerning the strain differentiation and the locality specificity. It was also noticed that strain No.413 showed only positive correlations.

III. *Oryza punctata* KOTSCHY

1. C.c. of the respective character-combinations in the strain level were fixed to be significant in 44 cases out of 81 character-combinations (=3 strains x 27 character-combinations), abbreviated as 44/81=54.3%, and averages and their s.d. through the whole-combinations within the groups were found to be 1.63 ± 0.99 (**TA 25**), $340/702=48.4\%$, 12.59 ± 7.84 (**26**), $384/783=49.0\%$, 14.22 ± 8.45 (**27**), $79/135=58.5\%$, 2.93 ± 1.22 (**KE 28**), $165/270=61.1\%$, 6.11 ± 2.71 (**29**), $244/405=60.3\%$, 9.04 ± 3.59 (**30**), respectively. It was noticed that **No.26** showed 100.0% significances in combination No.27. In the summed-up groups, those were found to be $288/486=59.3\%$, 10.67 ± 4.10 (**31**) and $628/1,188=52.9\%$, 23.26 ± 10.91 (**32**), respectively.

2. The whole combinations were divided into the 2 groups, *i.e.*, group I (combination Nos.1 ~ 18) and group II (Nos.19 ~ 27). Significant correlations were accounted, and averages and their s.d. through the whole combinations within the groups were found as follows; 28/

54=51.9%, 1.56 ± 0.96 & $16/27=59.3\%$, 1.78 ± 1.03 (**TA 25**, I & II), $204/468=43.6\%$, 11.33 ± 8.92 & $136/234=58.1\%$, 15.11 ± 3.96 (**26**, I & II), $232/522=44.4\%$, 12.89 ± 9.55 & $152/261=58.2\%$, 16.89 ± 4.58 (**27**, I & II), $49/90=54.4\%$, 2.72 ± 1.15 & $36/45=66.7\%$, 3.33 ± 1.25 (**KE 28**, I & II), $94/180=52.2\%$, 5.22 ± 2.76 & $71/90=78.9\%$, 7.89 ± 1.45 (**29**, I & II), $143/270=53.0\%$, 7.94 ± 3.64 & $101/135=74.8\%$, 11.22 ± 2.22 (**30**, I & II), respectively. In summed-up groups, those were found to be $171/324=52.8\%$, 9.50 ± 4.15 & $117/162=72.2\%$, 13.00 ± 2.79 (**31**, I & II), $375/792=47.4\%$, 20.83 ± 12.01 & $253/396=63.9\%$, 28.11 ± 5.78 (**32**, I & II), respectively. It was ascertained that the values were clearly larger in the group II than those of the group I through the whole groups.

3. Moreover, the group I was redivided into 6 sub-groups as follows; sub-group 1 (combination Nos.1 ~ 3), sub-2 (Nos.4 ~ 6), sub-3 (Nos.7 ~ 9), sub-4 (Nos.10 ~ 12), sub-5 (Nos.13 ~ 15) and sub-6 (Nos.16 ~ 18). Significant correlations were accounted as follows in the order from sub-1 to sub-6; **TA 25** --- $4/9=44.4\%$, $6/9=66.7\%$, $3/9=33.3\%$, $7/9=77.8\%$, $1/9=11.1\%$, $7/9=77.8\%$, **26** --- $10/78=12.8\%$, $61/78=78.2\%$, $10/78=12.8\%$, $58/78=74.4\%$, $9/78=11.5\%$, $56/78=71.8\%$, **27** --- $14/87=16.1\%$, $67/87=77.0\%$, $13/87=14.9\%$, $65/87=74.7\%$, $10/87=11.5\%$, $63/87=72.4\%$, **KE 28** --- $7/15=46.7\%$, $9/15=60.0\%$, $5/15=33.3\%$, $10/15=66.7\%$, $7/15=46.7\%$, $11/15=73.3\%$, **29** --- $11/30=36.7\%$, $23/30=76.7\%$, $6/30=20.0\%$, $23/30=76.7\%$, $10/30=33.3\%$, $21/30=70.0\%$, **30** --- $18/45=40.0\%$, $32/45=71.1\%$, $11/45=24.4\%$, $33/45=73.3\%$, $17/45=37.8\%$, $32/45=71.1\%$, respectively. In summed-up groups, those were found as follows; **31** --- $22/54=40.7\%$, $38/54=70.4\%$, $14/54=25.9\%$, $40/54=74.1\%$, $18/54=33.3\%$, $39/54=72.2\%$, **32** --- $32/132=24.2\%$, $99/132=75.0\%$, $24/132=18.2\%$, $98/132=74.2\%$, $27/132=20.5\%$, $95/132=72.0\%$, respectively.

4. It was clearly ascertained that subs-2, -4 and -6, *i.e.*, ratio columns, showed the higher significances in comparison with those of subs-1, -3 and -5. The former and the latter averages and their s.d. through the respective sub-groups were found as follows; **TA 25** --- $20/27=74.1\%$, 2.22 ± 0.63 & $8/27=29.6\%$, 0.89 ± 0.74 , **26** --- $175/234=74.8\%$, 19.44 ± 4.97 & $29/234=12.4\%$, 3.22 ± 1.69 , **27** --- $195/261=74.7\%$, 21.67 ± 4.99 & $37/261=14.2\%$, 4.11 ± 1.85 , **TA 28** --- $30/45=66.7\%$, 3.33 ± 0.94 & $19/45=42.2\%$, 2.11 ± 0.99 , **29** --- $67/90=74.4\%$, 7.44 ± 1.77 & $27/90=30.0\%$, 3.00 ± 1.49 , **30** --- $97/135=71.9\%$, 10.78 ± 2.49 & $46/135=34.1\%$, 5.11 ± 2.08 , respectively. In summed-up groups, those were found as follows; **31** --- $117/162=72.2\%$, 13.00 ± 2.63 & $54/162=33.3\%$, 6.00 ± 1.76 , **32** --- $292/396=73.7\%$, 32.44 ± 3.66 & $83/396=21.0\%$, 9.22 ± 2.35 , respectively. Those differences found between the 2 groups might be seen as specificities of the characters or the character-combinations.

5. The respective strains showed significant correlations in the ranges between 21 and 8. It was noticeable that the strain No.474 showed significances in 21/27 combinations (=77.8% in the whole character-combinations), followed by Nos.460 and 464 (19/27 combinations, 70.4%), the whole of which were collected in Kenya. On the other hand, No.461 showed significances only in 8/27 combinations (=29.6%), followed by No.2086 (9/27=33.3%) and Nos.2084, 2101 and 2105 (10/27=37.0%). Average values and their s.d. through the whole strains within the respective groups were found as follows; 14.67 ± 2.06 (**TA 25**), 13.08 ± 2.35 (**26**), 13.24 ± 2.37 (**27**), 15.80 ± 4.17 (**KE 28**), 16.50 ± 2.29 (**29**), 16.27 ± 3.07 (**30**), respectively. In the summed-up groups, those were found to be 16.00 ± 2.98 (**31**) and 14.27 ± 3.00 (**32**), respectively. It was noticed that the ranges (from 21 to 8) were located as intermediate between *O. longistaminata* (from 27 to 7) and *O. breviligulata* (from 22 to 15). It showed one of the species specificities.

6. Significant correlations were analysed in the positive or the negative statuses as well as in the degrees of the respective statuses. Significant correlations were accounted as follows in the order of 0.1% levels (positive, negative and the whole), of 1% levels (positive, negative and the whole) and of 5% levels (positive, negative and the whole); **TA 25** --- 21 (47.7%), 5 (11.4%), 26 (59.1%), 8 (18.2%), 1 (2.3%), 9 (20.5%), 6 (13.6%), 3 (6.8%), 9 (20.5%), **26** --- 108 (31.8%), 55 (16.2%), 163 (47.9%), 63 (18.5%), 17 (5.0%), 80 (23.5%), 87 (25.6%), 10 (2.9%), 97 (28.5%), **27** --- 129 (33.6%), 60 (15.6%), 189 (49.2%), 71 (18.5%), 18 (4.7%), 89 (23.2%), 93 (24.2%), 13 (3.4%), 106 (27.6%), **KE 28** --- 42 (53.2%), 6 (7.6%), 48 (60.8%), 16 (20.3%), 1 (1.3%), 17 (21.5%), 11 (13.9%), 3 (3.8%), 14 (17.7%), **29** --- 89 (53.9%), 13 (7.9%), 102 (61.8%), 25 (15.2%), 9 (5.5%), 34 (20.6%), 20 (12.1%), 9 (5.5%), 29 (17.6%), **30** --- 131 (53.7%), 19 (7.8%), 150 (61.5%), 41 (16.8%), 10 (4.1%), 51 (20.9%), 31 (12.7%), 12 (4.9%), 43 (17.6%), respectively. In summed-up groups, those were found as follows; **31** --- 152 (52.8%), 24 (8.3%), 176 (61.1%), 49 (17.0%), 11 (3.8%), 60 (20.8%), 37 (12.9%), 15 (5.2%), 52 (18.1%), **32** --- 260 (41.4%), 79 (12.6%), 339 (54.0%), 112 (17.8%), 28 (4.5%), 140 (22.3%), 124 (19.8%), 25 (4.0%), 149 (23.7%), respectively.

It might be a noticeable phenomenon that about 60% of them showed significant combinations at 0.1% level. It might have meant an instance of the biological actions, which were extremely called "all or nothing", *i.e.*, going from one extreme to another. In a stricter sense, those characters or/and character-combinations were looked upon as being in possession of a stable state, and they were exhibited independently on the other characters or character-combinations. Those values were reported as 65.6%, 76.6%, ca. 79% and 74.6% in the cases of *O. sativa* collected in Madura, Indonesia¹⁵⁾, Fiji²⁰⁾, *O. longistaminata* of the present paper, and *O. breviligulata* of the present paper, respectively. It meant that the tendency would fundamentally be shown in the genus *Oryza*, regardless of the species status, disregarding differences in species and locality specificities to some extent.

7. The positive and the negative combinations in the total were accounted as follows; **TA 25** --- 35 (79.6%) as positive, 9 (20.4%) as negative, 44 (100.0%) as total, **26** --- 258 (75.9%), 82 (24.1%), 340, **27** --- 293 (76.3%), 91 (23.7%), 384, **KE 28** --- 69 (87.3%), 10 (12.7%), 79, **29** --- 134 (81.2%), 31 (18.8%), 165, **30** --- 203 (83.2%), 41 (16.8%), 244, respectively. In the summed-up groups, those were found as follows; **31** --- 238 (82.6%), 50 (17.4%), 288, **32** --- 496 (79.0%), 132 (21.0%), 628, respectively. Nearly the same patterns were found in the cases of *O. sativa* collected in Madura¹⁵⁾, Fiji²⁰⁾, *O. longistaminata* of the present paper, and *O. breviligulata* of the present paper as \oplus 82.1% and \ominus 17.9%, \oplus 83.9% and \ominus 16.1%, \oplus ca. 80% and \ominus ca. 20%, and \oplus 80.7% and \ominus 19.3%, respectively. The tendency was also constant in the genus *Oryza*, regardless of the species status, showing diversities in species and locality specificities.

8. Negative correlations were found in the strain level in some combinations, though positive correlations were found in the most strains in the same character-combinations, and *vice versa*. Four cases were found, *i.e.*, strain No.459, combination 11·12, strain No.474, combination 11·13, strain No.473, combination 14·15, strain No.2091, combination 1·11. It was an interesting and important phenomenon concerning strain differentiation and locality specificity. It was also noticed that strain No.471 showed only positive correlations.

IV. *Oryza brachyantha* CHEV. et ROEHR.

1. C.c. of the respective character-combinations (at the strain level only in this species)

were fixed to be significant in 15 cases out of 27 combinations of the whole cases (=55.6%), and the average and its s.d. through the whole combinations were found to be 0.56 ± 0.50 (SE 33).

2. The whole combinations were divided into 2 groups, *i.e.*, the group I (combination Nos.1 ~ 18) and the group II (Nos.19 ~ 27). Significant correlations, averages and its s.d. through the whole combinations within the groups were found as $6/18=33.3\%$, 0.33 ± 0.47 and $9/9=100.0\%$, 1.00 ± 0.00 , in groups I and II, respectively. The latter values were clearly larger than those of the former, which were the same as in cases of the former 3 species, *i.e.*, *O. longistaminata*, *O. breviligulata* and *O. punctata*.

3. Moreover, the group I was redivided into 6 sub-groups as in the former 3 species. Significant correlations were accounted as follows in the order from sub-1 to sub-6; $0/3=0.0\%$, $1/3=33.3\%$, $1/3=33.3\%$, $2/3=66.7\%$, $0/3=0.0\%$ and $2/3=66.7\%$, respectively.

4. It was clearly ascertained that subs-2, -4 and -6, *i.e.*, ratio columns, showed the higher significances in comparison with those of subs-1, -3 and -5. The former and the latter averages and their s.d. through the respective sub-groups were found to be $5/9=55.6\%$, 0.55 ± 0.50 , and $1/9=11.1\%$, 0.11 ± 0.31 , respectively. This tendency was the same as in the cases of the former 3 species.

5. Significant correlations were analysed in the positive or the negative statuses as well as in the degrees of the respective statuses. Significant correlations were accounted as follows in the same order of the former 3 species; 11 (73.3%), 1 (6.7%), 12 (80.0%), 1 (6.7%), 1 (6.7%), 2 (13.3%), 1 (6.7%), 0 (0.0%) and 1 (6.7%), respectively. It might be noticeable that 80% of them showed significant combinations at 0.1% level. It might have meant an instance of those biological actions, which were the same as in the cases of *O. sativa* in the previous papers^{15, 20}, *O. longistaminata*, *O. breviligulata* and *O. punctata* in the present paper.

6. The positive, the negative and the total significant correlations were accounted as 13 (86.7%), 2 (13.3%) and 15 (100.0%), respectively. Those ratios were nearly the same in cases of *O. sativa* in the previous papers^{15, 20}, and in the cases of *O. longistaminata*, *O. breviligulata* and *O. punctata* in the present paper. In other words, the tendency was constant in the genus *Oryza*, regardless of the species status.

V. Comparison of the whole species and groups

For summing-up the data, the results of the respective species and groups mentioned above were used, and were given in Table 12. However, groups 4 (TA, *O. longistaminata*), 20 (IV, *O. breviligulata*) and 33 (SE, *O. brachyantha*) were omitted here owing to being only 1 strain each.

1. C.c. of the respective character-combinations at the group level were fixed to be significant in 566 cases out of 864 character-combinations (=32 groups x 27 character-combinations), abbreviated as $566/864=65.5\%$ (Table 12). Significant correlations in the group level were accounted as follows in the order of the combination numbers from 1 to 27; 17, 14, 22; 25, 17, 10; 14, 16, 27; 27, 19, 9; 6, 9, 15; 24, 21, 10; 31, 29, 30; 31, 28, 27; 31, 31, 26 groups, respectively. It may be noticed that the values were particularly larger and smaller in the combination numbers 19, 22, 25 and 26, and 13, respectively. Average and its s.d. through the whole combinations within the groups were found to be 20.96 ± 7.94 . Group characteristics were found, in detail.

2. The whole combinations were divided into the 2 groups, *i.e.*, the group I (combination

Table 12. Summed-up data of group level showing correlation coefficients in the 27 character-combinations; data of Nos.1~12, Nos.13~24, and Nos.25~27 cited from the previous^{24, 25)} and the present papers, respectively.

Combination No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Character Country Mark	Nos.	1	1	2	4	4	5	11	11	12	14	14	15	21	21	22	24	24	25	1	2	3	4	5	6	31	32	35
	Group Mark	2	3	3	5	6	6	12	13	13	15	16	16	22	23	23	25	26	26	11	12	13	14	15	16	33	34	36
MD	1	*** ** ** *					*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **
	2	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **
	3	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **
TA	5	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **
	6	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **
KE	7	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **	** **
	8	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *
NI	9			***						*	***	*		**	***	***	***	***	*	***	***	***	***	***	***	***	***	***
	10	*** **	*** **	*** **	*		*	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **
IV	11			**						***	*				**				***	**	**	**	**	*	***	***	***	
	12	*	**		***	***	***	***	***	***	***	***	***	***	***	***	***	***	*	***	***	***	***	***	***	***	***	***
SE	13	*		*			*	**	***										***	***	*	*	*	*	***	***	***	
	14	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **	*** **
SUM	15	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	16	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	*
NI	17			***						*	***							*	***	***	***	***	***	***	***	***	***	
	18			***	***	*				***	***	**	**	*	*			*	***	***	***	***	***	***	***	***	***	
	19			***	***					***	***	**	**	*	**	*		*	***	***	***	***	***	***	***	***	***	
SE	21			***	***					***	***				***	***			***	***	***	***	***	***	***	***	***	
	22			***	***					***	***				*	*		*	***	**	***	***	***	***	***	***	***	
	23			***	***					***	***				***	***			***	***	***	***	***	***	***	***	***	
SUM	24			***	***					***	***	*	*		***	***			***	***	***	***	***	***	***	***	***	
	25			**											**				***	***	***	***	***	***	***	***	***	
TA	26			*	**	**				***	***				**	***			***	***	***	***	***	***	***	***	***	
	27	*		**	**	**	*	*		***	***	*			**	**			***	***	***	***	***	***	***	***	***	
	28								*		*							**	**		*		***	*				
KE	29			***						**								**	***		**	***	***	***	***	**	*	
	30			***						**								*	***	***	*	**	***	***	***	***	*	
	31		*	***	*					**	***	*			*	***	***	**	***	***	***	***	***	***	***	***	*	
SUM	32	*	*	**	***	**				***	***	***			*	***	***	***	***	***	***	***	***	***	***	***	*	
	34	***	***	***	***	***	***	***	***	***	***	***	***	***	**	***	***	***	***	***	***	***	***	***	***	***	***	***
WEST	35	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

Character numbers; 1, 11, 21 - length, 2, 12, 22 - width, 3, 13, 23 - thickness, 4, 14, 24 - L/W, 5, 15, 25 - L/T, 6, 16, 26 - W/T, 1~6 - unhusked grains, 11~16 - husked grains, 21~26 - comparative values (=husked/unhusked), 31 - area (UHG), 32 - volume (UHG), 33 - area (HG), 34 - volume (HG), 35 - quotient of area (=33/31), 36 - quotient of volume (=34/32)

***, **, *; significant at 0.1%, 1% and 5% levels, respectively

d.f.; 28 in the strain level; 11, 45, 58, 34, 35, 8, 3, 27, 32, 5, 33, 5, 40, 105, 188; 5, 15, 22, 15, 5, 22, 47; 1, 24, 27, 3, 8, 13, 16, 42; 105 and 81 in the order of group mark from Nos.1 to 35, omitted Nos.4, 20 and 33 owing to 1 strain each.

Nos.1 ~ 18) and the group II (Nos.19 ~ 27). Significant correlations were accounted as 52.4% (=302/576) and 91.7% (=264/288) in the groups I and II, respectively. It was ascertained that the values of the group II were clearly larger than those of the group I throughout the whole groups.

3. Those averages and their s.d. through the whole combinations within the groups were found to be 16.78 ± 6.36 and 29.33 ± 1.83 in the groups I and II, respectively. Moreover, group I redivided into 6 sub-groups as in the former 4 species. Significant correlations were accounted as follows in the order from sub-1 to sub-6; $53/96=55.2\%$, $52/96=54.2\%$, $57/96=59.4\%$, $55/96=57.3\%$, $30/96=31.3\%$ and $55/96=57.3\%$, respectively.

4. It was ascertained that subs-2, -4 and -6, *i.e.*, ratio columns, showed the higher significances [56.3% (=162/288)] in comparison with those of subs-1, -3 and -5 [48.6% (=140/288)]. However, those differences found were clearly ascertained to be smaller than those of the whole of strain level. Those averages and their s.d. through the whole combinations within sub-groups were found to be 18.00 ± 6.55 and 15.56 ± 5.91 in the higher (2, 4, 6) and in the lower (1, 3, 5) sub-groups, respectively.

5. The respective groups showed significant correlations as follows in the order from the group **Nos.1** to **35**, omitted **Nos.4, 20** and **33**; 23, 22, 22, 23, 23, 17, 15, 18, 21, 14, 23, 15, 26, 24, 24; 13, 18, 17, 15, 12, 15, 16; 2, 15, 19, 7, 10, 12, 16, 20; 25, 24, respectively. It was noticeable that the group **No.14** showed significances in 26/27 combinations (=96.3%), followed by **No.34** (25/27=92.6%). On the other hand, **No.25** showed significances only in 2/27 combinations (=7.4%), followed by **No.28** (7/27=25.9%). One, 1, 3, 4, 2, 1, 1, 1, 2, 2, 2, 5, 1, 1, 2, 1, 1 and 1 groups showed significances in 26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 10, 7 and 2 character-combinations, respectively. Average and its s.d. through the whole groups were found to be 17.69 ± 5.51 .

In *O. longistaminata* (17 groups, 359 total significances), *O. breviligulata* (7, 106) and *O. punctata* (8, 101), those were found to be 21.12 ± 3.69 , 15.14 ± 1.96 and 12.63 ± 5.74 , respectively. Those differences found might be looked upon as one of the species specificities.

6. Significant correlations were analysed in the positive or the negative statuses as well as in the degrees of the respective statuses. Significant correlations were accounted as follows in the same order of the former 4 species; 383 (67.7%), 31 (5.5%), 414 (73.2%); 69 (12.2%), 12 (2.1%), 81 (14.3%); 56 (9.9%), 15 (2.7%), 71 (12.6%), respectively. It might be a noticeable phenomenon that about three fourths (73.2%) of them showed significant correlations at 0.1% level. It might have meant an instance of those biological actions, which were extremely called "all or nothing", *i.e.*, going from one extreme to another. In a stricter sense, those characters were looked upon as being in possession of a stable state, and they were exhibited independently on the other characters.

7. The positive and the negative combinations in the total were accounted as 508 combinations (=89.8%) and 58 combinations (=10.2%), respectively. Nearly the same patterns as mentioned above were found in cases of *O. sativa* and of other species in the genus *Oryza*.

Negative correlations were found in the group level in some combinations, though positive correlations were found in the most groups in the same character-combinations, and *vice versa*. Two cases were found, *i.e.*, group **No.18**, combination 21·22, and group **No.9**, combination 25·26. Those unnatural facts and discrepancies were not to be fully explained at the present time. Both of those two combinations, *i.e.*, 21·22 and 25·26, were ascertained to be a few significant combinations, *i.e.*, $6/32=18.8\%$ and $10/32=31.3\%$, respectively. It was,

however, an interesting phenomenon concerning species evolution and/or strain differentiation.

8. Significant correlations found in combination Nos.1 ~ 3 (sub-1), Nos.7 ~ 9 (sub-3) and Nos.19 ~ 27 (group II) only showed the positive status. In a stricter sense, 22, 3 and 2 combinations, *i.e.*, Nos.1 ~ 4, 6 ~ 10, 12, 14 ~ 16 and 19 ~ 27, Nos.5, 11 and 17, and Nos.13 and 17, showed the positive, the negative, and the mixed statuses. However, Nos.13 and 18 showed only 1 negative status in each group, and were looked upon as the ones having the positive status in general. So, all combinations might be regarded as having the positive (24 combinations) and the negative (3 combinations, *i.e.*, 4·6, 14·16 and 24·26) statuses, which may be looked upon as the character-combination's specificities.

Summary

Succeeding the previous papers, the remaining 3 mutual relationships among 24 characters in view of the practical values were described. Further, correlation coefficients in the whole character-combinations (=27) were summed-up. The main results obtained here were summarized as follows.

Concerning the correlation coefficients among the 3 character-combinations, 82.1, 77.3, 78.3, 100.0, 74.1, 74.8, 70.0, 80.0, 89.7, 88.2, 81.0, 89.5, 81.0, 88.1, 85.4, 81.2; 100.0, 96.1, 97.2, 100.0, 94.1, 100.0, 95.8, 96.6; 88.9, 71.8, 73.6, 86.7, 86.7, 86.7, 87.0, 78.0; 100.0; 76.3 and 87.6% in the whole strains showed significant relationships in the order of group **No.1** to **No.35**, respectively. It was confirmed that the values of group **Nos.4, 17, 20, 22** (=100.0%) and **No.7** (=70.0%) were fixed to be the highest and the lowest ones through the whole groups, respectively.

Species differentiations and character-combinations were extensively found. Locality specificities were detected to some extent. For example, strains of West Africa showed the higher significances than those of East Africa in 2 items in case of *O. longistaminata*.

From the previous and the present experiments, concerning correlation coefficients among 27 character-combinations, 3,175/5,130 cases (=61.9%), 887/1,323 (=67.1%), 628/1,188 (=52.9%), 15/27 (=55.6%) and 4,705/7,668 (=61.4%) showed significant relations through the whole cases in view of the strain levels in *O. longistaminata*, *O. breviligulata*, *O. punctata*, *O. brachyantha* and the whole species, respectively. In view of the group level, 566/864 (=65.5%) showed significant relationships through the whole species.

Several character-combination-specificities were found. In general, combination Nos.5, 11 and 17 showed the negative significant relationships, but the remaining 24 showed the positive significant relationships, regardless of the species status in the genus *Oryza*. About three fourths of the combinations showed significant correlations at 0.1% level. The positive and the negative correlations were shown as the ratio of 8 to 2. Those two phenomena were looked upon as the fundamental natures of genus *Oryza*, regardless of species status, showing diversities in species and locality specificities. The ranges of the significant correlations were found to be largest in *O. longistaminata*, followed by *O. punctata* and *O. breviligulata* in the order.

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