

Grain Morphology of Wild Rice in African Countries (V)

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Introduction

On the distribution of wild rice in Africa, some scientific reports have been published^{1,2,4-6,23-26)}. 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 are 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)²⁸⁾ reported wild rice close to the *japonica* type of *O. sativa*. Xw *et al.* (1993)²⁷⁾ studied interspecific superoxide dismutase zymogram of genus *Oryza*. Farooq *et al.* (1992)³⁾ reported variability in salt tolerance of accessions of wild rice species, *Oryza punctata* and *O. officinalis*. Reimers *et al.* (1993)²²⁾ studied wild species of *Oryza* in the resistance to rice blast (B1). 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 global viewpoints.

The writer made research trips in the 8 countries of Africa. In the previous papers, the preliminary and advanced data have been 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 reported⁵⁻¹⁷⁾. Further, in the previous papers, adding to these, habitat and the records of the morphological characters of the unhusked grains¹⁸⁾, the husked grains¹⁹⁾, the comparative data (= husked/unhusked)²⁰⁾, and grain areas and volumes²¹⁾ of the wild rices collected in 1984, 1985 and 1988 were described.

In the present paper, correlation coefficients between the practical values of the unhusked and husked grains and linear regression between these were mainly described, in order to confirm the morphological characters of grains, which were to make the strain's specificities more obvious.

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 unhusked and the husked grains in the grain level, correlation coefficient between the two were calculated through the whole characters, *i.e.*, the

unhusked grains (Tables 1 to 11) and the husked grains (Tables 12 to 22), linear regression omitted in these tables.

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 were given in Tables 1 to 10 and 12 to 21, *i.e.*, *O. longistaminata*: Tables 1 & 12 - Madagascar, accession Nos.301-313 collected in 1985 and Nos.2001-2047 collected in 1988, Tables 2 & 13 - Tanzania, No.314 in 1984 and Nos.2048-2083 in 1988, Tables 3 & 14 - Kenya, Nos.315-324 in 1985, Tables 4 & 15 - Nigeria, Nos.325-336 in 1984 and Nos.337-382 in 1985, Tables 5 & 16 - Ivory Coast, Nos.384-390 in 1984, Tables 6 & 17 - Senegal including Gambia in 1985, Nos.391-441 in Casamance region and Nos.444-455 in northern region, *O. breviligulata*: Tables 7 & 18 - Nigeria, Nos.328-334 in 1984 and Nos.344-380 in 1985, Tables 5 & 16 - Ivory Coast, No.383 in 1984, Tables 8 & 19 - Senegal including Gambia in 1985, Nos.398-442 in Casamance region and Nos.443-456 in northern region, *O. punctata*: Tables 9 & 20 - Tanzania, Nos.457-459 in 1984 and Nos.2084-2109 in 1988, Tables 10 & 21 - Kenya, Nos.460-464 in 1984 and Nos.465-474 in 1985, *O. brachyantha*: Tables 8 & 19 - Senegal, No.475 in 1985.

For summing-up the data, the results mentioned above were used, and were given in Tables 11 & 22 for the practical values, but not for the standard deviations and individual grain level. In these tables, 12 morphological character-combinations of the grains were illustrated by the average values of the respective groups; *i.e.*, *O. longistaminata* in the first columns --- **1**: Madagascar (**MD** mark 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 both the 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 both the 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), 20 (IV) and 33 (SE) were omitted owing to being only 1 strain each.

Some strains have different meanings in view of physiological, meteorological and phylogenetical characters, and should be separately considered in morphological studies as well. Accordingly, they are divided into two groups, and thereafter are summed-up in the respective countries and groups, in view of the future 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]).

I. *O. longistaminata* CHEV. et ROEHR.

1. Length and width of UHG

Correlation coefficient (abbreviated as c.c.) and linear regression (abbreviated as l.r.) of width (abbreviated as W) on length (abbreviated as L) in the same strains were calculated, and c.c. are shown in the leftest columns of Tables 1 to 6. In **MD** (Table 1), 1, 3, 4; 3, 2, 5; 1, 8, 9; 8, 34 and 42 strains showed significances at 0.1% (1985 [abbreviated as 1], 1988 [2], both years [3]), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 38.5, 27.7 and 30.0% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 2), 1, 1, 2; 6, 6; 29 and 29 strains showed significances at 0.1% (1984 [abbreviated as 4], 1988 [5], both years [6]) and 5% (5, 6) levels and no significance even at 5% level (5, 6), respectively. 100.0, 19.4 and 21.6% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 3), 2, 2, 1 and 5 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. Just half strains of the whole showed significances.

In **NI** (Table 4), 1, 7, 8; 2, 2; 1, 1, 2; 3, 19 and 22 strains showed significances at 0.1% (1984 [abbreviated as 8], 1985 [9], both years [10]), 1% (9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 40.0, 34.5 and 35.3% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 5), 2 strains (= 28.6% strains of the whole) and 5 strains (71.4%) showed significances at 5% level and no significance even at 5% level, respectively. In **SE** (Table 6), 13, 3, 16; 3, 3; 7, 7; 12, 4 and 16 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. 65.7, 42.9 and 61.9% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 28, 32, 8, 24; 10, 12, 7, 5; 13, 27, 16, 11; 56, 119, 76 and 43 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. 47.7, 37.4, 29.0 and 48.2% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of West Africa showed higher significances than those of East Africa.

In group level (Table 11), 5, 4, 2 and 2 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level.

Table 1. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Madagascar, *O. longistaminata*, 301-313 in 1985 and 2001-2047 in 1988

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
301	0.8386 **	0.8910 ***	0.5000 **	0.6934 ***	-0.5000 **	0.2774
302	0.1115	0.0739	0.3122	0.5882 ***	-0.6176 ***	0.2680
303	-0.1070	0.2479	0.2920	0.5184 **	-0.7469 ***	0.1741
304	-0.4490 *	-0.7184 ***	0.0000	0.7792 ***	-0.0506	0.5831 ***
305	-0.0920	0.3345	0.4441 *	0.5955 ***	-0.7102 ***	0.1392
306	0.5621 **	-0.4554 *	0.0797	0.7343 ***	0.4702 **	0.9443 ***
307	0.5170 **	0.4881 **	0.3316	0.4618 *	-0.4280 *	0.6031 ***
308	0.1890	-0.0468	-0.9897 ***	-0.7544 ***	-0.8705 ***	0.9798 ***
309	0.1754	-0.2325	-0.5858 ***	0.3529	-0.6163 ***	0.5181 **
310	-0.1890	0.7857 ***	-0.7559 ***	-0.8486 ***	-0.9766 ***	0.9425 ***
311	0.1587	0.1462	-0.2632	0.2569	-0.8160 ***	0.5199 **
312	0.0206	0.0127	0.0948	0.4928 **	-0.3980 *	0.5996 ***
313	-0.7559 ***	-0.7559 ***	0.9990 ***	0.9774 ***	0.9449 ***	0.9928 ***
Average	0.9010 ***	0.7124 **	0.7793 **	0.6396 *	-0.0188	0.7691 **
2001	0.0363	0.0514	0.1519	0.5689 **	-0.5029 **	0.4204 *
2002	-0.0590	0.1670	0.1838	0.4101 *	-0.7328 ***	0.3153
2003	0.4770 **	0.3133	0.2699	0.3031	-0.6271 ***	0.5489 **
2004	0.4219 *	-0.0619	0.0245	0.3036	-0.5234 **	0.6499 ***
2005	0.2572	0.4456 *	0.2692	0.6216 ***	-0.5078 **	0.3559
2006	0.3760 *	0.4160 *	0.5012 **	0.5582 **	-0.3529	0.5781 ***
2007	0.4652 **	0.4773 **	0.1707	-0.1347	-0.5827 ***	0.8815 ***
2008	-0.0506	0.0173	-0.2757	0.2228	-0.6375 ***	0.6028 ***
2009	0.0451	0.1117	-0.1007	0.5079 **	-0.4909 **	0.4961 **
2010	0.0013	-0.0752	0.2556	0.4727 **	-0.5993 ***	0.4177 *
2011	0.3000	0.1497	-0.0743	0.1584	-0.7320 ***	0.5507 **
2012	0.2536	-0.1569	-0.0727	0.3292	-0.5963 ***	0.5567 **
2013	-0.0606	0.6876 ***	0.0813	0.1763	-0.8747 ***	0.3117
2014	-0.1236	0.2222	0.0368	0.3546	-0.6384 ***	0.4898 ***
2015	0.2175	0.3967 *	0.1128	0.0649	-0.6956 ***	0.6668 ***
2016	-0.0703	-0.1641	0.0936	0.4214 *	-0.4205 *	0.6417 ***
2017	0.1876	-0.0607	-0.0318	0.2496	-0.6488 ***	0.5709 ***
2018	0.2896	-0.0786	-0.1369	0.5582 **	-0.3786 *	0.5535 **
2019	0.0795	0.2551	0.0235	0.4164 *	-0.5892 ***	0.4867 **
2020	0.6030 ***	-0.0475	0.0241	0.0913	-0.5958 ***	0.7437 ***
2021	0.3013	-0.1823	-0.2212	0.2847	-0.4510 *	0.7239 ***
2022	-0.1191	-0.0122	-0.1778	0.2521	-0.5135 **	0.6959 ***
2023	0.0137	0.0029	-0.2980	0.0498	-0.5898 ***	0.7724 ***
2024	0.3986 *	0.0219	0.1575	0.5467 **	-0.1803	0.7237 ***
2025	-0.0302	0.0166	-0.1790	0.1762	-0.5768 ***	0.6987 ***
2026	0.2147	0.2524	0.4249 *	0.5841 ***	-0.7098 ***	0.1508

(Continued)

Table 1. (Continued)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
2027	0.3896 *	0.2660	-0.1296	0.4196 *	-0.5065 **	0.5638 ***
2028	-0.3667 *	-0.0272	0.2909	0.5460 **	-0.4228 *	0.5252 **
2029	0.1805	-0.0456	0.2420	0.5593 **	-0.5122 **	0.4215 *
2030	0.3108	-0.1400	0.0120	0.6254 ***	-0.1843	0.6463 ***
2031	0.4628 *	0.2069	0.1538	0.2891	-0.4380 *	0.7315 ***
2032	0.2049	0.3704 *	-0.0600	0.2785	-0.6760 ***	0.5149 **
2033	0.2605	-0.0232	-0.0997	0.1449	-0.6859 ***	0.6090 ***
2034	0.0866	0.3714 *	-0.0793	0.0117	-0.6013 ***	0.7886 ***
2035	0.3247	0.3557	0.3261	0.3112	-0.8079 ***	0.3035
2036	0.3374	0.3609	0.2767	0.3181	-0.5709 ***	0.5956 ***
2037	0.3830 *	-0.1795	0.0490	0.4855 **	-0.2298	0.7360 ***
2038	0.0062	0.2621	0.4032 *	0.5915 ***	-0.5080 **	0.3910 *
2039	-0.1113	0.4849 **	0.3474	0.4988 **	-0.8069 ***	0.1045
2040	0.1216	-0.1899	0.3042	0.5392 **	-0.3863 *	0.5669 **
2041	-0.0221	0.5881 ***	-0.2367	0.0432	-0.8445 ***	0.4911 **
2042	0.1712	0.3519	0.3149	0.3722 *	-0.5268 **	0.5898 ***
2043	0.6436 ***	0.7006 ***	0.6307 ***	0.3077	-0.4430 *	0.7142 ***
2044	0.5849 ***	0.4600 *	0.2571	0.0385	-0.4738 **	0.8611 ***
2045	0.3519	0.2091	0.4682 **	0.5945 ***	-0.3525	0.5392 **
2046	0.1623	0.1173	-0.2874	-0.0739	-0.7062 ***	0.7530 ***
2047	0.4484 *	-0.1200	0.1529	0.3393	-0.3290	0.7745 ***
Average	0.6705 ***	0.6045 ***	0.4782 ***	0.3055 *	-0.5386 ***	0.4021 **
Average of both groups	0.7175 ***	0.6620 ***	0.5337 ***	0.3430 **	-0.4809 ***	0.4420 ***

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

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

Table 2. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Tanzania, *O. longistaminata*, 314 in 1984 and 2048-2083 in 1988

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
314	0.6372 ***	0.2938	0.3775 *	0.5880 ***	-0.0241	0.7937 ***
2048	0.2705	0.4099 *	0.0763	0.0358	-0.7268 ***	0.6543 ***
2049	0.4142 *	0.0131	0.1453	0.2531	-0.6128 ***	0.6042 ***
2050	-0.1478	-0.0407	0.2090	0.4722 **	-0.4628 *	0.5580 **
2051	0.4289 *	0.6252 ***	0.7501 ***	0.6644 ***	-0.8531 ***	0.2534
2052	-0.1188	0.0146	0.3337	0.4646 **	-0.6506 ***	0.1196
2053	0.3041	0.1516	0.4163 *	0.5871 ***	-0.2849	0.6065 ***
2054	0.2599	0.3300	0.5809 ***	0.5988 ***	-0.7485 ***	0.0774
2055	0.3040	-0.2378	-0.4304 *	0.3379	-0.5564 **	0.5926 ***

(Continued)

Table 2. (Continued)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
2056	0.0676	0.3166	0.5317 **	0.5552 **	-0.7850 ***	-0.0699
2057	0.2186	0.1113	0.3982 *	0.6113 ***	-0.4948 **	0.3786 *
2058	0.1391	0.0099	0.0899	0.3472	-0.3965 *	0.7198 ***
2059	-0.2374	-0.0860	0.4683 **	0.7012 ***	-0.5233 **	0.2313
2060	0.2490	0.0144	0.5722 ***	0.6913 ***	-0.4564 *	0.3244
2061	0.0501	0.0749	0.1633	0.3352	-0.3768 *	0.7436 ***
2062	-0.3074	0.1252	0.0083	0.1712	-0.5355 **	0.7328 ***
2063	-0.1387	0.2527	0.1198	0.2943	-0.5108 **	0.6687 ***
2064	0.4507 *	-0.0973	-0.1008	0.2344	-0.5437 **	0.6867 ***
2065	0.0040	-0.1359	0.5374 **	0.7030 ***	-0.0580	0.6471 ***
2066	0.2783	0.0609	0.0117	0.1809	-0.4621 *	0.7861 ***
2067	0.2196	0.3147	0.4605 *	0.5668 **	-0.4436 *	0.4849 **
2068	0.2529	0.2675	0.3497	0.4310 *	-0.6073 ***	0.4510 *
2069	0.1814	0.1890	0.1946	0.3903 *	-0.5256 **	0.5708 ***
2070	-0.6211 ***	0.6170 ***	0.0509	0.6470 ***	-0.8381 ***	-0.1442
2071	0.0243	0.3372	0.1803	0.3664 *	-0.7731 ***	0.2983
2072	-0.2163	0.0050	0.0885	0.3750 *	-0.7338 ***	0.3480
2073	0.1762	-0.1591	0.4181 *	0.6898 ***	-0.2980	0.4842 **
2074	0.2232	0.0924	0.4993 **	0.5405 **	-0.5897 ***	0.3524
2075	0.2678	0.1714	0.3384	0.5725 ***	-0.5099 **	0.4089 *
2076	-0.3897 *	0.3416	0.1675	0.7342 ***	-0.6444 ***	0.0397
2077	0.0900	0.2206	0.4059 *	0.6792 ***	-0.6761 ***	0.0777
2078	-0.1563	0.2064	0.2548	0.4542 *	-0.7318 ***	0.2695
2079	-0.4028 *	-0.3365	0.3907 *	0.8001 ***	-0.4560 *	0.1672
2080	-0.3923 *	-0.0848	0.1936	0.6803 ***	-0.6731 ***	0.0788
2081	-0.1319	-0.0950	0.0274	0.4527 *	-0.6558 ***	0.3697 *
2082	0.2434	0.2912	-0.0526	0.0411	-0.6356 ***	0.7420 ***
2083	-0.0716	0.1996	0.3332	0.5056 **	-0.7001 ***	0.2554
Average	0.4240 **	0.4895 **	0.7567 ***	0.6777 ***	-0.7132 ***	0.0212
Average of both groups	0.4407 **	0.5033 **	0.7713 ***	0.6887 ***	-0.7076 ***	0.0319

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

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

2. Length and thickness of UHG

C.c. and l.r. of T on L in the same strains were calculated, and c.c. are shown in the second columns from the left of Tables 1 to 6. In MD (Table 1), 4, 3, 7; 1, 2, 3; 1, 6, 7; 7, 36 and 43 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 46.2, 23.4 and 28.3% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 2), 2, 2; 1, 1; 1, 33 and 34 strains showed significances at 0.1% (5, 6) and 5% (5, 6) levels and no significance even at 5% level (4, 5, 6), respectively. 0.0, 8.3 and 8.1% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 3), 2, 2, 1 and 5 strains showed significances at 0.1%, 1% and 5%

Table 3. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Kenya in 1985, *O. longistaminata*, 315-324

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
315	0.0740	-0.2258	0.1766	0.6260 ***	-0.0271	0.7591 ***
316	0.0941	0.1228	0.2111	0.5163 **	-0.5941 ***	0.3795 *
317	0.1940	0.1424	-0.2958	0.3629 *	-0.5696 **	0.5518 **
318	0.7095 ***	0.4760 **	0.7806 ***	0.8837 ***	0.3640 *	0.7569 ***
319	-0.0044	0.3067	-0.1532	0.2185	-0.7608 ***	0.4485 *
320	-0.4423 *	-0.6993 ***	-0.3162	0.4975 **	-0.7334 ***	0.2248
321	-0.9581 ***	-0.6699 ***	0.4411 *	0.6189 ***	-0.7677 ***	0.0262
322	-0.1487	0.3397	-0.8137 ***	0.1034	-0.8306 ***	0.4673 **
323	-0.5347 **	-0.3865 *	0.7027 ***	0.9108 ***	-0.3149	0.1050
324	0.5000 **	0.5000 **	0.9990 ***	0.9624 ***	-0.1147	0.1596
Average	0.8193 **	0.9851 ***	0.8518 **	0.6125	-0.9310 ***	-0.2896

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

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

levels and no significance even at 5% level, respectively. Just half strains of the whole strains showed significances, which was the same as in case of the former item.

In **NI** (Table 4), 8, 8; 1, 6, 7; 1, 3, 4; 3, 12 and 15 strains showed significances at 0.1% (9, 10), 1% (8, 9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 40.0, 58.6 and 55.9% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 5), 1, 1 and 5 strains showed significances at 1% and 5% levels and no significance even at 5% level, respectively. 28.6% strains of the whole showed significances, which was the same as in case of the former item. In **SE** (Table 6), 13, 3, 16; 4, 1, 5; 3, 1, 4; 15, 2 and 17 strains showed significances at 0.1% (12, 13, 14), 1% (12, 13, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 57.1, 71.4 and 59.5% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 30, 35, 11, 24; 16, 18, 5, 13; 11, 18, 9, 9; 50, 119, 82 and 37 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. 53.3, 37.4, 23.4 and 55.4% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noted that strains of West Africa showed relatively higher significances than those of East Africa, which was the same as in case of the former item.

In group level (Table 11), 4, 5, 1 and 3 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, 34 and 35 groups showed significances at 0.1% level, and 15 and 16 showed no significances even at 5% level.

3. Width and thickness of UHG

C.c. and l.r. of T on W in the same strains were calculated, and c.c. are shown in the third columns from the left of Tables 1 to 6. In **MD** (Table 1), 4, 1, 5; 1, 2, 3; 1, 2, 3; 7, 42 and 49 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 46.2, 10.6 and 18.3% strains of the whole

Table 4. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Nigeria, *O. longistaminata*, 325-336 in 1984 and 337-382 in 1985

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
325	-0.1424	0.0782	0.5276 **	0.7328 ***	-0.5802 ***	0.1236
326	-0.0284	0.2706	0.4619 *	0.5979 ***	-0.5617 **	0.3252
327	-0.6514 ***	-0.4181 *	0.3231	0.9045 ***	-0.5182 **	-0.1063
335	0.4600 *	0.4850 **	0.4801 **	0.5424 **	-0.4567 *	0.4976 **
336	0.2499	0.2393	0.6557 ***	0.2499	0.2393	0.6557 ***
Average	0.9864 **	0.9318 *	0.9721 **	0.0347	-0.5570	0.8098
337	-0.2943	-0.6815 ***	0.5393 **	0.9224 ***	0.1755	0.5418 **
338	0.3928 *	0.8436 ***	0.6982 ***	0.4329 *	-0.6597 ***	0.3916 *
339	0.6173 ***	0.0268	0.5213 **	0.5993 ***	-0.1376	0.7098 ***
340	0.0891	-0.3103	-0.4804 **	0.5320 **	-0.1019	0.7875 ***
341	0.3485	0.7579 ***	0.1061	-0.2589	-0.9421 ***	0.5662 **
342	0.8689 ***	0.0366	-0.3086	-0.7640 ***	-0.8801 ***	0.9771 ***
343	-0.1071	-0.5179 **	-0.4048 *	0.0658	-0.4091 *	0.8834 ***
345	0.1104	0.4767 **	0.3926 *	0.5652 **	-0.7079 ***	0.1816
346	-0.0524	-0.1706	0.5035 **	0.6355 ***	-0.5465 **	0.2898
348	0.1442	0.4644 **	0.4924 **	0.6552 ***	-0.4722 **	0.3564
349	0.2723	-0.3606	-0.8977 ***	-0.2621	-0.7931 ***	0.7952 ***
352	0.2639	0.1781	-0.0712	0.0490	-0.6973 ***	0.6772 ***
354	0.1228	0.0997	-0.0491	0.4427 *	-0.3774 *	0.6612 ***
355	0.6606 ***	0.9575 ***	0.7825 ***	0.5881 ***	-0.9853 ***	-0.4435 *
357	0.0000	0.0000	0.4472 *	0.4432 *	-0.7488 ***	0.2613
358	-0.0396	0.4805 **	0.0422	0.2709	-0.7622 ***	0.4151 *
360	0.3258	0.8155 ***	-0.1231	0.2301	-0.8107 ***	0.3827 *
362	-0.2603	-0.5172 **	0.1759	0.8337 ***	0.0144	0.5630 **
364	0.3075	-0.9507 ***	-0.4385 *	-0.2164	-0.8500 ***	0.6970 ***
365	-0.5812 ***	-0.9315 ***	0.3203	0.9348 ***	-0.2745	0.0848
369	-0.5703 ***	0.6659 ***	0.0788	0.0681	-0.6772 ***	0.6877 ***
371	0.0658	-0.1881	-0.2889	0.5554 **	-0.4121 *	0.5243 **
373	0.4996 **	-0.2127	0.2440	0.6218 ***	-0.0256	0.7635 ***
375	-0.0617	0.3698 *	0.8730 ***	0.9768 ***	-0.9544 ***	-0.8685 ***
377	0.1363	0.5525 **	0.8386 ***	0.9061 ***	-0.7188 ***	-0.3583
378	-0.1202	0.4233 *	0.0456	0.2944	-0.7538 ***	0.4055 *
379	0.6188 ***	0.2058	0.4082 *	0.8929 ***	0.1496	0.5773 ***
381	0.5628 **	0.0097	0.8069 ***	0.9365 ***	-0.6625 ***	0.8827 ***
382	-0.8750 ***	-0.3750 *	-0.4063 *	0.2138	-0.8723 ***	0.2908
Average	0.2577	0.1641	0.0798	0.7974 ***	-0.3600	0.2731
Average of both groups	0.5544 ***	0.4530 **	0.2911	0.7506 ***	-0.4252 *	-0.2762

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

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

Table 5. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Ivory Coast in 1984, *O. longistaminata* (384-390) and *O. breviligulata* (383)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
384	0.2812	0.3911 *	0.2638	0.3405	-0.7517 ***	0.3537
385	-0.0628	-0.0900	-0.0675	0.4743 **	-0.4598 *	0.5594 **
386	0.2355	-0.1118	0.5303 **	0.6899 ***	-0.4977 **	0.2808
387	-0.1401	0.2944	0.1661	0.5009 **	-0.7976 ***	0.1067
388	0.4334 *	-0.0219	0.1523	0.1937	-0.6953 ***	0.5636 **
389	-0.4037 *	-0.5400 **	-0.0277	0.8239 ***	-0.4684 **	0.1098
390	-0.1780	0.1172	0.3129	0.7017 ***	-0.6580 ***	0.0720
Average	0.1390	0.3049	0.9213 **	0.7326	-0.6551	-0.4691
383	0.1755	0.2850	-0.0807	0.4377 *	-0.4760 **	0.5805 ***

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

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

Table 6. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Senegal in 1985, *O. longistaminata*, 391-441 in Casamance region and 444-455 in northern region

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
391	0.1068	0.8525 ***	0.5266 **	0.6968 ***	-0.9114 ***	-0.3410
392	-0.3830 *	0.1999	0.1976	0.3591	-0.4538 *	0.6684 ***
393	-0.0670	0.1079	-0.8311 ***	-0.7632 ***	-0.9366 ***	0.9386 ***
394	0.3968 *	0.3074	-0.2152	0.4226 *	-0.6052 ***	0.4646 **
395	-0.6448 ***	0.1300	-0.2193	0.4160 *	-0.6388 ***	0.4317 *
396	0.8335 ***	-0.7674 ***	-0.5590 **	0.6968 ***	-0.4178 *	0.9420 ***
397	0.1235	0.6516 ***	0.1961	0.2439	-0.7906 ***	0.4003 *
399	-0.2045	-0.2508	0.2149	0.4757 **	-0.5686 **	0.4480 *
400	0.4533 *	0.8556 ***	0.8018 ***	0.9383 ***	-0.8988 ***	-0.6936 ***
401	-0.0196	0.3291	0.5216 **	0.6346 ***	-0.7405 ***	0.0395
402	-0.5334 **	0.7258 ***	-0.6198 ***	-0.6415 ***	-0.8974 ***	0.9142 ***
406	0.4053 *	-0.5600 **	-0.1179	0.2404	-0.5764 ***	0.6545 ***
407	0.6487 ***	0.0000	0.3469	0.5071 **	-0.0356	0.8403 ***
408	0.7346 ***	0.8029 ***	0.7459 ***	0.3697 *	-0.6903 ***	0.4160 *
409	0.6582 ***	-0.4257 *	0.1572	0.6146 ***	0.1274	0.8605 ***
411	0.3790 *	0.4255 *	0.6682 ***	0.6027 ***	-0.8248 ***	-0.0504
412	-0.4504 *	0.0536	0.2100	0.9026 ***	-0.6782 ***	-0.2985
414	-0.5165 **	0.7763 ***	0.1021	0.4456 *	-0.9011 ***	-0.0144
416	-0.4302 *	0.5150 **	-0.8240 ***	-0.7097 ***	-0.9164 ***	0.9295 ***
419	0.8317 ***	-0.0487	0.0000	0.6863 ***	0.2971	0.8984 ***
420	-0.7930 ***	-0.6447 ***	0.5238 **	0.7995 ***	-0.7311 ***	-0.1751

(Continued)

Table 6. (Continued)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
423	0.2913	0.6356 ***	0.8478 ***	0.7846 ***	-0.0410	0.5871 ***
424	0.6074 ***	0.1488	0.7717 ***	0.8568 ***	-0.7996 ***	0.9946 ***
426	0.9942 ***	-0.8072 ***	-0.8660 ***	0.9266 ***	-0.8148 ***	0.9730 ***
427	0.3541	0.3829 *	-0.2794	0.2270	-0.6256 ***	0.6162 ***
429	0.3401	-0.2895	-0.1808	0.5442 **	-0.1940	0.7165 ***
431	-0.1279	0.5214 **	0.4238 *	0.7200 ***	-0.8569 ***	-0.2601
433	0.8117 ***	-0.1562	-0.4254 *	-0.6616 ***	-0.8938 ***	0.9262 ***
434	-0.1581	-0.6679 ***	0.6170 ***	0.7769 ***	0.1151	0.7145 ***
435	-0.1767	-0.2113	-0.4704 **	0.1415	-0.9172 ***	0.2615
436	0.3310	0.1056	0.9674 ***	0.8592 ***	-0.8254 ***	-0.4210 *
437	0.5949 ***	0.5055 **	0.9600 ***	0.8661 ***	-0.7665 ***	0.9844 ***
439	0.5013 **	-0.5710 ***	-0.4414 *	0.5134 *	0.0892	0.9005 ***
440	0.8386 ***	0.6934 ***	0.1890	-0.3151	-0.7956 ***	0.8256 ***
441	-0.7438 ***	-0.0978	0.0000	0.5619 **	-0.8702 ***	-0.0831
Average	0.3435 *	0.5095 **	0.3240	0.1830	-0.6452 ***	0.6261 ***
444	0.2108	-0.3626 *	0.6233 ***	0.7576 ***	-0.3032	0.3904 *
447	-0.6753 ***	0.8371 ***	-0.8930 ***	0.8817 ***	-0.9127 ***	-0.6134 ***
449	0.3424	-0.1643	-0.5676 **	0.0619	-0.4254 *	0.8971 ***
451	0.2448	-0.1150	0.0576	0.8675 ***	-0.1000	0.4080 *
452	0.6485 ***	0.5469 **	0.7906 ***	0.8574 ***	-0.0759	0.4457 *
454	0.0620	0.6776 ***	0.6026 ***	0.7738 ***	-0.9563 ***	-0.5563 **
455	0.7907 ***	-0.6996 ***	-0.6462 ***	0.6460 ***	0.4911 **	0.9822 ***
Average	0.8490 *	0.4831	0.7874 *	0.6993	0.1387	0.8043 *
Average of both groups	0.5888 ***	0.5546 ***	0.5114 ***	0.2488	-0.5885 ***	0.6300 ***

d.f.; 28, 33, 5 and 40 in strain level, the first, second and third averages, respectively
 ***, **, *; significant at 0.1%, 1% and 5% levels, respectively

showed significances in 1, 2 and 3, respectively. In **TA** (Table 2), 3, 3; 4, 4; 1, 7, 8; 22 and 22 strains showed significances at 0.1% (5, 6), 1% (5, 6) and 5% (4, 5, 6) levels and no significance even at 5% level (5, 6), respectively. 100.0, 38.9 and 40.5% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 3), 4, 1 and 5 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. Just half strains of the whole showed significances, which was the same as in cases of the former two items.

In **NI** (Table 4), 1, 6, 7; 2, 5, 7; 1, 6, 7; 1, 12 and 13 strains showed significances at 0.1% (8, 9, 10), 1% (8, 9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 58.6 and 61.8% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 5), 1 (= 14.3% of the whole) and 6 (= 85.7%) strains showed significances at 1% level and no significance even at 5% level, respectively. In **SE** (Table 6), 12, 5, 17; 5, 1, 6; 3, 3; 15, 1 and 16 strains showed significances at 0.1% (12, 13, 14), 1% (12, 13, 14) and 5% (12, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 57.1, 85.7 and 61.9% strains of the whole showed significances in 12, 13 and 14, respectively.

Table 7. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Nigeria, *O. breviligulata*, 328-334 in 1984 and 344-380 in 1985

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
328	0.6040 ***	0.3498	-0.1514	-0.2399	-0.7663 ***	0.8056 ***
329	0.7213 ***	0.0592	-0.3369	0.5589 **	-0.1133	0.7591 ***
330	0.1571	0.3373	0.1749	0.6039 ***	-0.5177 **	0.3668 *
331	0.6805 ***	0.2529	0.2596	0.3045	-0.4480 *	0.7135 ***
332	0.2681	0.1682	-0.4457	0.0859	-0.5195 **	0.8051 ***
333	0.1423	0.1221	-0.4447 *	-0.2034	-0.8120 ***	0.7345 ***
334	0.1298	-0.1209	-0.5405 **	0.0249	-0.7085 ***	0.6846 ***
Average	-0.4163	-0.7465	0.7070	0.9556 ***	0.3878	0.6421
344	-0.2148	0.3742 *	-0.5712 ***	-0.1129	-0.7837 ***	0.7027 ***
347	0.3684 *	0.1955	0.1601	0.1813	-0.5451 *	0.7242 ***
350	-0.3957 *	0.6998 ***	-0.2510	0.7401 ***	-0.9146 ***	-0.4107 *
351	0.3903 *	0.5775 ***	0.0610	-0.3757 *	-0.7652 ***	0.8828 ***
353	0.5804 ***	0.2675	-0.0848	-0.0759	-0.7489 ***	0.7158 ***
356	0.3004	0.4494 *	-0.0790	-0.1238	-0.8073 ***	0.6821 ***
359	0.6614 ***	0.0809	-0.3021	-0.1340	-0.5974 ***	0.8734 ***
361	0.0058	0.5729 ***	-0.4370 *	-0.3456	-0.8831 ***	0.7411 ***
363	0.1501	0.4287 *	-0.3580	-0.2363	-0.7386 ***	0.8281 ***
366	0.2451	0.3596	-0.2655	-0.3296	-0.7722 ***	0.8531 ***
367	0.5677 **	0.7059 ***	0.4998 **	0.1651	-0.7301 ***	0.5523 **
368	0.5925 ***	0.5925 ***	0.2900	0.4001 *	-0.3946 *	0.6833 ***
370	0.1556	0.0569	-0.3607	0.3979 *	-0.5535 **	0.5411 **
372	-0.3674 *	-0.0072	0.6076 ***	0.7856 ***	-0.7289 ***	-0.1525
374	0.3505	0.0160	-0.5126 **	0.0036	-0.6639 ***	0.7444 ***
376	-0.2345	0.0396	-0.0650	0.7471 ***	-0.6386 ***	0.0316
380	0.1445	0.4666 **	0.1538	0.2692	-0.6492 ***	0.5560 **
Average	-0.0721	0.0021	0.8939 ***	0.9249 ***	-0.5467 *	-0.1916
Average of both groups	-0.1527	0.0394	0.7307 ***	0.8861 ***	-0.2301	0.1091

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

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

In SUM, 32, 36, 12, 24; 15, 21, 7, 14; 13, 22, 12, 10; 47, 111, 76 and 35 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. 56.1, 41.6, 29.0 and 57.8% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of West Africa showed remarkably higher significances than those of West Africa, which was the same as in cases of the former two items.

In group level (Table 11), 5, 4, 1 and 3 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first item.

Table 8. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Senegal in 1985, *O. breviligulata*, 398-442 in Casamance region and 443-456 in northern region; *O. brachyantha*, 475

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
398	-0.0509	0.1628	0.0369	0.6019 ***	-0.2434	0.6275 ***
403	0.3978 *	0.2213	-0.3607	0.2879	-0.4479 *	0.7260 ***
404	0.0301	0.4516 *	-0.4897 **	0.0214	-0.7705 ***	0.6178 ***
405	0.5285 **	0.1388	-0.3007	0.3185	-0.4307 *	0.7165 ***
410	0.7811 ***	0.0355	-0.2100	-0.2615	-0.5758 ***	0.9392 ***
413	0.7826 ***	-0.3036	-0.2113	0.1433	-0.2892	0.9032 ***
415	0.2303	0.2830	-0.3542	0.1663	-0.5938 ***	0.6919 ***
417	-0.7746 ***	0.5534 **	-0.6124 ***	0.3556	-0.8198 ***	0.2433
418	0.1249	-0.0609	-0.3278	-0.0587	-0.6801 ***	0.7705 ***
421	0.2261	0.5609 **	-0.0844	0.1767	-0.7573 ***	0.5058 **
422	-0.6566 ***	0.6787 ***	-0.4901 **	0.5853 ***	-0.9339 ***	-0.2594
425	0.5585 **	0.1322	-0.1851	-0.0717	-0.5507 **	0.8709 ***
428	0.1600	0.2010	-0.7428 ***	-0.7307 ***	-0.8992 ***	0.9546 ***
430	0.5520 **	0.7847 ***	0.0279	0.0337	-0.8032 ***	0.5653 **
432	0.3541	0.1361	-0.5161 **	-0.5018 **	-0.8295 ***	0.8970 ***
438	0.5160 *	0.5259 **	0.6455 ***	0.8441 ***	-0.3510	0.2055
442	0.1907	0.4745 **	-0.5078 **	-0.1503	-0.7235 ***	0.7896 ***
Average	-0.2710	-0.2031	0.8191 ***	0.9094 ***	-0.0640	0.3552
443	-0.1484	0.1479	-0.3025	0.3702 *	-0.6381 ***	0.4769 **
445	0.3083	0.4136 *	-0.1181	0.0633	-0.7930 ***	0.5544 **
446	-0.1930	0.6315 ***	-0.3152	0.1315	-0.8820 ***	0.3469
448	0.1391	0.2601	-0.1542	0.0104	-0.7348 ***	0.6679 ***
450	0.1009	0.3198	-0.6202 ***	-0.3436	-0.9278 ***	0.6679 ***
453	-0.0034	0.1918	-0.0298	0.4135 *	-0.6329 ***	0.4412 *
456	0.2180	0.1351	-0.1732	0.0329	-0.5584 **	0.8062 ***
Average	-0.3554	-0.4498	0.6429	0.9735 ***	-0.0773	0.1515
Average of both groups	-0.3126	-0.2986	0.8482 ***	0.9329 ***	-0.0265	0.3332
475	0.0136	0.0300	0.1523	0.3592	-0.2118	0.8350 ***

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

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

4. L/W and L/T of UHG

C.c. and l.r. of L/T on L/W in the same strains were calculated, and c.c. are shown in the fourth columns from the left of Tables 1 to 6. In MD (Table 1), 8, 5, 13; 2, 11, 13; 1, 5, 6; 2, 26 and 28 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 84.6, 44.7 and 53.3% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 2), 1, 14, 15; 6, 6; 6, 6; 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 showed

Table 9. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Tanzania, *O. punctata*, 457-459 in 1984 and 2084-2109 in 1988

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
457	0.4744 **	0.2197	0.0374	0.6519 ***	-0.2187	0.5955 ***
458	-0.0747	0.0593	-0.0554	0.2108	-0.3636 *	0.8335 ***
459	-0.6700 ***	-0.5814 ***	0.6450 ***	0.8866 ***	-0.3610 *	0.1106
Average	-0.9622	-0.8934	0.9820	0.9999 **	-0.9401	-0.9417
2084	-0.3001	-0.1166	0.0658	0.5732 ***	-0.4363 *	0.4858 **
2085	0.0613	0.3217	-0.1497	0.2388	-0.7608 ***	0.4429 *
2086	-0.1313	-0.2138	0.2787	0.7402 ***	-0.3487	0.3697 *
2087	-0.2111	-0.2726	0.0857	0.7426 ***	-0.6493 ***	0.0207
2088	-0.0134	0.1132	0.4732 **	0.7040 ***	-0.6656 ***	0.0525
2089	-0.2328	0.0451	0.3337	0.7360 ***	-0.6591 ***	0.0166
2090	0.2795	0.1223	0.3081	0.5842 ***	-0.4436 *	0.4669 **
2091	0.0101	0.0983	-0.0116	0.6064 ***	-0.5595 **	0.3158
2092	-0.0617	-0.3176	-0.0131	0.4449 *	-0.5749 ***	0.4718 **
2093	-0.0563	0.0572	0.2277	0.6113 ***	-0.4884 **	0.3868 *
2094	-0.0578	0.4215 *	-0.1403	0.4900 **	-0.7466 ***	0.2048
2095	-0.1337	0.2079	0.0077	0.6391 ***	-0.7936 ***	-0.0484
2096	0.3291	0.2849	0.1341	0.3933 *	-0.6775 ***	0.4056 *
2097	-0.0772	-0.1998	-0.1124	0.4546 *	-0.6138 ***	0.4193 *
2098	-0.0450	0.1074	-0.0488	0.4011 *	-0.5795 ***	0.5119 **
2099	-0.2646	-0.5657 **	0.2852	0.7459 ***	-0.5758 ***	0.1062
2100	-0.4413 *	0.1077	-0.5442 **	0.4207 *	-0.7193 ***	0.3177
2101	0.5776 ***	-0.2062	-0.2451	0.4492 *	-0.1800	0.7962 ***
2102	0.1749	0.2908	0.0465	0.3604	-0.5326 **	0.5947 ***
2103	0.6515 ***	0.0338	0.2393	0.5519 **	-0.0499	0.8048 ***
2104	-0.1125	-0.0067	-0.1281	0.5488 **	-0.6937 ***	0.2118
2105	-0.1371	0.0545	-0.1042	0.3779 *	-0.6904 ***	0.4020 *
2106	0.4061 *	0.3244	0.3541	0.5234 **	-0.3805 *	0.5868 ***
2107	0.3761 *	0.0279	-0.0411	0.3327	-0.5478 **	0.6050 ***
2108	-0.4781 **	0.1506	0.1056	0.6464 ***	-0.8084 ***	-0.0871
2109	0.2138	0.1955	-0.2641	0.2812	-0.5448 **	0.6483 ***
Average	0.2206	0.1722	0.3959 *	0.5860 **	-0.5534 **	0.3447
Average of both groups	0.3909 *	0.2434	0.4782 **	0.5634 **	-0.5451 **	0.3798 *

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

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

significances in 4, 5 and 6, respectively. In KE (Table 3), 5, 2, 1 and 2 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 80.0% strains of the whole showed significances.

In NI (Table 4), 3, 13, 16; 1, 3, 4; 3, 3; 1, 10 and 11 strains showed significances at 0.1% (8,

Table 10. Correlation coefficient of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Kenya, *O. punctata*, 460-464 in 1984 and 465-474 in 1985

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
460	0.7157 ***	0.4604 *	0.5799 ***	0.4808 **	-0.3075	0.6848 ***
461	-0.0563	0.4027 *	0.3115	0.1293	-0.2668	0.9205 ***
462	-0.0815	0.3405	0.6956 ***	0.6859 ***	-0.2817	0.5022 **
463	-0.0050	0.2215	0.6878 ***	0.9199 ***	-0.4333 *	-0.0465
464	-0.2107	0.3949 *	-0.0866	0.5381 **	-0.8146 ***	0.0453
Average	0.2129	0.8079	-0.2885	0.8141	-0.7350	-0.2052
465	0.1603	-0.1174	-0.2418	0.3976 *	-0.4454 *	0.6249 ***
466	0.3648 *	-0.5417 **	-0.2316	0.5939 ***	0.0847	0.8515 ***
467	-0.2414	0.2367	-0.1392	0.4059 *	-0.3361	0.7227 ***
468	0.1978	-0.4084 *	0.1850	0.6319 ***	0.2202	0.8950 ***
469	0.0164	0.3672 *	0.2544	0.2939	-0.3971 *	0.7576 ***
470	0.8093 ***	0.8595 ***	0.7007 ***	0.0595	-0.7526 ***	0.6103 ***
471	0.5018 **	0.1645	0.0135	0.6042 ***	-0.1695	0.6808 ***
472	-0.2893	0.2317	-0.0858	0.5504 **	-0.5006 **	0.4423 *
473	0.2808	-0.7247 ***	-0.3933 *	0.5416 **	0.2459	0.9462 ***
474	0.2047	-0.9206 ***	0.0904	0.9608 ***	0.8012 ***	0.9356 ***
Average	0.1229	0.4779	0.5090	0.9417 ***	-0.4806	-0.1601
Average of both groups	0.1813	0.5118	0.2924	0.9099 ***	-0.4905	-0.0868

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

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

9, 10), 1% (8, 9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 65.5 and 67.7% strains of the whole showed significances in 8, 9 and 10, respectively, which were nearly the same as in case of the third item. In IV (Table 5), 3, 2 and 2 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. 71.4% strains of the whole showed significances. In SE (Table 6), 20, 6, 26; 4, 4; 5, 5; 6, 1 and 7 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. 82.9, 85.7 and 83.3% strains of the whole showed significances in 12, 13 and 14, respectively.

In SUM, 59, 78, 33, 45; 14, 31, 21, 10; 10, 21, 13, 8; 24, 60, 40 and 20 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. 77.6, 68.4, 62.6 and 75.9% strains of the whole showed significances in 15, 16, 34 and 35, respectively.

In group level (Table 11), 4, 1, 2 and 6 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first and the third items.

5. L/W and W/T of UHG

Table 11. Group averages of six components of unhusked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T. Country and group marks were noted in the text.

Country	Group mark	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
MD	1	0.9010 ***	0.7124 **	0.7793 **	0.6396 *	-0.0188	0.7691 **
	2	0.6705 ***	0.6045 ***	0.4782 ***	0.3055 *	-0.5386 ***	0.4021 **
	3	0.7175 ***	0.6620 ***	0.5337 ***	0.3430 **	-0.4809 ***	0.4420 ***
TA	5	0.4240 **	0.4895 **	0.7567 ***	0.6777 ***	-0.7132 ***	0.0212
	6	0.4407 **	0.5033 **	0.7713 ***	0.6887 ***	-0.7076 ***	0.0139
KE	7	0.8193 **	0.9851 ***	0.8518 **	0.6125	-0.9310 ***	-0.2896
NI	8	0.9864 **	0.9318 *	0.9721 **	0.0347	-0.5570	0.8098
	9	0.2577	0.1641	0.0798	0.7974 ***	-0.3600	0.2731
IV	10	0.5544 ***	0.4530 **	0.2911	0.7506 ***	-0.4252 *	0.2762
	11	0.1390	0.3049	0.9213 **	0.7326	-0.6551	-0.4691
SE	12	0.3435 *	0.5095 **	0.3240	0.1830	-0.6452 ***	0.6261 ***
	13	0.8490 *	0.4831	0.7874 *	0.6993	0.1387	0.8043 *
	14	0.5888 ***	0.5546 ***	0.5114 ***	0.2488	-0.5885 ***	0.6300 ***
SUM	15	0.5881 ***	-0.0208	0.6501 ***	0.5428 ***	-0.4562 ***	0.4944 ***
	16	0.6157 ***	0.0863	0.7123 ***	0.5592 ***	-0.5415 ***	0.3373 ***
NI	17	-0.4163	-0.7465	0.7070	0.9556 ***	0.3878	0.6421
	18	-0.0721	0.0021	0.8939 ***	0.9249 ***	-0.5467 *	-0.1916
	19	-0.1527	0.0394	0.7307 ***	0.8861 ***	-0.2301	0.1091
SE	21	-0.2710	-0.2031	0.8191 ***	0.9094 ***	-0.0640	0.3552
	22	-0.3554	-0.4498	0.6429	0.9735 ***	-0.0773	0.1515
	23	-0.3126	-0.2986	0.8482 ***	0.9329 ***	-0.0265	0.3332
SUM	24	-0.1243	-0.0507	0.8091 ***	0.8880 ***	-0.2119	0.2530
TA	25	-0.9622	-0.8934	0.9820	0.9999 **	-0.9401	-0.9417
	26	0.2206	0.1722	0.3959 *	0.5860 **	-0.5534 **	0.3447
	27	0.3909 *	0.2434	0.4782 **	0.5634 **	-0.5451 **	0.3798 *
KE	28	0.2129	0.8079	-0.2885	0.8141	-0.7350	-0.2052
	29	0.1229	0.4779	0.5090	0.9417 ***	-0.4806	-0.1601
	30	0.1813	0.5118	0.2924	0.9099 ***	-0.4905	-0.0868
SUM	31	0.1768	0.4863 *	0.3824	0.9136 ***	-0.4872 *	-0.0923
	32	0.3538 *	0.3581 *	0.4273 **	0.7098 ***	-0.4735 **	0.2793

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 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

C.c. and l.r. of W/T on L/W in the same strains were calculated, and c.c. are shown in the fifth columns from the left of Tables 1 to 6. In MD (Table 1), 8, 24, 32; 2, 10, 12; 2, 7, 9; 1, 6 and 7 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3) respectively. 92.3, 87.2 and 88.3% of the whole showed significances in 1, 2 and 3, respectively. It was remarkable that they showed the highest significances through the former 5 items in the whole of 1, 2 and 3. In TA (Table 2), 18, 18; 8,

Table 12. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Madagascar, *O. longistaminata*, 301-313 in 1985 and 2001-2047 in 1988

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
301	0.8660 ***	0.0000	0.5000 **	0.9966 ***	0.9572 ***	0.9777 ***
302	-0.2093	0.1679	0.2251	0.6632 ***	-0.6937 ***	0.0727
303	-0.0825	-0.0246	0.3298	0.6296 ***	-0.7083 ***	0.0967
304	-0.3668 *	-0.7385 ***	0.4804 ***	0.8264 ***	0.1784	0.7013 ***
305	0.8140 ***	0.3921 *	0.6508 ***	0.1884	-0.7146 ***	0.5513 **
306	-0.2161	-0.5998 ***	0.6086 ***	0.8703 ***	0.3976 *	0.7967 ***
307	0.4609 *	0.5411 **	0.2446	0.3786 *	-0.5388 **	0.5632 **
308	0.6758 ***	-0.3874 *	-0.9449 ***	-0.2561	-0.7236 ***	0.8525 ***
309	-0.2640	0.5016 **	-0.9432 ***	-0.2649	-0.9050 ***	0.6486 ***
310	0.6628 ***	0.6100 ***	-0.1890	-0.6293 ***	-0.9226 ***	0.8804 ***
311	0.1963	-0.1640	0.4924 **	0.5345 **	-0.7788 ***	0.1136
312	0.3558	0.2782	0.6991 ***	0.7381 ***	-0.5298 **	0.1660
313	-0.5000 **	-0.1890	0.9449 ***	0.9107 ***	0.5852 ***	0.8679 ***
Average	0.8649 ***	0.6719 *	0.8205 ***	0.5766 *	-0.4616	0.7600 **
2001	0.2607	0.2576	0.2312	0.3411	-0.5769 ***	0.5647 **
2002	0.1297	0.0074	-0.2877	0.4082 *	-0.5950 ***	0.4792 **
2003	0.2453	0.0366	-0.2755	0.1112	-0.6930 ***	0.6281 ***
2004	-0.0860	0.0658	0.0223	0.4250 *	-0.6671 ***	0.3780 *
2005	0.2628	0.2521	0.4382 *	0.7706 ***	-0.3910 *	0.2829
2006	0.0174	0.1030	0.1635	0.5046 **	-0.5242 **	0.4652 **
2007	0.2217	-0.2988	0.0522	0.3376	-0.3551	0.7571 ***
2008	-0.0924	0.0321	0.0325	0.6072 ***	-0.6549 ***	0.1948
2009	0.1267	0.5202 **	0.5244 **	0.6237 ***	-0.6930 ***	0.1276
2010	0.2064	0.0056	0.1119	0.5000 **	-0.4353 *	0.5558 **
2011	-0.0741	0.0561	0.3044	0.5097 **	-0.7397 ***	0.1950
2012	0.3533	-0.2889	0.0972	0.3553	-0.5113 **	0.6168 ***
2013	0.0722	0.3726 *	-0.0512	0.2542	-0.5712 ***	0.6441 ***
2014	-0.0095	0.6097 ***	0.2490	0.4059 *	-0.8312 ***	0.1548
2015	0.3082	0.2286	0.3425	0.4795 **	-0.5814 ***	0.4326 *
2016	0.1228	0.0150	0.1076	0.2864	-0.4279 *	0.7412 ***
2017	0.3242	0.0225	-0.0442	0.2333	-0.4028 *	0.7890 ***
2018	0.0399	0.0366	-0.0695	0.2091	-0.6304 ***	0.6228 ***
2019	-0.0625	-0.0089	-0.0699	0.3808 *	-0.3994 *	0.6896 ***
2020	0.0404	-0.1048	0.2765	0.5808 ***	-0.4095 *	0.5020 **
2021	0.3175	-0.0017	0.0215	0.2872	-0.4669 **	0.6936 ***
2022	-0.2224	0.4257 *	0.1451	0.4078 *	-0.6696 ***	0.3832 *
2023	-0.1998	0.2503	0.1224	0.2540	-0.6807 ***	0.5299 **
2024	0.1674	-0.0803	-0.1294	0.1294	-0.6515 ***	0.6623 ***
2025	0.2731	0.3446	-0.2979	-0.3101	-0.7644 ***	0.8458 ***
2026	0.3878 *	0.0229	0.1966	0.4072 *	-0.4600 *	0.6213 ***

(Continued)

Table 12. (Continued)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
2027	0.3163	0.1235	0.1479	0.3489	-0.4809 **	0.6495 ***
2028	-0.1691	0.1830	-0.5105 **	0.2886	-0.7364 ***	0.4301 *
2029	0.3041	0.2050	0.3255	0.5389 **	-0.4098 *	0.5459 **
2030	0.3187	0.1989	0.2782	0.4377 *	-0.3864 *	0.6593 ***
2031	0.4086 *	-0.0238	0.1493	0.3309	-0.4698 **	0.6732 ***
2032	0.0226	0.2811	-0.1857	0.0762	-0.7874 ***	0.5481 **
2033	0.3557	0.2277	0.1473	0.1841	-0.6754 ***	0.5940 ***
2034	0.2295	0.2588	-0.0525	0.2504	-0.6338 ***	0.5435 **
2035	0.0655	0.4097 *	-0.0735	0.0054	-0.6256 ***	0.7735 ***
2036	0.3539	-0.0991	-0.2733	-0.1194	-0.7156 ***	0.7737 ***
2037	0.1311	0.0394	0.0226	0.2520	-0.6732 ***	0.5378 **
2038	0.2829	0.4952 **	0.0301	0.2815	-0.7475 ***	0.4170 *
2039	0.2356	0.1971	0.2861	0.3145	-0.4068 *	0.7371 ***
2040	0.2673	0.2017	0.0845	0.1889	-0.6368 ***	0.6309 ***
2041	0.3926 *	0.1598	0.2936	0.4143 *	-0.5478 **	0.5071 **
2042	0.2236	-0.2495	0.1194	0.3722 *	-0.5268 **	0.5898 ***
2043	0.4737 **	0.5537 **	0.6551 ***	0.5217 **	-0.4605 *	0.5147 **
2044	0.3538	-0.3525	0.2008	0.7934 ***	0.4170 *	0.8812 ***
2045	0.1311	-0.1589	0.6129 ***	0.8258 ***	-0.1043	0.4713 **
2046	0.3548	0.3342	0.8505 ***	0.8535 ***	-0.1856	0.3515
2047	0.0304	-0.3737 *	0.0429	0.4127 *	-0.4996 **	0.5804 ***
Average	0.7134 ***	0.8224 ***	0.4322 **	0.5482 ***	-0.7003 ***	0.2094
Average of both groups	0.5396 ***	0.7897 ***	0.5076 ***	0.5290 ***	-0.6117 ***	0.3426 **

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

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

Table 13. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Tanzania, *O. longistaminata*, 314 in 1984 and 2048-2083 in 1988

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
314	0.7814 ***	0.6489 ***	0.5258 **	0.2324	-0.4669 **	0.7506 ***
2048	0.3520	0.3445	0.2811	0.3894 *	-0.6057 ***	0.4947 **
2049	0.2775	-0.0004	0.1555	0.4402 *	-0.4079 *	0.6331 ***
2050	0.2555	-0.3176	0.1835	0.5622 **	-0.1540	0.7291 ***
2051	0.5353 **	0.5269 **	0.8511 ***	0.7792 ***	-0.4338 *	0.2251
2052	-0.0939	0.4704 **	0.2659	0.6315 ***	-0.8139 ***	-0.0784
2053	-0.0136	0.5186 **	0.1050	0.2956	-0.7869 ***	0.3500
2054	-0.3192	0.3776 *	-0.2912	0.0559	-0.7658 ***	0.5909 ***
2055	0.3276	-0.5488 **	-0.2366	0.6700 ***	0.0414	0.7671 ***

(Continued)

Table 13. (Continued)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
2056	0.4771 **	0.2594	0.4286 *	0.5306 **	-0.5124 **	0.4474 *
2057	0.2773	0.2169	0.5234 **	0.6360 ***	-0.6456 ***	0.1706
2058	-0.3504	0.1062	-0.2223	0.4968 **	-0.5566 **	0.4338 *
2059	0.1652	0.3041	0.3362	0.6063 ***	-0.4843 **	0.3986 *
2060	-0.0318	-0.1177	0.6375 ***	0.7689 ***	-0.4956 **	0.1700
2061	-0.2182	0.3300	-0.1321	0.2403	-0.7599 ***	0.4389 *
2062	-0.0251	0.1065	-0.3649 *	0.0789	-0.5930 ***	0.7475 ***
2063	0.3152	0.6410 ***	0.2351	0.0410	-0.6605 ***	0.7197 ***
2064	0.1992	0.2985	-0.1630	0.1356	-0.6557 ***	0.6511 ***
2065	0.1833	0.1868	0.5985 ***	0.6033 ***	-0.3325	0.5502 **
2066	-0.0747	0.0844	0.2524	0.5406 **	-0.4980 **	0.4554 *
2067	-0.0051	0.2903	0.1460	0.5110 **	-0.5662 **	0.4170 *
2068	-0.0668	0.3054	0.5701 **	0.7655 ***	-0.4987 **	0.1713
2069	0.1121	0.4037 *	0.4167 *	0.5420 **	-0.5195 **	0.2517
2070	-0.4947 **	0.2869	0.1652	0.6035 ***	-0.7412 ***	0.0574
2071	0.1260	0.2457	0.3014	0.3877 *	-0.5898 ***	0.5109 **
2072	0.1800	0.0507	0.4107 *	0.4094 *	-0.7581 ***	0.2791
2073	-0.1941	-0.0627	0.6484 ***	0.8224 ***	-0.4414 *	0.1394
2074	0.1530	0.1111	0.2398	0.4095 *	-0.5181 **	0.4878 **
2075	0.1320	0.2017	0.1970	0.4396 *	-0.6967 ***	0.3275
2076	0.1080	0.3853 *	0.0834	0.6868 ***	-0.5684 **	0.2027
2077	-0.2592	0.0625	0.3500	0.7635 ***	-0.6708 ***	-0.0421
2078	-0.2774	0.5984 ***	0.1725	0.5860 ***	-0.8750 ***	-0.1299
2079	-0.1509	-0.1601	0.3987 *	0.5952 ***	-0.5634 **	0.3194
2080	-0.5687 **	-0.1873	0.0614	0.5845 ***	-0.6402 ***	0.2403
2081	0.1282	0.2568	0.3372	0.6341 ***	-0.5527 **	0.2880
2082	0.3654 *	0.4541 *	0.1944	0.5429 **	-0.6053 ***	0.3320
2083	-0.3403	0.2376	-0.3481	0.3515	-0.7953 ***	0.2738
Average	0.1114	0.5695 ***	0.4830 **	0.6546 ***	-0.7341 ***	0.1894
Average of both groups	0.1540	0.5879 ***	0.5280 ***	0.6503 ***	-0.7142 ***	0.1974

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

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

8; 7, 7; 1, 3 and 4 strains showed significances at 0.1% (5, 6), 1% (5, 6) and 5% (5, 6) levels and no significance even at 5% level (4, 5, 6), respectively. 0.0, 91.7 and 89.2% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 3), 5, 1, 1 and 3 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 70.0% strains of the whole showed significances.

In NI (Table 4), 1, 17, 18; 2, 2, 4; 1, 3, 4; 1, 7 and 8 strains showed significances at 0.1% (8, 9, 10), 1% (8, 9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 75.9 and 76.5% strains of the whole showed significances in 8, 9 and 10, respectively, which were nearly the same as in cases of the third and fourth items. In IV (Table

Table 14. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Kenya in 1985, *O. longistaminata*, 315-324

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
315	0.0177	-0.0532	0.1910	0.5463 **	-0.3044	0.6281 ***
316	0.3337	0.0844	0.2840	0.5899 ***	-0.1661	0.6955 ***
317	0.2050	0.5305 **	0.2903	0.5082 **	-0.6290 ***	0.3406
318	0.5078 **	0.4262 *	0.9860 ***	0.8992 ***	-0.3999 *	0.0411
319	-0.1219	0.1650	-0.1257	0.3816 *	-0.6356 ***	0.4651 **
320	-0.3347	-0.8982 ***	0.4564 *	0.8099 ***	0.0231	0.6037 ***
321	0.5065 **	-0.4286 *	0.4255 *	0.3251	-0.6427 ***	0.5148 **
322	0.0285	-0.7340 ***	-0.2185	0.2903	-0.6330 ***	0.5513 **
323	-0.1737	-0.5042 **	0.6847 ***	0.7997 ***	-0.4970 **	0.1231
324	0.0000	0.0000	0.0000	0.9999 ***	0.0000	0.0000
Average	0.8922 ***	0.9458 ***	0.8944 ***	0.1843	-0.7974 **	0.3289

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

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

5), 4, 2 and 1 strains showed significances at 0.1%, 1% and 5% levels, respectively. In other words, the whole of the strains showed significances. In **SE** (Table 6), 25, 2, 27; 1, 1, 2; 2, 1, 3; 7, 3 and 10 strains showed significances at 0.1% (12, 13, 14), 1% (12, 13, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 80.0, 57.1 and 76.2% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 62, 104, 55, 49; 11, 29, 21, 8; 11, 25, 17, 8; 23, 32, 14 and 18 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. 78.5, 83.2, 86.9 and 78.3% strains of the whole showed significances in 15, 16, 34 and 35, respectively. 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 4 items.

In group level (Table 11), 7, 1 and 5 groups showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first, third and fourth items.

6. L/T and W/T of UHG

C.c. and l.r. of W/T on L/T in the same strains were calculated, and c.c. are shown in the rightmost columns of Tables 1 to 6. In **MD** (Table 1), 7, 26, 33; 2, 11, 13; 4, 4; 4, 6 and 10 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, 87.2 and 83.3% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 2), 1, 13, 14; 3, 3; 4, 4; 16 and 16 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, 55.6 and 56.8% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 3), 2, 2, 2 and 4 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively.

Table 15. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Nigeria, *O. longistaminata*, 325-336 in 1984 and 337-382 in 1985

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
325	-0.0577	0.3464	0.5159 **	0.6794 ***	-0.5214 **	0.2672
326	0.4045 *	0.4157 *	0.1024	-0.0082	-0.6878 ***	0.7277 ***
327	-0.0609	-0.1323	-0.0127	0.2431	-0.7349 ***	0.4755 **
335	0.2977	0.3972 *	0.5208 **	0.6126 ***	-0.4577 *	0.4197 *
336	0.1438	0.0721	0.5231 **	0.6939 ***	-0.3041	0.4731 **
Average	0.9697 ***	0.9287 *	0.9774 **	0.6138	-0.6466	0.2039
337	-0.6881 ***	-0.7207 ***	0.2182	0.8551 ***	-0.1952	0.3416
338	0.8267 ***	0.9437 ***	0.9424 ***	0.6850 ***	-0.7472 ***	-0.0311
339	0.8866 ***	0.7035 ***	0.5601 **	-0.0473	-0.8344 ***	0.5895 ***
340	-0.2152	-0.1925	-0.2236	0.1009	-0.3338	0.9037 ***
341	0.5735 ***	-0.1107	-0.7664 ***	-0.2623	-0.8385 ***	0.7430 ***
342	0.6615 ***	-0.5355 **	-0.7161 ***	-0.1958	-0.5017 **	0.9456 ***
343	0.5220 **	-0.5283 **	-0.6644 ***	-0.4699 **	-0.7653 ***	0.9276 ***
345	-0.5101 **	0.1529	-0.5345 **	0.8952 ***	-0.4326 *	0.0139
346	0.0422	-0.2298	0.2216	0.4929 **	-0.5120 **	0.4905 **
348	-0.0342	0.7317 ***	-0.0984	0.7933 ***	-0.7803 ***	-0.2442
349	-0.1612	0.0403	0.2857	0.4497 *	-0.8023 ***	0.1724
352	0.3987 *	0.6839 ***	0.1089	-0.2048	-0.8055 ***	0.7376 ***
354	0.0254	0.0234	0.3897 *	0.5080 **	-0.5903 ***	0.3916 *
355	-0.0933	-0.1175	0.7935 ***	0.9451 ***	-0.0722	0.2562
357	0.9325 ***	0.9428 ***	0.8242 ***	0.4644 **	-0.6135 ***	0.4091 *
358	0.5774 ***	0.5774 ***	0.5000 **	0.2132	-0.8111 ***	0.3982 *
360	0.3798 *	0.7113 ***	0.6124 ***	0.7640 ***	-0.6958 ***	-0.0688
362	0.6707 ***	-0.1047	0.4675 **	0.1856	-0.8085 ***	0.4256 *
364	0.4944 **	-0.7930 ***	-0.8430 ***	-0.5533 **	-0.8599 ***	0.8994 ***
365	-0.1814	-0.3945 *	0.4708 **	0.8749 ***	-0.2663	0.2329
369	0.2479	0.6922 ***	-0.1961	0.1294	-0.8931 ***	0.3300
371	-0.3106	-0.2390	0.0594	0.6795 ***	-0.5561 **	0.2298
373	0.2221	0.3696 *	0.3227	0.2879	-0.4461 *	0.7286 ***
375	-0.3624 *	0.1916	0.6784 ***	0.8325 ***	-0.4734 **	0.0930
377	0.1340	0.4308 *	0.7485 ***	0.7572 ***	-0.7998 ***	-0.2189
378	-0.1424	0.7356 ***	0.4583 *	0.0186	-0.5754 ***	0.8068 ***
379	0.6330 ***	0.7596 ***	0.0000	-0.9117 ***	-0.9800 ***	0.9663 ***
381	-0.4690 **	0.0613	0.6864 ***	0.9289 ***	-0.9225 ***	-0.7149 ***
382	0.4821 **	-0.1133	-0.8964 ***	-0.6571 ***	-0.8438 ***	0.9578 ***
Average	-0.0181	0.2056	0.4539 *	0.7975 ***	-0.4392 *	0.1864
Average of both groups	0.3493 *	0.4239 *	0.7346 ***	0.7904 ***	-0.5331 **	0.0907

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

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

Table 16. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Ivory Coast in 1984, *O. longistaminata* (384-390) and *O. breviligulata* (383)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
384	0.3142	0.4708 **	0.5261 **	0.5550 **	-0.7132 ***	0.1784
385	0.2388	0.4582 *	0.2559	0.4902 **	-0.5562 **	0.4449 *
386	-0.2041	-0.0862	0.2856	0.4976 **	-0.3918 *	0.6006 ***
387	-0.2227	0.4333 *	-0.1062	0.4665 **	-0.8381 ***	0.0805
388	0.0831	0.2281	0.2980	0.4716 **	-0.5145 **	0.5077 **
389	-0.1098	-0.1428	0.3780 *	0.6778 ***	-0.5664 **	0.2166
390	-0.1300	0.2702	0.1472	0.4660 **	-0.6837 ***	0.3196
Average	0.2295	0.6325	0.7911 *	0.9795 ***	-0.7702 *	-0.6278
383	0.1286	0.6135 ***	-0.1501	-0.1427	-0.7535 ***	0.7739 ***

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

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

Table 17. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Senegal in 1985, *O. longistaminata*, 391-441 in Casamance region and 444-455 in northern region

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
391	0.3019	0.8063 ***	-0.2326	-0.3806 *	-0.9343 ***	0.6812 ***
392	-0.8111 ***	-0.3847 *	0.0000	0.6327 ***	-0.1491	0.6701 ***
393	-0.7511 ***	0.9460 ***	-0.6327 ***	-0.7190 ***	-0.9200 ***	0.9329 ***
394	-0.2270	-0.4832 **	-0.6800 ***	0.6150 ***	-0.3205	0.5493 **
395	-0.8476 ***	-0.0365	-0.1997	0.5121 **	-0.5785 ***	0.4021 *
396	-0.1485	-0.3037	0.5042 **	0.8926 ***	-0.6183 ***	-0.1980
397	0.6455 ***	0.4918 **	0.6202 ***	0.4626 *	-0.1389	0.8117 ***
399	0.3527	0.4545 *	0.3654 *	0.3491	-0.6493 ***	0.4789 **
400	0.2204	0.6061 ***	0.6667 ***	0.9275 ***	-0.6521 ***	-0.3229
401	0.1003	0.4277 *	-0.1837	0.2152	-0.7163 ***	0.5211 **
402	-0.2256	-0.5860 ***	-0.1833	0.2988	-0.5716 ***	0.6121 ***
406	-0.2796	-0.3036	0.2632	0.7223 ***	-0.5839 ***	0.1396
407	0.8018 ***	0.4444 *	0.8018 ***	0.8431 ***	0.4894 **	0.8815 ***
408	0.4608 *	0.6255 ***	0.3885 *	0.2129	-0.8683 ***	0.2987
409	0.6321 ***	0.1322	-0.5393 **	-0.8074 ***	-0.9447 ***	0.9549 ***
411	0.1903	0.1724	0.9063 ***	0.9123 ***	-0.4545 *	-0.0515
412	-0.1116	-0.8833 ***	0.3273	0.9038 ***	0.1444	0.5537 **
414	0.7308 ***	0.0000	0.0000	-0.5295 **	-0.9644 ***	0.7288 ***
416	-0.5266 **	0.5971 ***	-0.2453	0.2852	-0.9488 ***	0.0194
419	0.0952	0.4255 *	0.4792 **	0.4462 *	-0.3188	0.7056 ***
420	-0.5653 **	-0.0747	0.1387	0.5801 ***	-0.8658 ***	-0.0974

(Continued)

Table 17. (Continued)

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
423	0.6547 ***	0.8559 ***	0.4129 *	-0.4646 **	-0.8362 ***	0.8742 ***
424	-0.1909	0.0652	-0.2988	-0.1378	-0.4926 **	0.9294 ***
426	-0.9509 ***	0.5971 ***	0.9509 ***	0.9417 ***	0.6504 ***	0.8681 ***
427	0.1114	0.2804	-0.3977 *	0.3088	-0.5582 **	0.6146 ***
429	-0.0088	-0.4313 *	-0.0545	0.4943 ***	-0.1850	0.7609 ***
431	-0.0766	0.5160 **	0.1087	0.4199 *	-0.7199 ***	0.3238
433	-0.5316 **	0.9433 ***	-0.3152	-0.3942 *	-0.9493 ***	0.6628 ***
434	-0.2704	-0.6485 ***	0.8489 ***	0.9543 ***	0.4861 **	0.7251 ***
435	0.1248	-0.1667	-0.6864 ***	-0.4670 **	-0.9503 ***	0.7189 ***
436	0.4595 *	-0.2051	0.7351 ***	0.2332	-0.9348 ***	0.1267
437	0.4622 *	0.9416 ***	0.6211 ***	-0.1046	-0.7103 ***	0.7742 ***
439	0.7109 ***	-0.0485	0.3333	0.2980	-0.3969 *	0.7577 ***
440	0.9449 ***	0.1429	-0.1890	-0.9980 ***	-0.9959 ***	0.9996 ***
441	-0.3786 *	0.3760 *	-0.5270 **	0.6719 ***	-0.7758 ***	-0.0551
Average	0.4092 *	0.7144 ***	0.6762 ***	0.4345 **	-0.4692 **	0.5881 ***
444	0.4886 **	0.1191	0.6974 ***	0.7522 ***	0.4270 *	0.9167 ***
447	-0.3099	0.3721 *	0.3669 *	0.6303 ***	-0.8587 ***	-0.1445
449	0.4266 *	-0.1058	0.0964	0.2079	-0.1522	0.9346 ***
451	-0.1544	0.0303	0.2712	0.9397 ***	-0.3970 *	-0.0600
452	-0.4564 *	-0.3536	0.0000	0.5323 **	-0.2846	0.6599 ***
454	0.3431	0.7675 ***	-0.0865	-0.5654 **	-0.9619 ***	0.7654 ***
455	0.5281 **	-0.6015 ***	-0.6213 ***	-0.4221 *	-0.6983 ***	0.9431 ***
Average	0.9454 **	0.8373 *	0.9522 ***	0.6155	-0.1094	0.7145
Average of both groups	0.5214 ***	0.7312 ***	0.7231 ***	0.4417 **	-0.4596 **	0.5905 ***

d.f.; 28, 33, 5 and 40 in strain level, the first, second and third averages, respectively
 ***, **, *; significant at 0.1%, 1% and 5% levels, respectively

60.0% strains of the whole showed significances.

In **NI** (Table 4), 1, 13, 14; 1, 4, 5; 5, 5; 3, 7 and 10 strains showed significances at 0.1% (8, 9, 10), 1% (8, 9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 40.0, 75.9 and 70.6% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 5), 2 and 5 strains showed significances at 1% level and no significance even at 5% level, respectively. 28.6% strains of the whole showed significances, which was the same as in cases of the first and the second items. In **SE** (Table 6), 20, 3, 23; 1, 1, 2; 5, 3, 8; 9 and 9 strains showed significances at 0.1% (12, 13, 14), 1% (12, 13, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 14), respectively. 74.3, 100.0 and 78.6% strains of the whole showed significances in 12, 13 and 14, respectively. It was remarkable that the whole strains of 13 showed significances.

In **SUM**, 47, 86, 49, 37; 13, 27, 18, 9; 15, 23, 10, 13; 32, 54, 30 and 24 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. 70.1, 71.6, 72.0 and 71.1% strains of

Table 18. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Nigeria, *O. breviligulata*, 328-334 in 1984 and 344-380 in 1985

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
328	0.6267 ***	0.0841	-0.1957	-0.1500	-0.6259 ***	0.8625 ***
329	0.4795 **	0.2204	-0.2329	0.5817 ***	-0.2973	0.6021 ***
330	0.2709	0.2404	-0.1223	0.4813 **	-0.4523 *	0.5629 **
331	0.4523 *	0.0336	0.4634 **	0.7033 ***	-0.2693	0.4933 **
332	0.2834	0.2268	0.2950	0.3436	-0.3326	0.7699 ***
333	0.2064	0.1259	-0.6707 ***	-0.4950 **	-0.8490 ***	0.8772 ***
334	0.2434	-0.1757	-0.2941	-0.0151	-0.6567 ***	0.7626 ***
Average	-0.5833	-0.6541	0.8333 *	0.9530 ***	-0.0137	0.2896
344	0.0727	0.3354	0.3536	0.4259 *	-0.4519 *	0.6139 ***
347	0.5691 **	-0.1912	0.0751	0.2944	-0.2424	0.8612 ***
350	-0.5039 *	0.6569 ***	-0.4433 *	0.4710 **	-0.8902 ***	-0.0291
351	0.2309	0.3657 *	0.3930 *	0.3065	-0.4389 *	0.7194 ***
353	0.5891 ***	0.0207	-0.3846 *	-0.2951	-0.7350 ***	0.8627 ***
356	0.1566	0.2370	-0.5088 **	-0.2612	-0.7399 ***	0.8411 ***
359	0.6121 ***	-0.1350	-0.2781	-0.1107	-0.5296 **	0.8971 ***
361	0.0453	0.5404 **	-0.0759	-0.0760	-0.7238 ***	0.7415 ***
363	-0.1067	0.2533	0.2871	0.4005 *	-0.4263 *	0.6566 ***
366	0.1927	0.1333	0.2822	0.3919 *	-0.2959	0.7625 ***
367	0.5588 **	0.5859 ***	0.5333 **	0.3214	-0.5296 **	0.6319 ***
368	0.5018 **	0.4960 **	0.2366	0.1488	-0.6891 ***	0.6117 ***
370	0.0478	0.2896	-0.2236	0.1170	-0.7932 ***	0.5100 **
372	-0.2708	0.2867	0.4585 *	0.7116 ***	-0.8385 ***	-0.2320
374	0.2908	0.2459	-0.1787	0.0914	-0.5945 ***	0.7443 ***
376	-0.1940	0.1704	0.1019	0.5548 **	-0.7120 ***	0.1851
380	-0.0524	0.4591 *	0.2171	0.2928	-0.6720 ***	0.5054 **
Average	-0.2677	-0.0787	0.8140 ***	0.9055 ***	-0.6811 **	-0.3123
Average of both groups	-0.3244	-0.0380	0.6584 ***	0.8663 ***	-0.5277 **	-0.0387

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

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

the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that the whole values were nearly the same. Strains of East (34) and West (35) Africas showed nearly the same significances.

In group level (Table 11), 3, 2, 1 and 7 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, 15, 16, 34 and 35 groups showed significances at 0.1%, 0.1% and 5% levels and no significance even at 5% level, respectively.

7. Length and width of HG

C.c. and l.r. of W on L in the same strains were calculated, and c.c. are shown in the left test

Table 19. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Senegal in 1985, *O. breviligulata*, 398-442 in Casamance region and 443-456 in northern region; *O. brachyantha*, 475

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
398	-0.5469 **	-0.1553	-0.4677 **	0.3257	-0.1561	0.8827 ***
403	0.0759	0.1958	-0.1817	0.3352	-0.5121 **	0.6358 ***
404	-0.2182	0.4578 *	-0.3028	-0.0426	-0.7262 **	0.7041 ***
405	0.4471 *	0.2471	0.0913	0.1684	-0.5910 ***	0.6940 ***
410	0.7752 ***	0.3953 *	0.1961	-0.0104	-0.4172 *	0.9129 ***
413	0.8958 ***	-0.0357	-0.2887	0.2524	-0.1794	0.9060 ***
415	0.2792	0.0700	-0.2376	0.3364	-0.3834 *	0.7392 ***
417	-0.5916 ***	0.1690	-0.6071 ***	0.2130	-0.4789 **	0.7550 ***
418	0.3598	-0.0252	0.1351	0.2156	-0.5496 **	0.6955 ***
421	0.4663 **	0.3082	0.5772 ***	0.7240 ***	-0.1438	0.5772 ***
422	-0.2354	0.6290 ***	-0.6417 ***	-0.7188 ***	-0.9414 ***	0.9090 ***
425	0.4871 **	0.2091	0.2395	0.3521	-0.3066	0.8430 ***
428	0.2963	0.0116	0.8619 ***	0.8498 ***	0.4316 *	0.8422 ***
430	0.1283	0.7583 ***	-0.2711	0.1297	-0.8487 ***	0.4109 *
432	0.2978	0.3832 *	-0.2083	-0.2395	-0.7739 ***	0.7976 ***
438	-0.1009	-0.4804 **	-0.4901 **	-0.1814	-0.8186 ***	0.7126 ***
442	0.4985 **	0.5833 ***	0.3477	0.1641	-0.5370 **	0.7415 ***
Average	-0.2214	-0.0929	0.8971 ***	0.9313 ***	-0.0237	0.3374
443	-0.1656	0.1309	0.3232	0.5076 **	-0.3952 *	0.5905 ***
445	0.1668	0.1021	-0.1693	0.2285	-0.6606 ***	0.5788 ***
446	-0.2026	0.3414	-0.1776	0.0619	-0.7157 ***	0.6509 ***
448	0.0228	-0.2561	0.1951	0.4418 *	0.3539	0.6816 ***
450	-0.0579	0.2839	-0.7140 ***	-0.3802 *	-0.9434 ***	0.6621 ***
453	-0.1478	0.1700	-0.0267	0.3799 *	-0.6446 ***	0.4611 *
456	0.1935	0.1966	0.3377	0.4215 *	-0.2857	0.7471 ***
Average	-0.6616	-0.2837	0.5206	0.9670 ***	-0.6015	-0.3795
Average of both groups	-0.3498	-0.1988	0.8969 ***	0.9412 ***	-0.0984	0.2382
475	0.1769	0.5583 **	0.1489	-0.0049	-0.5768 ***	0.8170 ***

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

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

columns of Tables 12 to 17. In MD (Table 12), 4, 4; 1, 1, 2; 2, 3, 5; 6, 43 and 49 strains showed significances at 0.1% (1, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 53.9, 4.3 and 16.7% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 13), 1, 1; 4, 4; 1, 1; 31 and 31 strains showed significances at 0.1% (4, 6), 1% (5, 6) and 5% (5, 6) levels and no significance even at 5% level (5, 6), respectively. 100.0, 13.9 and 16.2% strains of the whole showed significances in 4, 5 and 6, respectively, which were nearly the same as in cases of the first and the third items. In KE (Table 14), 2 (= 20.0% of the whole) and 8 (= 80.0% of the whole) strains showed

Table 20. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Tanzania, *O. punctata*, 457-459 in 1984 and 2084-2109 in 1988

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
457	0.1809	0.4325 *	0.3569	0.3781 *	-0.5046 **	0.6071 ***
458	0.4196 *	0.1015	-0.3144	-0.2373	-0.6108 ***	0.9132 ***
459	-0.6023 ***	0.2719	-0.1029	0.4981 **	-0.8037 ***	0.1135
Average	-0.3789	0.1073	-0.9608	0.8058	-0.5000	0.1099
2084	0.3318	0.0813	-0.2189	0.1006	-0.7207 ***	0.6083 ***
2085	-0.1635	0.5734 ***	-0.2509	0.0167	-0.8370 ***	0.5165 **
2086	0.3037	0.1698	0.5816 ***	0.6145 ***	-0.5837 ***	0.2786
2087	0.2541	0.1211	0.4820 **	0.6116 ***	-0.5192 **	0.3561
2088	0.1536	0.2183	0.4714 **	0.6469 ***	-0.6009 ***	0.2180
2089	0.4653 **	-0.1448	0.2706	0.4163 *	-0.5179 **	0.5563 **
2090	-0.2074	-0.2920	0.2815	0.6242 ***	-0.6194 ***	0.2167
2091	-0.0493	-0.3457	0.3134	0.6712 ***	-0.5203 **	0.2758
2092	-0.0761	-0.1372	0.3211	0.7341 ***	-0.4681 **	0.2483
2093	0.0388	-0.2712	-0.0564	0.3610 *	-0.5489 **	0.5773 ***
2094	-0.0614	0.1221	-0.0421	0.5110 **	-0.5829 ***	0.3918 *
2095	-0.1244	0.0811	0.4416 *	0.6593 ***	-0.6350 ***	0.1579
2096	0.0532	0.4388 *	-0.1666	0.1445	-0.8389 ***	0.4010 *
2097	-0.3108	-0.2777	-0.1185	0.5184 **	-0.6226 ***	0.3361
2098	0.2374	-0.1584	0.2726	0.5061 *	-0.5786 ***	0.4062 *
2099	0.0433	0.3833 *	0.1472	0.4855 **	-0.7545 ***	0.2034
2100	-0.2501	0.3029	-0.1868	0.5857 ***	-0.8856 ***	-0.1518
2101	0.1177	0.3100	0.2421	0.4301 *	-0.7639 ***	0.2434
2102	0.3240	0.2096	0.0775	0.4101 *	-0.4443 *	0.6318 ***
2103	0.2480	0.2394	0.4533 *	0.6029 ***	-0.6594 ***	0.1975
2104	-0.2968	-0.0904	0.2901	0.7174 ***	-0.7655 ***	-0.1093
2105	0.1415	-0.0517	0.0488	0.4343 *	-0.5664 **	0.4916 **
2106	0.0413	0.3074	0.1192	0.3878 *	-0.7186 ***	0.3545
2107	0.0693	0.4883 **	0.0921	0.4534 *	-0.8267 ***	0.1166
2108	-0.2626	0.0198	-0.1306	0.4020 *	-0.8067 ***	0.2068
2109	-0.0754	-0.2822	0.2411	0.5796 ***	-0.7540 ***	0.0917
Average	0.2577	0.1154	0.7180 ***	0.7578 ***	-0.3810	0.0035
Average of both groups	0.4050 *	0.3324	0.7747 ***	0.7619 ***	-0.3827 *	0.0082

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

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

significances at 1% level and no significance even at 5% level, respectively.

In NI (Table 15), 9, 9; 5, 5; 1, 3, 4; 4, 12 and 16 strains showed significances at 0.1% (9, 10), 1% (9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 20.0, 58.6 and 52.9% strains of the whole showed significances in 8, 9 and 10, respectively, in

Table 21. Correlation coefficient of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T; collected in Kenya, *O. punctata*, 460-464 in 1984 and 465-474 in 1985

Accession No.	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
460	-0.2922	0.4018 *	-0.0161	0.1626	-0.5962 ***	0.6919 ***
461	-0.1609	0.5272 **	0.0000	0.1643	-0.6578 ***	0.6327 ***
462	0.1054	0.2535	0.4998 **	0.6540 ***	-0.1677	0.6337 ***
463	-0.0491	-0.2213	0.5387 **	0.7830 ***	-0.0618	0.5718 ***
464	0.1194	0.5384 **	-0.0194	0.0908	-0.7187 ***	0.6247 ***
Average	-0.0199	0.9472 *	0.3781	-0.4116	-0.9514 *	0.6713
465	0.1630	0.1648	0.3612 *	0.6435 ***	-0.4024 *	0.4401 *
466	0.3989 *	-0.0023	-0.1576	0.1062	-0.5374 **	0.7800 ***
467	0.1553	0.2261	0.3152	0.4353 *	-0.2185	0.7823 ***
468	0.3258	0.2988	0.3812 *	0.3226	-0.6035 ***	0.5591 **
469	-0.0880	-0.1955	-0.0183	0.1876	-0.4671 **	0.7746 ***
470	0.1496	-0.2156	-0.0330	0.2673	-0.6909 ***	0.5086 **
471	0.3212	-0.0343	-0.1863	0.6895 ***	-0.0548	0.6839 ***
472	-0.1498	0.1780	-0.0036	0.5724 ***	-0.4368 *	0.4856 **
473	-0.0152	0.2797	-0.4950 **	-0.4070 *	-0.8155 ***	0.8600 ***
474	0.2301	-0.9507 ***	-0.3814 *	0.1564	-0.5466 **	0.7409 ***
Average	-0.1367	-0.0431	0.5170	0.8178 **	-0.0650	0.5188
Average of both groups	0.0271	0.2803	0.4789	0.7093 **	-0.2932	0.4635

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

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

which the first figure showed very low significance. In IV (Table 16), no significant strain was found, which was quite reversed to the result of the fifth items. In SE (Table 17), 11, 11; 3, 2, 5; 4, 2, 6; 17, 3 and 20 strains showed significances at 0.1% (12, 14), 1% (12, 13, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 51.4, 57.1 and 52.4% strains of the whole showed significances in 12, 13 and 14, respectively.

In SUM, 25, 25, 5, 20; 13, 18, 8, 10; 12, 16, 5, 10; 57, 131, 89 and 43 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. 46.7, 31.1, 16.8 and 48.2% strains of the whole showed significances in 15, 16, 34 and 35, respectively. The whole of the data were looked upon as the minimum values through the former 6 items. The strains of east Africa (34) showed clearly lower significances than those of West Africa (35), which was the same tendency as the first, second and the third items.

In group level (Table 22), 5, 2, 2 and 4 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first, third, fourth and fifth items.

8. Length and thickness of HG

Table 22. Group averages of six components of husked grains; width on length, thickness on length, thickness on width, ratio of length to thickness (abbreviated as L/T) on L/W, W/T on L/W and W/T on L/T. Country and group marks were noted in the text.

Country	Group mark	Length and Width	Length and Thickness	Width and Thickness	L/W and L/T	L/W and W/T	L/T and W/T
MD	1	0.8649 ***	0.6719 *	0.8205 ***	0.5766 *	-0.4616	0.7600 **
	2	0.7134 ***	0.8224 ***	0.4322 **	0.5482 ***	-0.7003 ***	0.2094
	3	0.5396 ***	0.7897 ***	0.5076 ***	0.5290 ***	-0.6117 ***	0.3426 **
TA	5	0.1114	0.5695 ***	0.4830 **	0.6546 ***	-0.7341 ***	0.1894
	6	0.1540	0.5879 ***	0.5280 ***	0.6503 ***	-0.7142 ***	0.1974
KE	7	0.8922 ***	0.9458 ***	0.8944 ***	0.1843	-0.7974 **	0.3289
NI	8	0.9697 **	0.9287 *	0.9774 **	0.6138	-0.6466	0.2039
	9	-0.0181	0.2056	0.4539 *	0.7975 ***	-0.4392 *	0.1864
IV	10	0.3493 *	0.4239 *	0.7346 ***	0.7904 ***	-0.5331 **	0.0907
	11	0.2295	0.6325	0.7911 *	0.9795 ***	-0.7702 *	-0.6278
SE	12	0.4092 *	0.7144 ***	0.6762 ***	0.4345 **	-0.4692 **	0.5881 ***
	13	0.9454 **	0.8373 *	0.9522 ***	0.6155	-0.1094	0.7145
	14	0.5214 ***	0.7312 ***	0.7231 ***	0.4417 **	-0.4596 **	0.5905 ***
SUM	15	0.4639 ***	0.5599 ***	0.6610 ***	0.5818 ***	-0.4144 ***	0.4028 ***
	16	0.4991 ***	0.6726 ***	0.6798 ***	0.5643 ***	-0.5384 ***	0.2801 ***
NI	17	-0.5833	-0.6541	0.8333 *	0.9530 ***	-0.0137	0.2896
	18	-0.2677	-0.0787	0.8140 ***	0.9055 ***	-0.6811 **	-0.3123
	19	-0.3244	-0.0380	0.6584 ***	0.8663 ***	-0.5277 **	-0.0387
SE	21	-0.2214	-0.0929	0.8971 ***	0.9313 ***	-0.0237	0.3374
	22	-0.6616	-0.2837	0.5206	0.9670 ***	-0.6015	-0.3795
	23	-0.3498	-0.1988	0.8969 ***	0.9412 ***	-0.0984	0.2382
SUM	24	-0.2492	-0.0659	0.8208 ***	0.9154 ***	-0.2859 *	0.1153
TA	25	-0.3789	0.1073	-0.9608	0.8058	-0.5000	0.1099
	26	0.2577	0.1154	0.7180 ***	0.7578 ***	-0.3810	0.0035
	27	0.4050 *	0.3324	0.7747 ***	0.7619 ***	-0.3827 *	0.0082
KE	28	-0.0199	0.9472 *	0.3781	-0.4116	-0.9514 *	0.6713
	29	-0.1367	-0.0431	0.5170	0.8178 **	-0.0650	0.5188
	30	0.0271	0.2803	0.4789	0.7093 **	-0.2932	0.4635
SUM	31	0.0978	0.3102	0.6023 **	0.7093 ***	-0.2580	0.4952 *
	32	0.2594	0.2434	0.5802 ***	0.6973 ***	-0.2886	0.4818 ***

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 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

C.c. and l.r. of T on L in the same strains were calculated, and c.c. are shown in the second columns from the left of Tables 12 to 17. In MD (Table 12), 3, 1, 4; 2, 3, 5; 2, 4, 6; 6, 39 and 45 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 53.9, 20.5 and 25.0% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 13), 1, 2, 3; 4, 4; 4, 4; 26 and 26 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, 27.8 and 29.7% strains of the whole showed significances in 4, 5 and 6, respectively, which were nearly the same as in cases of the first, third and seventh items. In **KE** (Table 14), 2, 2, 2 and 4 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 60.0% strains of the whole showed significances, which was the same as in case of the sixth item.

In **NI** (Table 15), 12, 12; 2, 2, 4; 3, 3; 3, 12 and 15 strains showed significances at 0.1% (9, 10), 1% (8, 9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 40.0, 58.6 and 55.9% strains of the whole showed significances in 8, 9 and 10, respectively, which were quite the same as in case of the second item. In **IV** (Table 16), 1, 2 and 4 strains showed significances at 1% and 5% levels and no significance even at 5% level, respectively. 42.9% strains of the whole showed significances. In **SE** (Table 17), 12, 2, 14; 3, 3; 7, 1, 8; 13, 4 and 17 strains showed significances at 0.1% (12, 13, 14), 1% (12, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 62.9, 42.9 and 59.5% strains of the whole showed significances, which were nearly the same as in case of the first item.

In **SUM**, 32, 35, 9, 26; 12, 19, 11, 8; 17, 25, 12, 13; 46, 111, 75 and 36 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. 57.0, 41.6, 29.9 and 56.6% strains of the whole showed significances in 15, 16, 34 and 35, respectively. They were looked upon as nearly the same as in case of the third item.

In group level (Table 22), 7, 4 and 2 groups showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first, third, fourth, fifth and seventh items.

9. Width and thickness of HG

C.c. and l.r. of T on W in the same strains were calculated, and c.c. are shown in the third columns from the left of Tables 12 to 17. In **MD** (Table 12), 7, 3, 10; 2, 2, 4; 1, 1; 4, 41 and 45 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, 12.8 and 25.0% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 13), 4, 4; 1, 2, 3; 5, 5; 25 and 25 strains showed significances at 0.1% (5, 6), 1% (4, 5, 6) and 5% (5, 6) levels and no significance even at 5% level (5, 6), respectively. 100.0, 30.6 and 32.4% strains of the whole showed significances in 4, 5 and 6, respectively. They were looked upon as the same in case of the eighth item. In **KE** (Table 14), 2, 2 and 6 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. 40.0% strains of the whole showed significances.

In **NI** (Table 15), 12, 12; 3, 5, 8; 2, 2; 2, 10 and 12 strains showed significances at 0.1% (9, 10), 1% (8, 9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 60.0, 65.5 and 64.7% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 16), 1, 1 and 5 strains showed significances at 1% and 5% levels and no significance even at 5% level, respectively. 28.6% strains of the whole showed significances, which was the same as in cases of the first, second and sixth items. In **SE** (Table 17), 11, 2, 13; 4, 4; 4, 1, 5; 16, 4 and 20 strains showed significances at 0.1% (12, 13, 14), 1% (12, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 54.3, 42.9 and 52.4% strains of the whole showed significances in 12, 13 and 14, respectively, which were

nearly the same as in cases of the first and the eighth items.

In **SUM**, 34, 41, 16, 25; 16, 20, 7, 13; 10, 16, 8, 8; 47, 113, 76 and 37 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, which were nearly the same as in cases of the second, third and eighth items. 56.1, 40.5, 29.0 and 55.4% strains of the whole showed significances in 15, 16, 34 and 35, respectively.

In group level (Table 22), 8, 3 and 2 groups showed significances at 0.1%, 1% and 5% levels, respectively. In other words, the whole groups showed significances. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first, third, fourth, fifth, seventh and eighth items.

10. L/W and L/T of HG

C.c. and l.r. of L/T on L/W in the same strains were calculated, and c.c. are shown in the fourth columns from the left of Tables 12 to 17. In **MD** (Table 12), 8, 7, 15; 1, 6, 7; 1, 10, 11; 3, 24 and 27 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 76.9, 48.9 and 55.0% strains of the whole showed significances in 1, 2 and 3 respectively, which were nearly the same as in case of the fourth item. In **TA** (Table 13), 16, 16; 7, 7; 6, 6; 1, 7 and 8 strains showed significances at 0.1% (5, 6), 1% (5, 6) and 5% (5, 6) levels and no significance even at 5% level (4, 5, 6), respectively. 0.0, 80.6 and 78.4% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 14), 5, 2, 1 and 2 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 80.0% strains of the whole showed significances, which was the same as in case of the fourth item.

In **NI** (Table 15), 3, 13, 16; 5, 5; 1, 1; 2, 10 and 12 strains showed significances at 0.1% (8, 9, 10), 1% (9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 60.0, 65.5 and 64.7% strains of the whole showed significances in 8, 9 and 10, respectively, which were quite the same as in case of the ninth item. In **IV** (Table 16), 1 and 6 strains showed significances at 0.1% and 1% levels, respectively. 100.0% strains of the whole showed significances, which was the same as in case of the fifth item. In **SE** (Table 17), 15, 3, 18; 5, 2, 7; 5, 1, 6; 10, 1 and 11 strains showed significances at 0.1% (12, 13, 14), 1% (12, 13, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 71.4, 85.7 and 73.8% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 48, 71, 36, 35; 21, 34, 16, 18; 9, 25, 18, 7; 29, 60, 37 and 23 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. 72.9, 68.4, 65.4 and 72.3% strains of the whole showed significances in 15, 16, 34 and 35, respectively, which were nearly the same as in cases of the fourth and sixth items.

In group level (Table 22), 7, 2, 1 and 3 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first, third, fourth, fifth, seventh, eighth and ninth items.

11. L/W and W/T of HG

C.c. and l.r. of W/T on L/W in the same strains were calculated, and c.c. are shown in the fifth columns from the left of Tables 12 to 17. In **MD** (Table 12), 9, 24, 33; 2, 8, 10; 1, 12, 13; 1, 3 and 4 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 92.3, 93.6 and 93.3% strains of the whole

showed significances in 1, 2 and 3, respectively, which were the highest levels through the whole items. In **TA** (Table 13), 18, 18; 1, 12, 13; 3, 3; 3 and 3 strains showed significances at 0.1% (5, 6), 1% (4, 5, 6) and 5% (5, 6) levels and no significance even at 5% level (5, 6), respectively. 100.0, 91.7 and 91.9% strains of the whole showed significances in 4, 5 and 6, respectively, which were the highest levels through the whole items. In **KE** (Table 14), 4, 1, 1 and 4 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 60.0% strains of the whole showed significances, which was the same as in cases of the sixth and eighth items.

In **NI** (Table 15), 2, 19, 21; 1, 4, 5; 1, 2, 3; 1, 4 and 5 strains showed significances at 0.1% (8, 9, 10), 1% (8, 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, which were the highest levels through the whole items. In **IV** (Table 16), 3, 3 and 1 strains showed significances at 0.1%, 1% and 5% levels, respectively. In other words, the whole strains (= 7) showed significances, which was the same as in cases of the fifth and tenth items. In **SE** (Table 17), 23, 3, 26; 4, 4; 2, 2, 4; 6, 2 and 8 strains showed significances at 0.1% (12, 13, 14), 1% (12, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 82.9, 71.4 and 81.0% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 63, 105, 55, 50; 16, 36, 24, 12; 10, 25, 17, 8; 18, 24, 11 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. 83.2, 87.4, 89.7, and 84.3% strains of the whole showed significances in 15, 16, 34 and 35, respectively, which were the highest levels through the whole items.

In group level (Table 22), 4, 4, 2 and 3 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as in cases of the first, third, fourth, fifth, seventh, eighth, ninth and tenth items.

12. L/T and W/T of HG

C.c. and l.r. of W/T on L/T in the same strains were calculated, and c.c. are shown in the rightest columns of Tables 12 to 17. In **MD** (Table 12), 7, 23, 30; 2, 13, 15; 5, 5; 4, 6 and 10 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, 87.2 and 83.3% strains of the whole showed significances in 1, 2 and 3, respectively, which were quite the same as in case of the sixth item. In **TA** (Table 13), 1, 7, 8; 4, 4; 6, 6; 19 and 19 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, 47.2 and 48.7% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 14), 3, 3 and 4 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. 60.0% strains of the whole showed significances, which was the same as in cases of the sixth, eighth and eleventh items.

In **NI** (Table 15), 1, 12, 13; 2, 1, 3; 1, 4, 5; 1, 12 and 13 strains showed significances at 0.1% (8, 9, 10), 1% (8, 9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 58.6 and 61.8% strains of the whole showed significances in 8, 9 and 10, respectively, which were quite the same as in case of the third item. In **IV** (Table 16), 1, 1, 1 and 4 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 42.9% strains of the whole showed significances, which was the same as in case

of the eighth item. In **SE** (Table 17), 20, 5, 25; 4, 4; 1, 1; 10, 2 and 12 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. 71.4% strains of the whole showed significances in the whole of 12, 13 and 14.

In **SUM**, 50, 80, 41, 39; 13, 30, 22, 8; 7, 18, 11, 7; 37, 62, 33 and 29 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. 65.4, 67.4, 69.2 and 65.1% strains of the whole showed significances in 15, 16, 34 and 35, respectively.

In group level (Table 22), 2, 2 and 9 groups showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. In summed-up group, 15, 16, 35 and 34 showed significances at 0.1%, 0.1% and 0.1% levels and no significance even at 5% level, respectively.

13. Further discussion

Through the 12 items, significant items were found as 66.7% (104/156), 45.4% (256/564), 50.0% (360/720), 75.0% (9/12), 48.2% (208/432), 48.9% (217/444), 56.7% (68/120), 58.3% (35/60), 63.5% (221/348), 62.8% (256/408), 48.8% (41/84), 67.6% (284/420), 67.9% (57/84), 67.7% (341/504), 63.7% (818/1,284), 56.3% (1,284/2,280), 50.2% (645/1,284) and 64.1% (638/996) in order of group Nos.1 ~ 16 and 34 and 35, respectively. There were no remarkable differences through the whole items.

In comparison with 15 and 16 groups, 4 items, *i.e.*, the fifth and eleventh (L/W and W/T), and sixth and twelfth (L/T and W/T), showed the larger significances in 16 than those in 15. In the other 8 items, comparatively large significances were found in 15 rather than in 16.

In comparison with 34 and 35 groups, 4 items mentioned above showed comparatively, high significances in 34 rather than in 35 as well, In other 8 items, comparatively large significances were found in 35 rather than in 34.

In case of the wild rices in northeastern India (= Assam), using 17 strains⁶⁾, 54.9% items (112/204) showed significant relations through the whole cases. In comparison with these data and the present one, there was not any noticeable difference between them. On the other hand, 1 strain of *O. longistaminata* collected in Ethiopia showed significances in 91.7% (11/12) in the same items¹⁴⁾, and this was collected in an area relatively narrow and showing small intra-population's variations. And so it may be attributed to these differences between them.

II. *O. breviligulata* CHEV. et ROEHR.

1. Length and width of UHG

C.c. and l.r. of W on L in the same strains were calculated, and c.c. are shown in the leftmost columns of Tables 5, 7 and 8. In **NI** (Table 7), 3, 3, 6; 1, 1; 4, 4; 4, 9 and 13 strains showed significances at 0.1% (17, 18, 19), 1% (18, 19) and 5% (18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 42.9, 47.1 and 45.8% strains of the whole showed significances in 17, 18 and 19, respectively. In **IV** (Table 5), no significant strain was found. In **SE** (Table 8), 4, 4; 3, 3; 2, 2; 8, 7 and 15 strains showed significances at 0.1% (21, 23), 1% (21, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 52.9, 0.0 and 37.5% 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), 10, 4, 6 and 29 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 40.8% strains of the whole showed significances. In group level (Table 11),

no significant group was found through the whole groups and summed-up group.

2. Length and thickness of UHG

C.c. and l.r. of T on L in the same strains were calculated, and c.c. are shown in the second columns from the left of Tables 5, 7 and 8. In **NI** (Table 7), 5, 5; 1, 1; 3, 3; 7, 8 and 15 strains showed significances at 0.1% (18, 19), 1% (18, 19) and 5% (18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 0.0, 52.9 and 37.5% strains of the whole showed significances in 17, 18 and 19, respectively. In **IV** (Table 5), no significant strain was found, which was the same as in case of the former item. In **SE** (Table 8), 2, 1, 3; 4, 4; 1, 1, 2; 10, 5 and 15 strains showed significances at 0.1% (21, 22, 23), 1% (21, 23) and 5% (21, 22, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 41.2, 28.6 and 37.5% strains of the whole showed significances in 21, 22 and 23, respectively.

In **SUM** (24), 8, 5, 5 and 31 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 36.7% strains of the whole showed significances. In group level (Table 11), no significant group was found through the whole groups and summed-up group, which was the same as in case of the former item.

3. Width and thickness of UHG

C.c. and l.r. of T on W in the same strains were calculated, and c.c. are shown in the third columns from the left of Tables 5, 7 and 8. In **NI** (Table 7), 2, 2; 1, 2, 3; 1, 1, 2; 5, 12 and 17 strains showed significances at 0.1% (18, 19), 1% (17, 18, 19) and 5% (17, 18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 28.6, 29.4 and 29.2% strains of the whole showed significances in 17, 18 and 19, respectively. In **IV** (Table 5), 1 strain (= 100.0%) showed significance at 1% level. In **SE** (Table 8), 3, 1, 4; 4, 4; 10, 6 and 16 strains showed significances at 0.1% (21, 22, 23) and 1% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 41.2, 14.3 and 33.3% strains of the whole showed significances in 21, 22 and 23, respectively, in which the first figure was the same as in case of the second item.

In **SUM** (24), 6, 8, 2 and 33 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 32.7% strains of the whole showed significances. In group level (Table 11), 4 and 2 strains showed significances at 0.1% level and no significance even at 5% level, respectively. In summed-up group, it showed significance at 0.1% level, which was quite the reversed result to the former two items.

4. L/W and L/T of UHG

C.c. and l.r. of L/T on L/W in the same strains were calculated, and c.c. are shown in the fourth columns from the left of Tables 5, 7 and 8. In **NI** (Table 7), 1, 3, 4; 1, 1; 3, 3; 5, 11 and 16 strains showed significances at 0.1% (17, 18, 19), 1% (17, 19) and 5% (18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 28.6, 35.3 and 33.3% strains of the whole showed significances in 17, 18 and 19, respectively, which were nearly the same as in case of the third item. In **IV** (Table 5), no significant strain was found, which was the same as in cases of the first and second items. In **SE** (Table 8), 4, 4; 1, 1; 2, 2; 12, 5 and 17 strains showed significances at 0.1% (21, 23), 1% (21, 23) and 5% (22, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 29.4, 28.6 and 29.2% strains of the whole showed significances in 21, 22 and 23, respectively.

In **SUM** (24), 8, 2, 5 and 34 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 30.6% strains of the whole showed significances. In group level (Table 11), the whole groups (= 6) and summed-up group showed significances at 0.1% level.

5. L/W and W/T of UHG

C.c. and l.r. of W/T on L/W in the same strains were calculated, and c.c. are shown in the fifth columns from the left of Tables 5, 7 and 8. In NI (Table 7), 3, 14, 17; 2, 1, 3; 1, 2, 3; 1 and 1 strains showed significances at 0.1% (17, 18, 19), 1% (17, 18, 19) and 5% (17, 18, 19) levels and no significance even at 5% level (17, 19), respectively. 85.7, 100.0 and 95.8% strains of the whole showed significances in 17, 18 and 19, respectively, which were the highest levels in comparison with the former 4 items. In IV (Table 5), no significant strain was found, which was the same as in cases of the first, second and fourth items. In SE (Table 8), 11, 6, 17; 1, 1, 2; 2, 2; 3 and 3 strains showed significances at 0.1% (21, 22, 23), 1% (21, 22, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 23), respectively. 82.4, 100.0 and 87.5% strains of the whole showed significances in 21, 22 and 23, respectively, which were the highest levels in comparison with the former 4 items.

In SUM (24), 34, 5, 5 and 5 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 89.8% strains of the whole showed significances, which was the highest level in comparison with the former 4 items. In group level (Table 11), 1 and 5 strains showed significances at 5% level and no significance even at 5% level, respectively. In summed-up group, it showed no significance even at 5% level.

6. L/T and W/T of UHG

C.c. and l.r. of W/T on L/T in the same strains were calculated, and c.c. are shown in the rightest columns of Tables 5, 7 and 8. In NI (Table 7), 6, 11, 17; 3, 3; 1, 1, 2; 2 and 2 strains showed significances at 0.1% (17, 18, 19), 1% (18, 19) and 5% (17, 18, 19) levels and no significance even at 5% level (18, 19), respectively. 100.0, 88.2 and 91.7% strains of the whole showed significances in 18, 19 and 20, respectively, in which the first figure showed the highest value through the former six items. In IV (Table 5), significance was found at 1% level, which was the same as in case of the third item. In SE (Table 8), 12, 3, 15; 2, 2, 4; 1, 1; 3, 1 and 4 strains showed significances at 0.1% (21, 22, 23), 1% (21, 22, 23) and 5% (22, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 82.4, 85.7 and 83.3% strains of the whole showed significances in 21, 22 and 23, respectively, which were looked upon as nearly the same as in case of the fifth item.

In SUM (24), 32, 8, 3 and 6 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 87.8% strains of the whole showed significances. In group level (Table 11), no significant group was found through the whole groups and summed-up group, which was the same as in cases of the first and second items.

7. Length and width of HG

C.c. and l.r. of W on L in the same strains were calculated, and c.c. are shown in the leftest columns of Tables 16, 18 and 19. In NI (Table 18), 1, 2, 3; 1, 3, 4; 1, 1, 2; 4, 11 and 15 strains showed significances at 0.1% (17, 18, 19), 1% (17, 18, 19) and 5% (17, 18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 42.9, 35.3 and 37.5% strains of the whole showed significances in 17, 18 and 19, respectively. In IV (Table 16), no significant strain was found, which was the same as in cases of the first, second, fourth and fifth items. In SE (Table 19), 3, 3; 4, 4; 1, 1; 9, 7 and 16 strains showed significances at 0.1% (21, 23), 1% (21, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 47.1, 0.0 and 33.3% strains of the whole showed significances in 21, 22 and 23, respectively, in which the second figure was particularly low and the same as in case of the first item, and the third figure was the same as in case of the third item.

In **SUM (24)**, 6, 8, 3 and 32 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 34.7% strains of the whole showed significances, which was nearly the same as in cases of the second, third and fourth items. In group level (Table 22), no significant group was found through the whole groups and summed-up group, which was the same as in cases of the first, second and sixth items.

8. Length and thickness of HG

C.c. and l.r. of T on L in the same strains were calculated, and c.c. are shown in the second columns from the left of Tables 16, 18 and 19. In **NI** (Table 18), 2, 2; 2, 2; 2, 2; 7, 11 and 18 strains showed significances at 0.1% (18, 19), 1% (18, 19) and 5% (18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 0.0, 35.3 and 25.0% strains of the whole showed significances in 17, 18 and 19, respectively. Those were the lowest values through the former 7 items. In **IV** (Table 16), 1 strains (= 100.0%) showed significance at 0.1% level, which was the same as in cases of the third and sixth items. In **SE** (Table 19), 3, 3; 1, 1; 3, 3; 10, 7 and 17 strains showed significances at 0.1% (21, 23), 1% (21, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 41.2, 0.0 and 29.2% strains of the whole showed significances in 21, 22 and 23, respectively, which were nearly the same as in the seventh item.

In **SUM (24)**, 6, 3, 5 and 35 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 28.6% strains of the whole showed significances. In group level (Table 22), no significant group was found through the whole groups and summed-up group, which was the same as in cases of the first, second, sixth and seventh items.

9. Width and thickness of HG

C.c. and l.r. of T on W in the same strains were calculated, and c.c. are shown in the third columns from the left of Tables 16, 18 and 19. In **NI** (Table 18), 1, 1; 1, 2, 3; 4, 4; 5, 11 and 16 strains showed significances at 0.1% (17, 19), 1% (17, 18, 19) and 5% (18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 28.6, 35.3 and 33.3% strains of the whole showed significances in 17, 18 and 19, respectively, in which the first, second and third figures were the same as in cases of the third and fourth items, the fourth, seventh and eighth items, and the fourth item, respectively. In **IV** (Table 16), no significance was found, which was the same as in cases of the first, second, fourth, fifth and seventh items. In **SE** (Table 19), 4, 1, 5; 2, 2; 11, 6 and 17 strains showed significances at 0.1% (21, 22, 23) and 1% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 35.3, 14.3 and 29.2% strains of the whole showed significances in 21, 22 and 23, respectively, which were nearly the same as in case of the third item.

In **SUM (24)**, 6, 5, 4 and 34 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 30.6% strains of the whole showed significances, which was the same as in case of the fourth item. In group level (Table 22), 4, 1 and 1 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, it showed significance at 0.1% level, which was the same as in cases of the third and fourth items.

10. L/W and L/T of HG

C.c. and l.r. of L/T in L/W in the same strains were calculated, and c.c. are shown in the fourth columns from the left of Tables 16, 18 and 19. In **NI** (Table 18), 2, 1, 3; 2, 2, 4; 3, 3; 3, 11 and 14 strains showed significances at 0.1% (17, 18, 19), 1% (17, 18, 19) and 5% (18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 57.1, 35.3 and 41.7%

strains of the whole showed significances in 17, 18 and 19, respectively, in which the second figure was the same as in cases of the fourth, seventh, eighth and ninth items. In IV (Table 16), no strain showed significance, which was the same as in cases of first, second, fourth, fifth, seventh and ninth items. In SE (Table 19), 3, 3; 1, 1; 4, 4; 14, 2 and 16 strains showed significances at 0.1% (21, 23), 1% (22, 23) and 5% (22, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 17.7, 71.4 and 33.3% strains of the whole showed significances in 21, 22 and 23, respectively, in which the last figure was the same as in cases of the third and seventh items.

In SUM (24), 6, 5, 7 and 31 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 36.7% strains of the whole showed significances, which was the same as in case of the second item. In group level (Table 22), the whole of groups and summed-up group showed significances at 0.1% level, which was the same as in case of the fourth item.

11. L/W and W/T of HG

C.c. and l.r. of W/T on L/W in the same strains were calculated, and c.c. are shown in the fifth columns from the left of Tables 16, 18 and 19. In NI (Table 18), 3, 10, 13; 2, 2; 1, 3, 4; 3, 2 and 5 strains showed significances at 0.1% (17, 18, 19), 1% (18, 19) and 5% (17, 18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 57.1, 88.2 and 79.2% strains of the whole showed significances in 17, 18 and 19, respectively, in which the first figure was the same as in case of the tenth item. In IV (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level, which was the same as in case of the eighth item. In SE (Table 19), 6, 4, 10; 4, 4; 3, 1, 4; 4, 2 and 6 strains showed significances at 0.1% (21, 22, 23), 1% (21, 23) and 5% (21, 22, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 76.5, 71.4 and 75.0% strains of the whole showed significances in 21, 22 and 23, respectively, in which the second figure was the same as in case of the tenth item.

In SUM (24), 24, 6, 8 and 11 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 77.6% strains of the whole showed significances. In group level (Table 22), 2 and 4 groups showed significances at 1% level and no significance even at 5% level, respectively. In summed-up group, it showed significance at 5% level.

12. L/T and W/T of HG

C.c. and l.r. of W/T on L/T in the same strains were calculated, and c.c. are shown in the rightmost columns of Tables 16, 18 and 19. In NI (Table 18), 5, 12, 17; 2, 2, 4; 3 and 3 strains showed significances at 0.1% (17, 18, 19) and 1% (17, 18, 19) levels and no significance even at 5% level (18, 19), respectively. 100.0, 82.4 and 87.5% strains of the whole showed significances in 17, 18 and 19, respectively, in which the first figure was the same as in case of the sixth item. In IV (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level, which was the same as in cases of the eighth and eleventh items. In SE (Table 19), 16, 6, 22; 1, 1 and 2 strains showed significances at 0.1% (21, 22, 23) and 5% (21, 22, 23) levels, respectively. 100.0% strains of 21, 22 and 23 groups showed significances, which were the highest values through 12 items, presenting a particular phenomenon.

In SUM (24), 40, 4, 2 and 3 strains of the whole showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 93.9% strains of the whole showed significances, which was the highest values through the 12 items. In group level (Table 22), no significant group was found through the whole groups and summed-up group, which was the same as in cases of the first, second, sixth, seventh and eighth items.

13. Further discussion

Through the 12 items, significant items were found as 47.6% (40/84), 55.4% (113/204), 51.1% (153/288), 41.7% (5/12), 53.9% (110/204), 42.9% (36/84), 50.7% (146/288) and 51.7% (304/588) in order of the group Nos.17 to 24, respectively. There were no remarkable differences through the whole items. However, No.21 showed the highest value through the whole localities, which was a particular phenomenon.

III. *O. punctata* KOTSCHY

1. Length and width of UHG

C.c. and l.r. of W on L in the same strains were calculated, and c.c. are shown in the leftmost columns of Tables 9 and 10. In TA (Table 9), 1, 2, 3; 1, 1, 2; 3, 3; 1, 20 and 21 strains showed significances at 0.1% (25, 26, 27), 1% (25, 26, 27) and 5% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 23.1 and 27.6% strains of the whole showed significances in 25, 26 and 27, respectively. In KE (Table 10), 1, 1, 2; 1, 1; 1, 1; 4, 7 and 11 strains showed significances at 0.1% (28, 29, 30), 1% (29, 30) and 5% (29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 20.0, 30.0 and 26.7% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 3, 5; 2, 3; 1, 4; 12 and 32 strains showed significances at 0.1% (1984 and 1985 in the two countries [18 strains], abbreviated as 31, 1984, 1985 and 1988 in 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. 33.3 and 27.3% strains of the whole showed significances in 31 and 32, respectively. In group level (Table 11), 1 and 5 groups showed significance at 5% level and no significance even at 5% level, respectively. In summed-up group, 31 and 32 groups showed no significance even at 5% level and significance at 5% level, respectively.

2. Length and thickness of UHG

C.c. and l.r. of T on L in the same strains were calculated, and c.c. are shown in the second columns from the left of Tables 9 and 10. In TA (Table 9), 1, 1; 1, 1; 1, 1; 2, 24 and 26 strains showed significances at 0.1% (25, 27), 1% (26, 27) and 5% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 33.7, 7.7 and 10.4% strains of the whole showed significances in 25, 26 and 27, respectively. In KE (Table 10), 3, 3; 1, 1; 3, 2, 5; 2, 4 and 6 strains showed significances at 0.1% (29, 30), 1% (29, 30) and 5% (28, 29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 60.0% strains of the whole showed significances in the whole of 28, 29 and 30.

In SUM, 4, 4; 1, 2; 5, 6; 8 and 32 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. 55.6 and 27.3% strains of the whole showed significances in 31 and 32, respectively, in which the latter figure was the same as in case of the former item. In group level (Table 11), no significance was found through the whole groups. In summed-up group, significances at 5% level were found in both the cases of 31 and 32.

3. Width and thickness of UHG

C.c. and l.r. of T on W in the same strains were calculated, and c.c. are shown in the third columns from the left of Tables 9 and 10. In TA (Table 9), 1, 1; 2, 2; 2, 24 and 26 strains showed significances at 0.1% (25, 27) and 1% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 33.3, 7.7 and 10.4% strains of the whole showed significances in 25, 26 and 27, respectively, which were quite the same as in case of the second item. In KE

(Table 10), 3, 1, 4; 1, 1; 2, 8 and 10 strains showed significances at 0.1% (28, 29, 30) and 5% (29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 60.0, 20.0 and 33.3% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 5, 5; 0, 2; 1, 1; 12 and 36 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. 33.3 and 18.2% strains of the whole showed significances in 31 and 32, respectively. In group level (Table 11), 1, 1 and 4 groups showed significances at 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, 31 and 32 groups showed no significance even at 5% level and significance at 1% level, respectively.

4. L/W and L/T of UHG

C.c. and l.r. of L/T on L/W in the same strains were calculated, and c.c. are shown in the fourth columns from the left of Tables 9 and 10. In TA (Table 9), 2, 11, 13; 4, 4; 7, 7; 1, 4 and 5 strains showed significances at 0.1% (25, 26, 27), 1% (26, 27) and 5% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 84.6 and 82.8% strains of the whole showed significances in 25, 26 and 27, respectively, in which the first figure was the same as in case of the first item. They were the highest values through the former 4 items. In KE (Table 10), 2, 4, 6; 2, 2, 4; 2, 2; 1, 2 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. 80.0% strains of the whole showed significances in the whole of 28, 29 and 30. They were the highest values through the former 4 items.

In SUM, 8, 19; 4, 8; 2, 9; 4 and 8 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 81.2% strains of the whole showed significances in 31 and 32, respectively. Those were also the highest values through the former 4 items. In group level (Table 11), 2, 3 and 1 groups showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. In summed-up group, 31 and 32 groups showed significances at 0.1% level.

5. L/W and W/T of UHG

C.c. and l.r. of W/T on L/W in the same strains were calculated, and c.c. are shown in the fifth columns from the left of Tables 9 and 10. In TA (Table 9), 15, 15; 5, 5; 2, 3, 5; 1, 3 and 4 strains showed significances at 0.1% (26, 27), 1% (26, 27) and 5% (25, 26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 88.5 and 86.2% strains showed significances in 25, 26 and 27, respectively, in which the first figure was the same as in cases of the first and fourth items, and the second and third figures were the highest values through the whole of the former items. In KE (Table 10), 1, 2, 3; 1, 1; 1, 2, 3; 3, 5 and 8 strains showed significances at 0.1% (28, 29, 30), 1% (29, 30) and 5% (28, 29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 40.0, 50.0 and 46.7% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 3, 18; 1, 6; 5, 8; 9 and 12 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. 50.0 and 72.7% strains of the whole showed significances in 31 and 32, respectively. In group level (Table 11), 2 and 4 groups showed significances at 1% level and no significance even at 5% level, respectively. In summed-up group, 31 and 32 groups showed significances at 5% and 1% levels, respectively.

6. L/T and W/T of UHG

C.c. and l.r. of W/T on L/T in the same strains were calculated, and c.c. are shown in the

rightmost columns of Tables 9 and 10. In **TA** (Table 9), 2, 6, 8; 4, 4; 6, 6; 1, 10 and 11 strains showed significances at 0.1% (25, 26, 27), 1% (26, 27) and 5% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 61.5 and 62.1% strains of the whole showed significances in 25, 26 and 27, respectively, in which the first figure was the same as in cases of the first, fourth and fifth items. In **KE** (Table 10), 2, 9, 11; 1, 1; 1, 1; 2 and 2 strains showed significances at 0.1% (28, 29, 30), 1% (28, 30) and 5% (29, 30) levels and no significance even at 5% level (28, 30), respectively. 60.0, 100.0 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 cases of the second and third items. It was noticed that the value of 29 was particularly large.

In **SUM**, 13, 19; 1, 5; 1, 7; 3 and 13 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. 83.3 and 70.5% strains of the whole showed significances in 31 and 32, respectively. In group level (Table 11), 1 and 5 groups showed significances at 5% level and no significance even at 5% level, respectively, which were the same as in case of the first item. In summed-up group, no significance was found both in 31 and 32.

7. Length and width of HG

C.c. and l.r. of W on L in the same strains were calculated, and c.c. are shown in the leftmost columns of Tables 20 and 21. In **TA** (Table 20), 1, 1; 1, 1; 1, 1; 1, 25 and 26 strains showed significances at 0.1% (25, 27), 1% (26, 27) and 5% (25, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 3.9 and 10.4% strains of the whole showed significances in 25, 26 and 27, respectively, in which the first figure was the same as in cases of the first, fourth, fifth and sixth items, the second figure was particularly small, and the third figure was the same as in cases of the second and third items. In **KE** (Table 21), 1, 1; 5, 9 and 14 strains showed significances at 5% level (29, 30) and no significance even at 5% level (28, 29, 30), respectively. 0.0, 10.0 and 6.7% strains of the whole showed significances in 28, 29 and 30, respectively. It was noticed that the values of three groups were particularly small.

In **SUM**, 1, 1; 0, 1; 2, 2; 15 and 40 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. 16.7 and 9.1% strains of the whole showed significances in 31 and 32, respectively, which were also particularly the lowest values through the whole of the former items. In group level (Table 22), 1 and 5 groups showed significances at 5% level and no significance even at 5% level, respectively, which were the same as in cases of the first and sixth items. In summed-up group, no significance was found both in 31 and 32, which were the same as in case of the sixth item.

8. Length and thickness of HG

C.c. and l.r. of T on L in the same strains were calculated, and c.c. are shown in the second columns from the left of Tables 20 and 21. In **TA** (Table 20), 1, 1; 1, 1; 1, 2, 3; 2, 22 and 24 strains showed significances at 0.1% (26, 27), 1% (26, 27) and 5% (25, 26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 33.3, 15.4 and 17.2% strains of the whole showed significances in 25, 26 and 27, respectively, in which the first figure was the same as in cases of the second and third items. In **KE** (Table 21), 1, 1; 2, 2; 1, 1; 2, 9 and 11 strains showed significances at 0.1% (29, 30), 1% (28, 30) and 5% (28, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 60.0, 10.0 and 26.7% strains of the whole showed significances in 28, 29 and 30, respectively, in which the first, second and third figures were the same as in cases of the second, third and sixth items, the seventh item, and the first item, respectively.

In **SUM**, 1, 2; 2, 3; 2, 4; 13 and 35 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. 27.8 and 20.5% strains of the whole showed significances in **31** and **32**, respectively. In group level (Table 22), 1 and 5 groups showed significances at 5% level and no significance even at 5% level, respectively, which were the same as in cases of the first, sixth and seventh items. In summed-up group, no significance was found both in **31** and **32**, which were the same as in cases of the sixth and seventh items.

9. Width and thickness of HG

C.c. and l.r. of T on W in the same strains were calculated, and c.c. are shown in the third columns from the left of Tables 20 and 21. In **TA** (Table 20), 1, 1; 2, 2; 2, 2; 3, 21 and 24 strains showed significances at 0.1% (**26, 27**), 1% (**26, 27**) and 5% (**26, 27**) levels and no significance even at 5% level (**25, 26, 27**), respectively. 0.0, 19.2 and 17.2% strains of the whole showed significances in **25, 26** and **27**, respectively, in which the first figure was particularly small and the third figure was the same as in case of the eighth item. In **KE** (Table 21), 2, 1, 3; 3, 3; 3, 6 and 9 strains showed significances at 1% (**28, 29, 30**) and 5% (**29, 30**) levels and no significance even at 5% level (**28, 29, 30**), respectively. 40.0% strains of the whole showed significances in the whole of **28, 29** and **30** groups.

In **SUM**, 0, 1; 3, 5; 3, 5; 12 and 33 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. 33.3 and 25.0% strains of the whole showed significances in **31** and **32**, respectively, in which the first figure was the same as in cases of the first and third items. In group level (Table 22), 2 and 4 groups showed significances at 0.1% and no significance even at 5% level, respectively. In summed-up group, **31** and **32** groups showed significances at 1% and 0.1% levels, respectively.

10. L/W and L/T of HG

C.c. and l.r. of L/T on L/W in the same strains were calculated, and c.c. are shown in the fourth columns from the left of Tables 20 and 21. In **TA** (Table 20), 11, 11; 1, 3, 4; 1, 9, 10; 1, 3 and 4 strains showed significances at 0.1% (**26, 27**), 1% (**25, 26, 27**) and 5% (**25, 26, 27**) levels and no significance even at 5% level (**25, 26, 27**), respectively. 66.7, 88.5 and 86.2% strains of the whole showed significances in **25, 26** and **27**, respectively, in which the first, second and third figures were the same as in cases of the first, fourth, fifth, sixth and seventh items, the fifth item, and also the fifth item, respectively. In **KE** (Table 21), 2, 3, 5; 2, 2; 3, 5 and 8 strains showed significances at 0.1% (**28, 29, 30**) and 5% (**29, 30**) levels and no significance even at 5% level (**28, 29, 30**), respectively. 40.0, 50.0 and 46.7% strains of the whole showed significances in **28, 29** and **30**, respectively, in which the first, second and third figures were the same as in cases of the fifth and ninth items, the fifth item, and also the fifth item, respectively.

In **SUM**, 5, 16; 1, 4; 3, 12; 9 and 12 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, which were the same as in case of the fifth item. 50.0 and 72.7% strains of the whole showed significances in **31** and **32**, respectively. In group level (Table 22), 2, 2 and 2 groups showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. In summed-up group, both of **31** and **32** showed significances at 0.1% level, which were the same as in case of the fourth item.

11. L/W and W/T of HG

C.c. and l.r. of W/T on L/W in the same strains were calculated, and c.c. are shown in the fifth columns from the left of Tables 20 and 21. In **TA** (Table 20), 2, 19, 21; 1, 6, 7; 1 and 1

strains showed significances at 0.1% (25, 26, 27), 1% (25, 26, 27) and 5% (26, 27) levels, respectively. In other words, the whole strains (= 29) showed significances, and it was looked upon as a particular phenomenon. In **KE** (Table 21), 3, 3, 6; 3, 3; 2, 2; 2, 2 and 4 strains showed significances at 0.1% (28, 29, 30), 1% (29, 30) and 5% (29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 60.0, 80.0 and 73.3% strains of the whole showed significances in 28, 29 and 30, respectively, in which the first and second figures were the same as in cases of the second, third, sixth and eighth items, and the fourth item, respectively.

In **SUM**, 8, 27; 4, 10; 2, 3; 4 and 4 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 90.9% strains of the whole showed significances in 31 and 32, respectively, in which the first figure was the same as in case of the fourth item, and the second figure showed the highest values through the 12 items. In group level (Table 22), 2 and 4 groups showed significances at 5% level and no significance even at 5% level, respectively. In summed-up group, no significance was found both in 31 and 32, which was the same as in cases of the sixth, seventh and eighth items.

12. L/T and W/T of HG

C.c. and l.r. of W/T on L/T in the same strains were calculated, and c.c. are shown in the rightest columns of Tables 20 and 21. In **TA** (Table 20), 2, 3, 5; 3, 3; 3, 3; 1, 17 and 18 strains showed significances at 0.1% (25, 26, 27), 1% (26, 27) and 5% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 66.7, 34.6 and 37.9% strains of the whole showed significances in 25, 26 and 27, respectively, in which the first figure was the same as in cases of the first, fourth, fifth, sixth, seventh and tenth items. In **KE** (Table 21), 5, 6, 11; 3, 3; 1 and 1 strains showed significances at 0.1% (28, 29, 30), 1% (29, 30) and 5% (29, 30) levels, respectively. In other words, the whole of the strains (= 15) showed significances, and it was looked upon as a particular phenomenon.

In **SUM**, 13, 16; 3, 6; 1, 4; 1 and 18 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, in which value of 31 was the highest through 12 the items. 94.4 and 59.1% strains of the whole showed significances in 31 and 32, respectively, in which the first figure was the highest value through the 12 items. In group level (Table 22), no significant group was found through the whole groups (= 6), which was the same as in case of the second item. In summed-up group, 31 and 32 showed significances at 5% and 0.1% levels, respectively.

13. Further discussion

Through the whole items, significant items were found as 55.6% (20/36), 44.6% (139/312), 45.7% (159/348), 51.7% (31/60), 52.5% (63/120), 52.2% (94/180), 52.8% (114/216) and 47.9% (253/528) in order of the group **Nos.25** to **32**, respectively. There were no remarkable difference through the whole items.

In comparison with 31 and 32, 4 items, *i.e.*, Nos.4, 5, 10 and 11, showed comparatively high significances in 32 rather than in 31, and the remaining 8 items showed the reversed results.

IV. *O. brachyantha* CHEV. et ROEHR.

In the eighth and eleventh items, they showed significances at 1% and 0.1% levels, respectively. On the other hand, in the remaining 10 items, no significance was found at all. It may be said that the strain was located on a fairly unstable status in the whole wild species, seen from the viewpoint of evolutionary characters.

Summary

During the periods from October to November in 1984, from August to November in 1985 and from May to August in 1988, the writer was dispatched to the 8 countries of Africa, *i.e.*, Madagascar, Tanzania, Kenya, Nigeria, Ivory Coast, Liberia, Senegal and Gambia, for collecting the wild and cultivated rices. During the trips, 284 strains of wild rice, *i.e.*, 190 strains of *Oryza longistaminata* CHEV. et ROEHR., 49 of *Oryza breviligulata* CHEV. et ROEHR., 44 of *Oryza punctata* KOTSCHY, and 1 of *Oryza brachyantha* CHEV. et ROEHR., were collected and many populations of those were observed. To confirm the varietal variations, 12 mutual relationships among 24 characters fixed in view of the practical values, were investigated in this report, following the contents of the previous papers. The main results obtained were summarized as follows.

Concerning correlation coefficients among 12 character-combinations, 66.7, 45.4, 50.0, 75.0, 48.2, 48.9, 56.7, 58.3, 63.5, 62.8, 48.8, 67.6, 67.9, 67.7, 63.7, 56.3; 47.6, 55.4, 51.1, 41.7, 53.9, 42.9, 50.7, 51.7; 55.6, 44.6, 45.7, 51.7, 52.5, 52.2, 52.8, 47.9; 16.7; 50.2 and 64.1% in the whole strains showed significant relations in order of the group No.1 to No.35, respectively. It was confirmed that the values of group No.4 (= 75.0%) and No.33 (= 16.7%) were fixed to be the highest one and the lowest one through the whole groups, respectively.

Species differentiations and character-combinations were extensively found. Moreover, locality-specificities were detected to some extent. For example, strains of West Africa showed the higher significances than those of East Africa in *O. longistaminata*. In Tanzania (4, 5, 6, 25, 26, 27), the significant values were found as the highest levels through the whole localities in the eleventh item in *O. longistaminata* and *O. punctata*, too. It was noticeable that the highest significances were found in the eleventh, the twelfth and the twelfth items in *O. longistaminata*, *O. breviligulata* and *O. punctata*, respectively.

Further discussions should be made in the following papers, concerning the species and strain differentiations.

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