

Grain Morphology of Wild Rice in African Countries (VI)

Tadao C. KATAYAMA

(Laboratory of Crop Science)

Received for Publication September 7, 1995

Introduction

On the distribution of wild rice in Africa, some few scientific reports have been published^{1, 2, 4, 5, 24-27)}. Although Africa has been considered to be one of the most important distribution areas of the wild rice in the world, accumulations of complete data on these aspects is far from being perfect. Taking these facts into account, the present study-series were made to ascertain exactly the distribution, and the geographical, seasonal and ecotypic differentiations of wild rice in African areas.

Recently wild *Oryza* species have frequently been studied from several agronomic viewpoints. For example, Yuan *et al.* (1992)²⁹⁾ reported wild rice close to the *japonica* type of *O. sativa*. Xw *et al.* (1993)²⁸⁾ studied interspecific superoxide dismutase zymogram of genus *Oryza*. Farooq *et al.* (1992)³⁾ reported about variability in salt-tolerance of accessions of wild rice species, *Oryza punctata* and *O. officinalis*. Reimers *et al.* (1993)²³⁾ studied wild species of *Oryza* in the resistance to rice blast (Bl). These wild rices mentioned above may be used in the wider ranges of agronomy. These are the reasons why wild rice should be studied in the global viewpoints.

The writer made research trips in 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 reported¹⁵⁻¹⁷⁾. Further, in the previous papers else than these, habitat and the records of the morphological characters of the unhusked grains¹⁸⁾, the husked grains¹⁹⁾, the comparative data (= husked/unhusked)²⁰⁾, grain-areas and -volumes²¹⁾ and correlation coefficients between the practical values of the unhusked and husked grains and linear regression between these²²⁾. Concerning the wild rices collected in 1984, 1985 and 1988 were described, with the confirmation of the morphological characters of grains, in order to make the strains' specificities more obvious.

In the present paper, the following 12 mutual relationships among 24 characters in view of practical values were mainly described.

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 coefficients between the two were calculated through the whole characters, *i.e.*, the comparative values (Tables 1 to 11) and the comparison of the unhusked with the husked grains (Tables 12 to 22), linear regression being 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 are 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. In these tables, 6 morphological character-combinations of the grains are 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 both the 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 noted each.

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

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

1. Comparative values of length and width

Correlation coefficient (abbreviated as c.c.) and linear regression (abbreviated as l.r.) of width (W) on length (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), 2, 1, 3; 2, 2, 4; 2, 3, 5; 7, 41 and 48 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. 46.2, 12.8 and 20.0% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 2), 2, 2; 3, 3; 1, 31 and 32 strains showed significances at 1% (1985 [abbreviated as 5], 1984 and 1985 [6]) and 5% (5, 6) levels and no significance even at 5% level (1984 [abbreviated as 4], 5, 6), respectively. 0.0, 13.9 and 13.9% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 3), 5 and 5 strains showed significances at 0.1% level and no significance even at 5% level, respectively (1985 [abbreviated as 7]). Just half strains of the whole showed significances.

In **NI** (Table 4), 1, 9, 10; 2, 2; 1, 2, 3; 3, 16 and 19 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, 44.8 and 44.1% strains of the whole showed significances at 8, 9 and 10, respectively. In **IV** (Table 5), no significant strain was found (1984 [abbreviated as 11]). In **SE** (Table 6), 5, 3, 8; 5, 5; 5, 1, 6; 20, 3 and 23 strains showed significances at 0.1% (Casamance [abbreviated as 12], northern [13], both regions [14], in 1985), 1% (12, 14) and 5% (12, 13, 14) levels and no significance even at 5% level (12, 13, 14), respectively. 42.9, 57.1 and 45.2% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 25, 26, 8, 18; 9, 13, 6, 7; 11, 17, 8, 9; 62, 134, 85 and 49 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. 42.1, 29.5, 20.6 and 41.0% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of West Africa (35) showed higher significances than those of East Africa (34).

In group level (Table 11), 3, 1 and 9 groups showed significances at 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, **34** showed significances at 1% level, but **15, 16 and 35** showed no significance even at 5% level.

Table 1. Correlation coefficient of the six components ; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of W/T on L/T; collected in Madagascar, *O. longistaminata*, 301-303 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	0.5000**	0.1890	0.7559***	0.5000**	-0.6457***	0.3273
302	-0.3130	-0.4013*	0.3787*	0.6261***	-0.5332**	0.3187
303	-0.0191	0.3273	0.2641	0.5397**	-0.7452***	0.1537
304	0.1021	0.0674	0.6599***	0.8335***	0.2469	0.7385***
305	0.4117*	0.8135***	0.2456	0.6031***	-0.7177***	0.1203
306	0.7559***	0.6820***	-0.9022***	-0.5563**	-0.9535***	0.7759***
307	0.3504	0.0153	-0.4196*	-0.2398	-0.7236***	0.8163***
308	0.9980***	0.9466***	-0.9649***	-0.9761***	-0.9899***	0.9970***
309	0.0493	0.7906***	0.1550	-0.3960*	-0.6947***	0.9337***
310	0.5000**	0.9934***	0.3974*	0.5000**	-0.9820***	0.6547***
311	0.1917	0.3953*	0.6063***	0.6480***	-0.7174***	0.0560
312	0.2121	0.1956	0.5613**	0.7586***	-0.5412**	0.1249
313	-0.4193*	-0.5000**	0.9959***	0.9862***	0.9608***	0.9934***
Average	0.7501**	0.3577	0.6837**	0.6793*	0.0091	0.7006**
2001	-0.1547	0.1153	0.0937	0.4447*	-0.7114***	0.3111
2002	0.0119	0.3170	0.1807	0.4237*	-0.6857***	0.3632*
2003	-0.1920	0.0685	0.0501	0.4852**	-0.6567***	0.3345
2004	0.1933	0.0183	-0.0078	0.4386*	-0.5850***	0.4591*
2005	0.2383	0.1364	0.3252	0.4956**	-0.4297*	0.5682**
2006	0.0074	0.2506	0.3047	0.5517**	-0.7423***	0.1416
2007	0.1473	0.1610	0.5116**	0.6441***	-0.5589**	0.2648
2008	0.1265	0.2968	0.2712	0.7092***	-0.5636**	0.1731
2009	0.0527	0.2799	0.3678*	0.5572**	-0.5584**	0.3709*
2010	0.1294	0.2329	0.2278	0.2715	0.6858***	0.4953**
2011	0.0273	0.0751	0.1073	0.4755**	-0.7471***	0.2157
2012	0.2600	0.1409	0.1250	0.3964*	-0.4161*	0.6626***
2013	-0.0375	0.1976	0.0866	0.3856*	-0.4998**	0.6017***
2014	0.2389	0.1379	0.0684	0.2205	-0.8003***	0.3966*
2015	0.3403	-0.1234	0.3010	0.6145***	-0.4823**	0.3886*
2016	-0.1063	0.0864	0.2835	0.4914**	-0.6056***	0.3859*
2017	-0.0735	0.1194	0.0379	0.3266	0.5318**	0.6238***
2018	-0.0586	-0.1189	-0.2592	0.3722*	-0.6033***	0.5112**
2019	0.3209	0.3025	-0.5117**	0.1838	-0.7597***	0.4724**
2020	0.2228	0.5214**	0.2742	0.7432***	-0.1993	0.5041**
2021	0.3384	0.2474	0.1144	0.1582	-0.8108***	0.4405*
2022	0.0924	0.2717	-0.0397	0.3862*	-0.7246***	0.3400
2023	0.2113	0.0153	-0.2357	0.0389	-0.6591***	0.7389***
2024	-0.3121	0.1238	-0.0980	0.4235*	-0.6468***	0.4095*
2025	0.3220	0.0003	0.1342	0.2199	-0.6112***	0.6309***
2026	-0.0069	0.0893	-0.1842	0.3382	-0.7543***	0.3518

(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	0.1639	0.0262	0.0090	0.5540**	-0.4496*	0.4919**
2028	0.1705	0.2271	0.1379	0.2528	-0.6830***	0.5291**
2029	-0.1546	-0.0193	0.0773	0.5262**	-0.4242*	0.5422**
2030	0.3556	-0.2035	0.2972	0.6783***	-0.0553	0.6909***
2031	0.4112*	-0.1891	-0.2105	0.3364	-0.4709**	0.6664***
2032	-0.1740	0.2979	0.0856	0.6245***	0.7113***	0.0960
2033	0.0900	0.1837	0.2429	0.0975	-0.7458***	0.5826***
2034	0.2415	0.3905*	0.2403	0.4962**	0.6107***	0.3724*
2035	0.0626	0.0344	-0.0831	0.1610	-0.6643***	0.6227***
2036	0.4318*	0.0500	-0.1857	0.1733	-0.5260**	0.7417***
2037	-0.0541	-0.1443	0.1743	0.6766***	-0.5228**	0.1217
2038	0.1016	-0.1642	0.0469	0.4820**	-0.4950**	0.5146**
2039	-0.3141	0.1472	0.2274	0.4381*	-0.7270***	0.2869
2040	-0.2715	-0.0618	0.0437	0.3358	-0.6106***	0.5283**
2041	-0.1374	0.1909	-0.1010	0.4355*	-0.7275***	0.2768
2042	0.3712*	0.1330	0.0547	0.4271*	0.5343**	0.5259**
2043	0.5578**	0.1897	-0.1438	0.1134	-0.6042***	0.7198***
2044	0.1459	-0.6623***	0.0507	0.6393***	0.1041	0.8282***
2045	0.4955**	-0.0436	0.1756	0.4494*	-0.4781**	0.6511***
2046	0.6155***	0.3957*	0.3292	0.0738	-0.7569***	0.5889***
2047	0.3433	-0.1913	0.2686	0.4442*	-0.6403***	0.3991*
Average	0.0443	-0.0469	0.1022	0.3913**	-0.4972***	0.0689
Average of both groups	0.2299	0.0535	0.0790	0.3887**	-0.4437***	0.1031

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 the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	-0.0452	0.1858	-0.1209	0.1736	0.4286*	0.8083***
2048	0.4041*	0.1121	-0.1509	0.0033	-0.6952***	0.3905*
2049	0.0579	0.1312	0.6288***	0.7868***	-0.5929***	0.0197
2050	0.0291	0.2095	0.4153*	0.6500***	-0.7050***	0.0747
2051	0.2384	-0.2049	0.0795	0.4490*	-0.4417*	0.5997***
2052	-0.0363	0.4255*	0.1858	0.3207	-0.7108***	0.3303
2053	0.3218	-0.2642	-0.2546	0.2373	-0.4751**	0.7387***
2054	-0.1116	0.2933	-0.2577	0.1494	-0.7152***	0.5684**
2055	-0.3155	0.0917	-0.0800	0.4925**	-0.7740***	0.1644

(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	0.0548	-0.1666	0.0910	0.6816***	0.5832***	0.1813
2057	-0.2239	-0.1750	0.4606*	0.7004***	0.7147***	-0.0108
2058	0.0950	-0.1703	-0.2372	0.6232***	-0.4438*	0.4171*
2059	0.1727	-0.0269	0.4284*	0.6880***	-0.4797**	0.3028
2060	0.1866	-0.0701	0.2960	0.5332**	-0.5346**	0.4204*
2061	0.1721	0.1091	0.0920	0.3073	0.5667**	0.6055***
2062	-0.0216	-0.1046	0.3969*	0.7739***	-0.4712**	0.1868
2063	0.2141	0.3560	0.4122*	0.5632**	-0.6676***	0.2314
2064	0.5652**	-0.1019	0.0756	0.5604**	0.0462	0.7988***
2065	-0.3344	-0.4219*	0.2241	0.6968***	-0.6584***	0.0746
2066	-0.1585	0.4102*	0.3547	0.6464***	-0.7121***	0.0626
2067	0.4007*	-0.0169	-0.1399	0.5088**	0.2943	0.6697***
2068	0.1319	0.3741*	0.1092	0.1959	-0.7818***	0.4500*
2069	0.1514	0.3575	0.3214	0.6283***	0.5255**	0.3276
2070	-0.4864**	-0.1662	0.4172*	0.6750***	-0.6456***	0.1229
2071	0.2178	-0.3614*	0.4772**	0.6480***	-0.3087	0.5215**
2072	0.0352	-0.0798	0.4127*	0.5293**	-0.7964***	0.0826
2073	-0.0982	-0.0724	0.7227***	0.8078***	-0.0735	0.5272**
2074	0.3383	0.1762	0.1640	0.2634	-0.7328***	0.4580*
2075	0.3206	-0.2589	-0.1302	0.3268	-0.4756**	0.6719***
2076	0.0487	0.1109	0.0209	0.6868***	-0.5004**	0.2810
2077	-0.1251	-0.0760	0.2570	0.5383**	0.7177***	0.1926
2078	-0.3731*	0.0614	-0.0762	0.4780**	-0.7666***	0.1874
2079	-0.0649	-0.1593	0.4442*	0.6169***	-0.7690***	0.0075
2080	-0.0983	-0.3337	0.1288	0.5569**	-0.3933*	0.5419**
2081	0.0807	0.0700	0.3816*	0.7250***	-0.5244**	0.1997
2082	0.1461	0.3383	0.3987*	0.0125	-0.7866***	0.6163***
2083	-0.3377	-0.0874	0.1903	0.5511**	-0.6067***	0.3262
Average	0.4444**	0.6012***	0.5700***	0.7162***	-0.5557***	0.1629
Average of both groups	0.4566**	0.5973***	0.5205***	0.6830***	-0.5607***	0.2039

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. Comparative values of length and thickness

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), 5, 1, 6; 1, 1, 2; 2, 2, 4; 5, 43 and 48 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. 61.5, 8.5 and 20.0% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 2), 5, 5; 1, 31 and 32 strains showed significances at 5% (5, 6) and no significance even at 5% level (4, 5, 6), respectively. 0.0, 13.9 and 13.5% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 3), 2, 3 and 5 strains showed significances at 0.1% and 5% levels and no significance

Table 3. Correlation coefficient of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	0.1838	-0.3626*	0.4188*	0.7847***	-0.0900	0.5435**
316	0.3576	0.0600	0.3130	0.7276***	-0.1405	0.5707***
317	0.2627	0.3439	-0.0657	0.4582*	-0.6614***	0.3561
318	0.8159***	-0.2065	0.0393	0.9670***	0.7405***	0.8864***
319	0.0871	0.3950*	0.0021	0.2909	-0.7058***	0.4572*
320	-0.8199***	0.3075	-0.2143	0.6508***	-0.7580***	-0.0077
321	0.8075***	-0.6047***	-0.0403	0.1481	-0.4226*	0.8271***
322	-0.0516	-0.4502*	0.0717	0.3480	-0.4115*	0.7043***
323	0.8581***	0.3485	0.1433	-0.3952*	-0.7521***	0.8984***
324	0.9900***	0.9900***	0.9900***	0.9900***	0.9900***	0.9900***
Average	-0.1416	0.3994	0.0897	0.8102**	-0.4893	0.0883

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

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

even at 5% level, respectively (7). Just half strains showed significances, which was the same as in case of the former item.

In NI (Table 4), 12, 12; 5, 5; 5, 12 and 17 strains showed significances at 0.1% (9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 0.0, 58.6 and 50.0% strains of the whole showed significances in 8, 9 and 10, respectively. In IV (Table 5), no significant strain was found (11), which was the same as in case of the former item. In SE (Table 6), 6, 3, 9; 3, 3; 4, 3, 7; 22, 1 and 23 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) level, respectively. 37.1, 85.7 and 45.2% strains of the whole showed significances in 12, 13 and 14, respectively.

In SUM, 28, 29, 8, 21; 4, 5, 2, 3; 17, 24, 12, 12; 58, 132, 85 and 47 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. 45.8, 30.5, 20.6 and 43.4% strains of the whole showed significances in 15, 16, 34 and 35, respectively, which were nearly the same values of the former item. It was noted that strains of West Africa (35) showed relatively higher significances than those of East Africa (34), which was also the same as in case of the former item.

In group level (Table 11), 4, 1 and 8 groups showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. In summed-up group, 15, 16 and 35, and 34 showed significances at 0.1% and 1% level, respectively.

3. Comparative values of width and thickness

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), 6, 6; 1, 2, 3; 3, 1, 4; 3, 44 and 47 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. 76.9, 6.4 and 21.7% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 2), 2, 2; 1, 1; 10, 10; 1, 23 and 24 strains

Table 4. Correlation coefficient of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	-0.2278	-0.1651	0.5455*	0.8307***	0.5628**	0.0115
326	0.1219	0.1428	-0.0718	0.5118**	-0.5930***	0.3792*
327	0.4161*	-0.1059	-0.1507	0.4581*	0.3528	0.6653***
335	0.5763***	0.1914	0.5676**	0.4834**	0.3491	0.6330***
336	0.2538	0.2246	0.2923	0.3078	-0.3678*	0.7655***
Average	-0.1929	-0.3556	0.9071*	0.4149	0.5026	0.6588
337	-0.7986***	-0.2182	0.0183	0.6783***	-0.7539***	0.0298
338	0.7421***	0.6621***	0.4804**	0.3939*	-0.5603**	0.5278**
339	0.6961***	0.0581	0.6068***	0.4241*	0.5530**	0.5175**
340	0.2942	0.8131***	0.3091	0.0197	-0.6168***	0.7986***
341	0.7941***	-0.8216***	-0.6134***	0.0851	-0.4261*	0.9356***
342	-0.3203	0.7785***	0.0935	0.0397	-0.7086***	0.6654***
343	0.6047***	0.2384	0.2471	-0.1491	-0.7976***	0.7052***
345	-0.3273	-0.8420***	0.6497***	0.9193***	0.1718	0.2273
346	0.1435	0.0652	0.0903	0.4240*	-0.6283***	0.4325*
348	-0.3292	-0.2687	0.2160	0.5962***	0.5962***	0.1488
349	0.2751	0.9465***	0.4774**	0.6548***	-0.8254***	0.1161
352	0.1502	0.4343*	0.2488	-0.0918	-0.7587***	0.7126***
354	0.0534	0.2014	0.1287	0.2378	-0.7230***	0.4845**
355	0.8486***	0.2572	0.2498	0.8628***	0.5806***	0.9121***
357	0.6736***	0.3766*	0.0000	-0.4313*	-0.7583***	0.8888***
358	-0.0900	0.7523***	-0.0267	-0.0100	-0.8872***	0.4605*
360	0.4778**	0.5789***	0.1979	0.0849	-0.6396***	0.8141***
362	0.0995	0.2042	0.9682***	0.9132***	-0.9657***	0.7892***
364	-0.0689	-0.6974***	0.4431*	0.1894	-0.6947***	0.5739***
365	0.1383	0.1482	0.5374**	0.7829***	-0.5667**	0.0657
369	0.3889*	0.0817	0.2100	0.2652	-0.4495*	0.7421***
371	-0.1531	-0.4176*	-0.0589	0.7693***	-0.2132	0.4551*
373	0.6719***	0.8062***	0.7667***	0.2311	-0.5255***	0.7063***
375	-0.9352***	0.3281	0.5223**	0.7631***	0.7663***	0.1789
377	0.0648	0.4423*	0.0595	0.0846	-0.8124***	0.6340***
378	-0.4963**	0.4087*	0.2564	0.6393***	0.7731***	0.0100
379	-0.4274*	-0.1961	-0.4015*	0.0735	-0.6392***	0.7181***
381	0.2726	0.9282***	-0.0333	-0.8920***	-0.9946***	0.9340***
382	0.2303	-0.6667***	0.4277*	0.6532***	-0.6838***	0.0968
Average	-0.0385	0.4903**	0.6602***	0.8204***	-0.8281***	-0.3837*
Average of both groups	0.1222	0.2872	0.6937***	0.8414***	-0.7668***	-0.3206

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 the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	-0.0834	0.0241	0.1331	0.6218***	-0.5700**	0.2844
385	0.0596	-0.1538	0.3002	0.7690***	-0.3139	0.3735*
386	-0.0157	0.1671	0.4850**	0.7239***	0.5286**	0.1948
387	0.2056	0.2065	0.0060	0.3422	-0.5947***	0.5442**
388	0.1812	0.1105	0.4163*	0.5059**	-0.5266**	0.4599*
389	-0.0204	0.1062	0.2083	0.4450*	-0.6103***	0.4304*
390	0.2209	-0.0768	0.1230	0.4683**	-0.4509*	0.5737***
Average	0.1174	0.6513	0.4434	0.8802**	-0.7270	-0.3451
383	0.0904	0.0434	-0.1991	0.5738***	-0.4078*	0.4980**

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 the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	0.0511	-0.3440	0.2284	0.7290***	-0.4357*	0.2931
392	0.3385	0.1336	0.7237***	0.2519	-0.7067***	0.4588*
393	0.0000	0.5077**	-0.7666***	-0.7739***	-0.9550***	0.9183***
394	-0.1836	-0.0255	0.5166**	0.8968***	-0.0621	0.3857*
395	0.2100	-0.3612*	-0.0759	0.5270**	-0.3487	0.6127***
396	-0.4234*	-0.0754	0.6651***	0.9066***	-0.0132	0.4036*
397	0.4939**	0.7321***	0.3015	0.1305	-0.5965***	0.7124***
399	0.1070	-0.1380	0.0144	0.5339**	-0.5569**	0.3967*
400	0.2500	0.6313***	0.8256***	0.5204**	-0.3259	0.6156***
401	-0.2022	-0.0770	0.0375	0.4212*	-0.5479***	0.5241**
402	-0.8452***	0.3747*	-0.5115**	0.4175*	0.7327***	0.3020
406	0.3503	0.7906***	0.0000	0.2378	-0.9537***	0.5061**
407	0.3612*	-0.8607***	-0.6994***	0.1806	-0.2365	0.8935***
408	-0.4877**	-0.2354	-0.3235	0.4280*	-0.8891***	0.0289
409	-0.9001***	0.0164	-0.4303*	0.2892	-0.7417***	0.4263*
411	-0.1600	-0.2976	0.7262***	0.8513***	-0.8562***	-0.4592*
412	0.1204	-0.1922	0.2782	0.7833***	-0.2697	0.3873*
414	-0.2602	0.5417**	-0.2802	0.1066	-0.7454***	0.5789***
416	-0.3344	-0.3997*	0.0851	0.4408*	-0.7470***	0.2671
419	0.1819	0.3059	0.5968***	0.5642**	-0.5245**	0.4019*
420	-0.2368	0.1030	-0.2622	0.1315	-0.8197***	0.4582*

(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	-0.2004	-0.3007	0.3750*	0.6376***	-0.3521	0.4964**
424	-0.4899**	0.5533**	0.3721*	0.4086*	0.4511*	0.6182***
426	0.9996***	0.9987***	0.9997***	0.9939***	0.9959***	0.9799***
427	0.0690	-0.0599	-0.1135	0.3466	0.4905**	0.6127***
429	0.3879*	0.0975	0.4246*	0.5725***	-0.4089*	0.5033**
431	-0.2597	0.1733	-0.2897	0.3705*	-0.7259***	0.3536
433	0.5411**	0.3462	0.5874***	0.6214***	-0.4427*	0.4210*
434	0.4674**	0.0199	0.4877**	0.3624*	0.5313**	0.5950***
435	0.3780*	0.6348***	0.6170***	0.2303	-0.3558	0.8240***
436	0.8461***	0.0891	-0.0144	0.6109***	-0.8396***	0.9384***
437	0.4115*	-0.3955*	0.7150***	0.8837***	0.2006	0.6357***
439	-0.2020	-0.1387	0.6444***	0.7833***	0.2365	0.4138*
440	0.6547***	0.1890	0.8660***	0.8386***	0.6547***	0.9608***
441	-0.3362	-0.1224	0.3178	0.9310***	0.3931*	-0.0307
Average	0.3306	0.5869***	0.7810***	0.7845***	-0.3397*	0.3020
444	-0.9939***	0.4490*	0.5100**	0.2045	-0.7454***	0.8005***
447	0.3304	0.8531***	0.4207*	0.6151***	-0.8769***	-0.1692
449	0.3390	0.2437	0.8098***	0.7803***	-0.3625*	0.2686
451	0.3822***	0.5839***	-0.4910**	0.6504***	-0.6020***	0.2028
452	0.2182	0.3859*	0.9264***	0.4372*	-0.1479	0.8248***
454	-0.3932*	0.3632*	0.9979***	0.9793***	0.2454	0.4134*
455	-0.7566***	0.7988***	-0.8559***	0.3899*	-0.9895***	0.5107**
Average	0.4442	0.3336	0.7297	0.6423	-0.2007	0.6156
Average of both groups	0.3436*	0.5659***	0.7769***	0.7703***	-0.3260*	0.3370*

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 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, 36.1 and 35.1% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 3), 1, 1 and 8 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively (7). 20.0% strains of the whole showed significances.

In NI (Table 4), 5, 5; 2, 4, 6; 3, 3; 3, 17 and 20 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, 41.4 and 41.2% strains of the whole showed significances in 8, 9 and 10, respectively, which were nearly the same values in case of the 1st item. In IV (Table 5), 1, 1 and 5 strains showed significances at 1% and 5% levels and no significance even at 5% level, respectively (11). 28.6% strains of the whole showed significances. In SE (Table 6), 13, 4, 17; 3, 2, 5; 4, 1, 5; 15 and 15 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. 57.1, 100.0 and 64.3% strains of the whole showed significances in 12, 13 and 14, respectively.

Table 7. Correlation coefficient of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	-0.3148	0.1445	0.2908	0.6862***	-0.6163***	0.1366
329	0.2414	0.4517*	0.5367**	0.8521***	-0.2186	0.2891
330	0.1961	-0.2665	0.1254	0.7677***	0.0466	0.6394***
331	0.4375*	-0.4860**	0.4158*	0.5163**	-0.3858*	0.5826***
332	0.4699**	0.3938*	0.4872**	0.3521	-0.6399***	0.4765**
333	0.4171*	0.0832	0.0803	0.2996	-0.3818*	0.7457***
334	0.2499	0.4219*	0.1056	0.1120	-0.7997***	0.4892**
Average	0.3940	-0.2140	-0.0597	0.2066	-0.7924*	0.4118
344	0.2446	0.3556	0.8200***	0.8520***	-0.9090***	-0.5728***
347	-0.0113	0.1529	0.3002	0.6444***	-0.6118***	0.1857
350	-0.0760	-0.0704	0.2425	0.5751***	-0.4876**	0.4232*
351	-0.0788	-0.0786	0.1317	0.2398	-0.8767***	0.2389
353	0.4193*	-0.0865	0.1630	0.3043	-0.3544	0.7661***
356	0.2349	0.1044	0.6381***	0.5812***	-0.3687*	0.5193**
359	0.0789	0.2116	0.3241	0.4139*	-0.6534***	0.3909*
361	0.2432	-0.2457	0.7391***	0.7656***	-0.7714***	-0.1952
363	-0.2109	0.0717	0.6535***	0.8022***	-0.7576***	-0.3983*
366	0.0506	-0.1713	0.7375***	0.6537***	-0.4205*	0.3646*
367	0.0320	-0.1664	0.2992	0.5811***	-0.5339**	0.3668*
368	-0.0353	0.1318	0.2887	0.3671*	-0.7115***	0.3786*
370	0.2274	0.0584	0.1400	0.4603*	-0.3979*	0.6220***
372	-0.2202	0.2131	0.1692	0.4680**	-0.6149***	0.3841*
374	0.3826*	0.0357	0.2354	0.5567**	-0.3615*	0.5567**
376	-0.1033	0.0117	0.3406	0.5641**	-0.4076*	0.5183**
380	0.3532	0.6844***	0.4913**	0.4436*	-0.8640***	0.0709
Average	-0.6279**	0.3505	0.0639	0.5602*	-0.5951*	0.3570
Average of both groups	-0.2694	0.2455	0.0042	0.4745*	-0.5956**	0.4466*

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, 29, 31, 9, 22; 13, 16, 4, 12; 13, 24, 15, 9; 52, 119, 79 and 40 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. 51.4, 37.4, 26.2 and 51.8% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of West Africa (35) showed remarkably higher significances than those of East Africa (34), which was the same as in cases of the former two items.

In group level (Table 11), 6, 1, 1 and 5 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 8. Correlation coefficient of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	0.4268*	0.5505**	0.3371	0.0286	-0.8025***	0.6135***
403	0.4138*	-0.3649*	0.7310***	0.9202***	-0.3192	0.0589
404	0.2926	0.0225	0.4040*	0.6259***	-0.4715**	0.3674*
405	0.2185	-0.2440	0.1448	0.5300**	0.6900***	0.2286
410	0.4082*	-0.2282	0.0000	0.2091	0.5485**	0.6849***
413	0.5371**	0.0801	0.3727*	0.7370***	-0.0369	0.6394***
415	0.2217	0.2967	-0.0943	0.4071*	-0.3508	0.6930***
417	-0.8660***	-0.2540	0.6599***	0.8278***	0.3306	0.8032***
418	-0.0887	0.3458	0.2791	0.5744***	-0.7864***	0.0449
421	0.2386	-0.1160	0.7685***	0.3890*	-0.6873***	0.2821
422	0.1330	-0.5938***	0.3862*	0.1520	-0.5642**	0.7254***
425	0.1363	0.0125	0.2583	0.3439	-0.4857**	0.6465***
428	0.1068	0.6823***	0.6575***	0.5402**	-0.3930*	0.5614**
430	0.4985**	0.1555	0.1876	0.2516	-0.3893*	0.7806***
432	0.4167*	0.3956*	0.4747**	0.4734**	-0.6360***	0.3381
438	0.5825***	0.8977***	0.4836**	0.3733*	-0.8624***	0.1315
442	0.1694	0.3387	0.4708**	0.4829**	-0.7469***	0.2109
Average	0.0726	0.0284	0.9056***	0.9442***	0.1072	0.4244
443	0.1203	0.1953	0.5507**	0.6682***	-0.6811***	0.0723
445	0.3786*	0.2644	0.0937	0.5330**	-0.7423***	0.1473
446	0.0309	-0.1954	0.6503***	0.8000***	-0.3159	0.3055
448	0.0400	0.0420	0.5077**	0.7192***	-0.4672**	0.2548
450	0.4633**	0.8509***	0.0748	-0.0078	-0.6538***	0.7605***
453	0.1738	0.0204	0.1467	0.6387***	-0.7142***	0.0512
456	0.6327***	0.1967	0.7148***	0.7366***	-0.5149**	0.1870
Average	-0.5208	0.5106	0.0981	0.2247	-0.8398*	-0.4591
Average of both groups	0.1177	0.0025	0.8823***	0.9312***	-0.0512	0.3073
475	0.0271	0.2161	0.0240	0.3153	-0.4735**	0.6872***

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. Comparative values of L/W and L/T

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), 7, 8, 15; 4, 10, 14; 1, 13, 14; 1, 16 and 17 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, 66.0 and 71.7% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 2), 16, 16; 10, 10; 1, 1; 1, 9 and 10 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, 75.0 and 73.0% strains of the whole showed

Table 9. Correlation coefficient of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	-0.0510	0.0512	-0.0203	0.5769***	-0.3674*	0.5461**
458	0.1047	-0.1015	0.5361**	0.6933***	0.2358	0.8624***
459	-0.2647	-0.2291	0.0559	0.3936*	-0.2553	0.7865***
Average	0.8660	-0.7559	-0.3273	0.9990***	0.9608	0.9608
2084	0.3655*	-0.2166	-0.0716	0.3622*	-0.5035**	0.6150***
2085	0.1220	0.2259	-0.4683**	0.1581	-0.6633***	0.6256***
2086	0.2754	-0.0667	0.4547*	0.6853***	-0.0767	0.4361*
2087	-0.2926	0.0800	0.1308	0.6900***	-0.6464***	0.0966
2088	0.2830	-0.2293	-0.0746	0.6886***	-0.0989	0.6495***
2089	-0.1877	-0.1643	-0.0012	0.4707**	-0.7216***	0.2646
2090	-0.0158	-0.1530	0.2801	0.7022***	-0.4609*	0.3041
2091	0.2158	-0.2634	0.1679	0.7722***	-0.1340	0.5171**
2092	0.0044	-0.4010*	0.2681	0.7043***	-0.2309	0.5241**
2093	0.0729	0.1488	0.0422	0.3726*	-0.6888***	0.3843*
2094	0.1980	-0.1532	-0.3987*	0.3667*	-0.7406***	0.3418
2095	-0.1597	0.0051	0.1420	0.4768**	-0.5746***	0.1622
2096	0.2204	-0.0985	0.1675	0.4751**	-0.5916***	0.4215*
2097	0.0825	-0.2665	-0.2151	0.3996*	0.6176***	0.4664**
2098	0.1660	-0.3382	-0.0263	0.2341	-0.6637***	0.5675**
2099	-0.4054*	-0.0122	-0.0348	0.6553***	-0.6618***	0.1272
2100	0.2411	0.0428	-0.3562	0.1683	-0.6059***	0.6739***
2101	0.4238*	0.3243	0.0278	0.0981	0.7212***	0.6102***
2102	-0.0125	0.2284	0.4588*	0.7244***	-0.4748**	0.2553
2103	0.2671	0.1785	0.3141	0.4241*	-0.7012***	0.3413
2104	0.1631	0.1545	-0.0581	0.5054**	-0.6473***	0.3213
2105	0.1492	0.0807	0.3458	0.6205***	-0.5378**	0.3218
2106	0.3808*	0.2820	0.0022	0.1306	-0.7617***	0.5370**
2107	0.1087	-0.0894	-0.2914	0.3370	-0.5980***	0.5448**
2108	-0.0870	-0.1799	-0.0470	0.3196	-0.6459***	0.5091**
2109	-0.3534	0.2599	0.0746	0.6265***	-0.8114***	-0.0689
Average	0.0377	0.1854	0.3777	0.6039**	-0.6546***	0.0750
Average of both groups	0.0540	0.0846	0.2149	0.5567**	-0.5411**	0.3013

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 and 3 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively (7). 70.0% strains of the whole showed significances.

In NI (Table 4), 1, 12, 13; 2, 2; 1, 4, 5; 1, 13 and 14 strains showed significances at 0.1%

Table 10. Correlation coefficient of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	0.3916*	0.5621**	0.1623	0.0996	-0.7101***	0.7660***
461	-0.2819	0.2234	0.1988	0.2940	-0.3319	0.7993***
462	-0.0750	0.2694	0.5247**	0.6174***	-0.4803**	0.3897*
463	0.0952	0.4711**	0.6615***	0.7497***	0.5769***	0.1058
464	-0.4263*	0.4492*	0.1361	0.7008***	-0.3731*	0.3985*
Average	-0.7845	0.7298	-0.2789	0.3880	0.5950	0.9703**
465	0.1593	-0.1796	0.1836	0.3881*	0.5098**	0.5912***
466	-0.1391	-0.6322***	-0.0188	0.7084***	0.4134*	0.9336***
467	-0.4320*	0.2155	0.2949	0.2782	-0.5100**	0.6734***
468	0.0140	0.4731**	-0.1627	0.1338	-0.1946	0.9454***
469	0.0993	0.0046	0.1882	0.2102	-0.3242	0.8518***
470	0.2358	0.3624*	0.4505*	0.5448**	-0.6935***	0.2237
471	0.2584	-0.0576	0.5194**	0.6965***	0.2990	0.8904***
472	-0.0190	0.2277	0.0969	0.6224***	0.0179	0.7914***
473	-0.5854***	0.0165	-0.0169	0.5596**	-0.7642***	0.1002
474	0.7967***	0.7732***	0.9270***	0.9468***	0.7979***	0.9495***
Average	0.5462	0.1481	0.0093	0.0222	-0.5742	0.8264***
Average of both groups	0.3581	0.3246	0.0872	0.1733	-0.6097*	0.8827***

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

(8, 9, 10), 1% (8, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 55.2 and 58.8% strains of the whole showed significances in 8, 9 and 10, respectively. In IV (Table 5), 3, 2, 1 and 1 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (11). 85.7% strains of the whole showed significances. In SE (Table 6), 15, 4, 19; 4, 4; 7, 2, 9; 9, 1 and 10 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. 74.3, 85.7 and 76.2% strains of the whole showed significances in 12, 13 and 14, respectively.

In SUM, 47, 71, 36, 35; 12, 32, 24, 8; 18, 32, 17, 15; 30, 55, 30 and 25 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. 72.0, 71.1, 72.0 and 69.9% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of both East Africa (34) and West Africa (35) showed nearly the same values, which was a result quite different from those of the former 3 items.

In group level (Table 11), 6, 4, 1 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, which was the same as in case of the 3rd item.

Table 11. Group averages of the six components; comparative values of width on length, comparative values of thickness on length, comparative values of thickness on width, comparative values of L/T on L/W, comparative values of W/T on L/W and comparative values of 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	0.7501**	0.3577	0.6837**	0.6793*	0.0091	0.7006**
	2	0.0443	-0.0469	0.1022	0.3913**	-0.4972***	0.0689
	3	0.2299	0.0535	0.0790	0.3887**	-0.4437***	0.1031
TA	5	0.4444**	0.6012***	0.5700***	0.7162***	-0.5557***	0.1629
	6	0.4566**	0.5973***	0.5205***	0.6830***	-0.5607***	0.2039
KE	7	-0.1416	0.3994	0.0897	0.8102**	-0.4893	0.0883
NI	8	-0.1929	-0.3556	0.9071*	0.4149	0.5026	0.6588
	9	-0.0385	0.4903**	0.6602***	0.8204***	-0.8281***	-0.3837*
	10	-0.1222	0.2872	0.6937***	0.8414***	-0.7668***	-0.3206
IV	11	0.1174	0.6513	0.4434	0.8802**	-0.7270	-0.3451
SE	12	0.3306	0.5869***	0.7810***	0.7845***	-0.3397*	0.3020
	13	0.4442	0.3336	0.7297	0.6423	-0.2007	0.6156
	14	0.3436*	0.5659***	0.7769***	0.7703***	-0.3260*	0.3370*
SUM	15	0.0308	0.4021***	0.6440***	0.7769***	-0.6042***	0.0126
	16	0.0503	0.3636***	0.4774***	0.6235***	-0.6338***	0.0824
NI	17	0.3940	-0.2140	-0.0597	0.2066	-0.7924*	0.4118
	18	-0.6279**	0.3505	0.0639	0.5602*	-0.5951*	0.3570
	19	-0.2694	0.2455	0.0042	0.4745*	-0.5956**	0.4466*
SE	21	0.0726	0.0284	0.9056***	0.9442***	0.1072	0.4244
	22	-0.5208	0.5106	0.0981	0.2247	-0.8398	-0.4591
	23	-0.1177	-0.0025	0.8823***	0.9312***	-0.0512	0.3073
SUM	24	-0.1800	0.0289	0.7653***	0.8721***	-0.2149	0.2709
TA	25	0.8660	-0.7559	-0.3273	0.9990***	0.9608	0.9608
	26	0.0377	0.1854	0.3777	0.6039**	-0.6546***	0.0750
	27	0.0540	0.0846	0.2149	0.5567**	-0.5411**	0.3013
KE	28	-0.7845	0.7298	-0.2789	-0.3880	-0.5950	-0.9703***
	29	0.5462	0.1481	0.0093	-0.0222	-0.5742	0.8264**
	30	0.3581	0.3246	-0.0872	-0.1733	-0.6097*	0.8827***
SUM	31	0.4079	0.3377	0.0385	-0.0589	-0.5025*	0.8883***
	32	0.2141	0.2103	0.1389	0.3064*	-0.5050***	0.6548***

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

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

5. Comparative values of L/W and W/T

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), 10, 28, 38; 2, 12, 14; 4, 4; 1, 3 and 4 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. 92.3, 93.6 and 93.3% strains of the whole showed significances in 1, 2 and 3, respectively. It was remarkable that they showed the

Table 12. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Madagascar, *O. longistaminata*, 301-313 in 1985 and 2001-2047 in 1988

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
301	0.9986***	0.5000**	0.5000**	0.5636**	0.9690***	0.6758***
302	0.7092***	0.3013	0.2248	0.3976*	0.2454	0.4001*
303	0.0816	0.3503	0.2659	0.3537	0.3552	0.3287
304	0.6430***	0.9303***	0.6455***	0.8345***	0.8533***	0.7752***
305	0.7821***	0.7373***	0.8910***	0.4193*	0.5732***	0.5894***
306	0.9310***	0.6262***	0.9106***	0.7509***	0.9768***	0.6543***
307	0.9676***	0.7320***	0.8262***	0.8696***	0.7829***	0.5912***
308	0.2554	0.9286***	0.6547***	0.3459	0.9946***	0.7976***
309	0.9736***	0.9470***	0.7289***	0.9792***	0.8429***	0.9120***
310	0.2723	0.9286***	0.5000***	0.8096***	0.9569***	0.9103***
311	0.8844***	0.9233***	0.1667	0.9321***	0.9106***	0.9066***
312	0.0137	0.1194	0.1205	0.1830	0.1228	0.1060
313	0.9449***	0.5000**	0.7559***	0.0418	0.5624**	0.9449***
Average	0.9265***	0.8896***	0.9693***	0.7972**	0.8172***	0.8208***
2001	0.4969**	0.3884*	0.6374***	0.2053	0.5585**	0.2795
2002	0.4928**	0.5290**	0.2339	0.5043**	0.5405**	0.5364**
2003	0.5923***	0.5049**	0.3926*	0.1606	0.3725*	0.5519**
2004	0.0769	0.4136*	0.4980**	0.3256	0.2675	0.3947*
2005	0.7164***	0.1625	0.0318	0.4815**	0.3367	0.0694
2006	0.3268	0.1307	0.6823***	0.1141	0.5581**	0.2757
2007	0.4198*	0.3184	0.7709***	0.0309	0.7206***	0.7926***
2008	0.2987	0.7069***	0.2767	0.5314**	0.4691**	0.6705***
2009	0.3510	0.3255	0.2128	0.3637*	0.3570	0.3544
2010	0.0995	0.1183	0.4560*	0.0730	0.3905*	0.0533
2011	0.1698	0.3194	0.5368**	0.1385	0.2940	0.3074
2012	0.3269	0.4950**	0.0918	0.4001*	0.2484	0.4003*
2013	0.4243*	0.4799**	0.3023	0.3927*	0.0170	0.4022*
2014	0.6410***	0.4042*	0.8398***	0.6006***	0.6244***	0.5263**
2015	0.0759	0.5749***	0.8599***	0.4577*	0.4352*	0.6708***
2016	0.0462	0.1185	0.4910**	0.1813	0.4461*	0.4143*
2017	0.5434**	0.6093***	0.6547***	0.3718*	0.5777***	0.5760***
2018	0.3306	0.2806	0.4494*	0.0341	0.2965	0.2713
2019	0.3979*	0.0206	0.5672**	0.0753	0.6335***	0.0442
2020	0.4723**	0.7186***	0.6107***	0.4619*	0.3712*	0.7311***
2021	0.6043***	0.1438	0.1410	0.3296	0.7963***	0.5944***
2022	0.4345*	0.4847**	0.8715***	0.5455**	0.7334***	0.6635***
2023	0.0208	0.2581	0.4327*	0.3880*	0.2736	0.2426
2024	0.2700	0.5987***	0.5193**	0.0130	0.4719**	0.4967**
2025	0.6341**	0.3555	0.7170***	0.5419**	0.6511***	0.7327***
2026	0.6621***	0.4971**	0.7687***	0.3626*	0.5977***	0.3006

(Continued)

Table 12. (Continued)

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
2027	0.3396	0.4477*	0.6883***	0.1921	0.3357	0.5410**
2028	0.0687	0.0890	0.4285*	0.2865	0.4149*	0.1940
2029	0.6018***	0.5896***	0.3965*	0.4617*	0.3897*	0.3488
2030	0.5824***	0.3097	0.4176*	0.4667**	0.3916*	0.5668**
2031	0.3984*	0.4826**	0.7116***	0.4292*	0.5055**	0.4425*
2032	0.4112*	0.4547*	0.7624**	0.3927*	0.5613**	0.7384***
2033	0.0190	0.4085*	0.5633***	0.3697*	0.5265**	0.2726
2034	0.3089	0.3286	0.6166***	0.2703	0.5510**	0.6381***
2035	0.4143*	0.1820	0.4685***	0.1372	0.1385	0.1744
2036	0.0193	0.4546*	0.5609**	0.4288*	0.3015	0.4589*
2037	0.0438	0.2909	0.6402***	-0.0258	0.3348	0.5629**
2038	0.4317*	0.2484	0.3932*	0.2387	-0.1427	0.2382
2039	0.5406**	0.3079	0.7342***	0.1978	0.6809***	0.4275*
2040	0.4224*	0.3889*	0.3229	0.0881	0.2950	0.1947
2041	0.3668*	0.0937	0.6376***	0.1042	0.3779*	0.4469*
2042	-0.0314	0.4199*	0.6251***	0.4450*	0.5622**	0.4679**
2043	0.5210**	0.6262***	0.8840***	0.6419***	0.5895***	0.3119
2044	0.6376***	0.1160	0.5612**	0.1520	0.3396	0.3291
2045	0.5434**	0.2803	0.6151***	0.5378**	0.5264	-0.0032
2046	0.4389*	-0.0701	0.6434***	0.3970*	0.6385***	0.2533
2047	-0.0756	0.1069	0.7605***	0.0112	0.5466**	0.4383*
Average	0.8769***	0.9328***	0.9358***	0.7571***	0.6695***	0.8070***
Average of both groups	0.9115***	0.9166***	0.9041***	0.7669***	0.6983***	0.7847***

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 the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Tanzania, *O. longistaminata*, 314 in 1984 and 2048-2083 in 1988

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
314	0.9430***	0.8017***	0.8110***	0.7889***	0.7685***	0.6754***
2048	0.2924	0.2229	0.4277*	0.3413	0.1134	0.0636
2049	0.0878	0.3570	0.5655**	-0.0411	0.4946**	0.7380***
2050	0.2606	0.2560	0.7115***	0.2037	0.8500***	0.6577***
2051	0.6197***	0.8785***	0.8545**	0.7400***	0.4200*	0.4044*
2052	0.5482**	0.7394***	0.5629**	0.6620***	0.6274***	0.4677**
2053	0.4167*	0.4905**	0.6913***	0.5372**	0.3079	0.1853
2054	0.0791	0.5685**	0.4483*	0.4254*	0.2448	0.4143*
2055	0.7778***	0.1322	0.5262**	0.0289	0.7801***	0.4168*

(Continued)

Table 13. (Continued)

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
2056	0.1540	0.3912*	0.7175***	-0.0155	-0.0033	0.1620
2057	0.6437***	0.4575*	0.5883***	0.2980	0.4831**	0.4602*
2058	0.2174	0.4372*	0.8196***	0.4393*	0.5196**	0.6096***
2059	0.4290*	0.4608*	0.7677***	0.6352***	0.3764*	0.6367***
2060	0.3165	0.2491	0.3459	0.3633*	0.2479	-0.2468
2061	0.1952	0.2511	0.5067**	0.4404*	0.3685*	0.4987**
2062	-0.1706	0.4918**	0.7940***	0.3680*	0.6246***	0.8717***
2063	0.2715	-0.0151	0.7087***	0.2400	0.6244***	0.6653***
2064	-0.1302	0.5161**	0.3348	0.5009**	-0.2342	0.5567**
2065	0.4163*	0.4012*	0.8636***	0.1375	0.6929***	0.4817**
2066	0.1197	0.3490	0.6149***	0.1818	0.6607***	0.6669***
2067	0.1664	0.6445***	0.7316***	0.6439***	0.3689*	0.4810**
2068	0.6020***	0.0285	0.5193**	0.3406	0.6084***	0.2333
2069	-0.1358	0.2936	0.4458*	0.1076	0.1568	0.4212*
2070	0.7722***	0.5331**	0.6575***	0.5807***	0.4295*	0.7456***
2071	0.3716*	0.3715*	0.5435**	0.4629**	-0.0372	0.5580**
2072	0.3529	0.2874	0.6173***	0.2316	0.4831**	0.4288*
2073	0.6911***	0.6578***	0.2588	0.7288***	0.4438*	0.6237***
2074	0.6612***	0.4408*	0.6753***	0.5872***	0.6761***	0.3930*
2075	0.3779*	0.4222*	0.3142	0.5238**	-0.0072	0.1248
2076	0.5932***	0.4333*	0.6869***	0.5546**	0.4489*	0.5141**
2077	0.8380***	0.3344	0.5113**	0.6503***	0.6425***	0.3044
2078	0.4929**	0.4861**	0.6464***	0.5164**	0.3844*	0.3928*
2079	0.4831**	0.2068	0.8009***	0.2372	0.6742***	0.4080*
2080	0.3133	0.3701*	0.0853	0.5073**	0.0021	0.3021
2081	0.2270	0.2809	0.3857*	0.2954	0.2258	0.4800**
2082	0.6493***	0.3011	0.3416	0.2758	0.4515*	-0.0568
2083	0.6013***	0.5973***	0.4023*	0.6073***	0.3125	0.6766***
Average	0.6351***	0.8897***	0.5432***	0.8423***	0.6760***	0.8650***
Average of both groups	0.6439***	0.8959***	0.5575***	0.8395***	0.6907***	0.8505***

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

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

highest significances throughout the former 5 items in the whole of **1, 2** and **3**. In **TA** (Table 2), 20, 20; 9, 9; 1, 3, 4; 4 and 4 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, 88.9 and 89.2% strains of the whole showed significances in **4, 5** and **6**, respectively, which showed the highest values throughout the former 5 items in the whole of **1, 2** and **3**. In **KE** (Table 3), 6, 2 and 2 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively (**7**). 80.0% strains of the whole showed significances.

In **NI** (Table 4), 1, 21, 22; 1, 4, 5; 1, 2, 3; 2, 2 and 4 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. 60.0, 93.1 and 88.2% strains of the whole showed significances in **8, 9** and

Table 14. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Kenya in 1985, *O. longistaminata*, 315-324

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
315	0.1732	0.4883**	0.8658***	0.4343*	0.6268***	0.8132***
316	-0.2496	0.4437*	0.5579**	0.3004	0.1817	0.5356**
317	-0.0098	-0.2832	0.7608***	-0.0522	0.2400	0.2243
318	-0.2418	0.8786***	0.8729***	-0.2359	-0.7671***	0.2785
319	0.1534	0.3173	0.2614	0.3492	0.3605	0.2959
320	0.7135***	0.9129***	0.7906***	0.7802***	0.9009***	0.8457***
321	-0.0394	0.9305***	0.9990***	0.9390***	0.7530***	0.8917***
322	0.8801***	0.9259***	0.3750*	0.8873***	0.7183***	0.7662***
323	0.7748***	0.6851***	0.6288***	0.9449***	0.8284***	-0.0368
324	0.9449***	0.0000	0.0000	0.9972***	0.9333***	0.0000
Average	0.8924***	0.9815***	0.9733***	0.6989*	-0.3621	0.8916***

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

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

10, respectively. In IV (Table 5), 2, 3, 1 and 1 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (11). 85.7% strains of the whole showed significances, which was the same as in case of the 4th item. In SE (Table 6), 16, 4, 20; 4, 4; 5, 1, 6; 10, 2 and 12 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. 71.4% strains of the whole showed significances in the whole of 12, 13 and 14.

In SUM, 60, 108, 64, 44; 14, 35, 23, 12; 13, 20, 10, 10; 20, 27, 10 and 17 strains showed significances at 0.1% (15, 16, 34, 35), 1% (15, 16, 34, 35) and 5% (15, 16, 34, 35) levels and no significance even at 5% level (15, 16, 34, 35), respectively. 81.3, 85.8, 90.7 and 79.5% 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 contrary to the 1st, 2nd and 3rd items.

In group level (Table 11), 6, 2 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 3rd and 4th items.

6. Comparative values of L/T and W/T

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, 14, 21; 11, 11; 10, 10; 6, 12 and 18 strains showed significances at 0.1% (1, 2, 3), 1% (2, 3) and 5% (2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 53.9, 74.5 and 70.0% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 2), 1, 7, 8; 4, 4; 5, 5; 20 and 20 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, 44.4 and 46.0% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 3), 6, 1, 1 and 2 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (7). 80.0% strains of the

Table 15. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Nigeria, *O. longistaminata*, 325–336 in 1984 and 337–382 in 1985

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
325	0.0218	-0.1066	0.5130**	-0.1390	-0.0509	0.2669
326	0.2083	0.6791***	0.8453***	0.5262**	0.5422**	0.6762***
327	0.4072*	0.8156***	0.7430***	0.7788***	0.5327**	0.8118***
335	0.9234***	0.8281***	0.9172***	0.9396***	0.8871***	0.8698***
336	0.9098***	0.9000***	0.7780***	0.8951***	0.8719***	0.7051***
Average	0.9922***	0.9970***	0.9951***	0.9438*	0.6360	0.9804**
337	0.8931***	0.4804**	0.8018***	0.7710***	0.8980***	0.4962**
338	0.8181***	0.8429***	0.9776***	0.9327***	0.8190***	0.9630***
339	0.1107	-0.8577***	-0.2100	-0.6867***	-0.1393	0.5425**
340	0.9503***	0.6455***	0.9707***	0.8399***	0.9629***	0.9979***
341	0.9705***	0.9152***	0.0000	0.9707***	-0.1529	0.7168***
342	0.9592***	0.9201***	0.7746***	0.6060***	0.9330***	0.9205***
343	0.9001***	0.7456***	0.9030***	0.7509***	0.9479***	0.9360***
345	0.9877***	0.4560*	0.8292***	0.5667**	0.4187*	0.7175***
346	0.0135	0.3241	0.4634**	0.3834*	0.4624*	0.0994
348	0.9503***	0.7641***	0.8696***	0.8310***	0.5273**	0.9061***
349	0.1378	0.2146	0.8964***	0.0812	0.4818**	0.6375***
352	0.0960	0.4057*	0.2534	0.1131	0.2406	0.2069
354	0.2981	0.0176	0.5645**	0.1089	0.5199**	-0.0347
355	0.4977**	0.9872***	0.5718***	0.9373***	0.6884***	0.0724
357	0.4226*	0.7298***	0.7071***	0.7067***	0.3310	0.0365
358	0.9015***	0.7785***	0.8135***	0.7705***	0.9113***	0.7616***
360	0.8554***	0.7035***	0.2500	0.9016***	0.5476**	0.8034***
362	0.8924***	0.5280**	0.5590**	0.3526	0.9295***	0.8653***
364	0.5458**	0.8027**	0.8663***	0.6034***	0.7631***	0.9169***
365	0.9048***	-0.0428	0.4804**	0.7691***	0.8451***	0.3034
369	0.6005***	0.6290***	0.9584***	0.7496***	0.1530	0.6725***
371	0.0268	0.6040***	0.4393*	0.2524	0.0604	0.5508**
373	0.2283	0.7217***	0.8729***	0.9002***	0.9243***	0.9487***
375	0.9403***	0.4221*	0.6864***	0.5050**	0.7046***	0.1125
377	0.9808***	-0.6122***	0.7845***	0.7898***	0.7427***	-0.0161
378	0.6365***	0.5695**	0.9808***	-0.1040	0.6218***	0.6845***
379	0.8844***	0.7906***	0.0000	0.0178	-0.1012	-0.1781
381	0.6751***	0.6202***	0.6124***	0.9096***	0.9991***	-0.5394**
382	0.6486***	0.3675*	0.8385***	0.7852***	0.6532***	0.8370***
Average	0.9572***	0.7414***	0.8831***	0.8813***	0.9501***	0.8724***
Average of both groups	0.9590***	0.8984***	0.9324***	0.8898***	0.9266***	0.8993***

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 the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Ivory Coast in 1984, *O. longistaminata* (384-390) and *O. breviligulata* (383)

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
384	0.6411***	0.8107***	0.7423***	0.6219***	0.4653**	0.6888***
385	0.1748	0.3146	0.6776***	0.2114	0.1879	0.6337***
386	0.0401	0.3962*	0.2911	0.1350	0.3281	0.4578*
387	0.4667**	0.6709***	0.3774*	0.7636***	0.2359	0.5508**
388	0.2400	0.4035*	0.5488**	0.2815	0.3512	0.5282**
389	0.6149***	0.6937***	0.4519*	0.7110***	0.7162***	0.4439*
390	0.5051**	0.5615**	0.5138**	0.7001***	0.3135	0.4703**
Average	0.9633***	0.9120**	0.9167**	0.9231**	0.9276**	0.7679*
383	0.8118***	0.8518***	0.9139***	0.7832***	0.7926***	0.8757***

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

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

Table 17. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Senegal in 1985, *O. longistaminata*, 391-441 in Casamance region and 444-455 in northern region

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
391	0.6765***	0.6993***	0.9305***	0.6517***	-0.8409***	0.7969***
392	0.8823***	0.5000**	0.9792***	0.9159***	0.9764***	0.9000***
393	0.4369*	0.8439***	0.8578***	0.7940***	0.8435***	0.8105***
394	-0.1159	0.8740***	0.0801	0.0862	0.1681	0.9028***
395	0.9858***	0.9552***	0.9755***	0.9945***	0.9786***	0.9759***
396	0.2670	0.9587***	0.1336	0.4749**	-0.0780	0.5354**
397	0.9375***	0.3953*	0.5385**	0.8002***	0.5363**	0.4826**
399	-0.3391	0.4460**	0.7312***	0.1841	0.1123	0.3699*
400	0.8961***	0.6124***	0.3273	0.8500***	0.6962***	0.3515
401	0.4789***	0.4675**	0.2919	0.3439	-0.1099	0.2163
402	0.2193	0.9077***	0.9456***	0.6747***	0.8400***	0.9513***
406	0.8461***	0.5222**	0.7572***	0.6918***	0.9575***	0.6513***
407	0.8475***	0.8729***	0.6864***	0.7548***	0.4541*	0.1264
408	0.9712***	0.8942***	0.9631***	0.8049***	0.8719***	0.8828***
409	0.7317***	0.5512**	0.4231*	-0.7086***	0.5785***	0.5558**
411	0.8917***	0.4423*	0.6429***	0.3765*	0.7832***	0.3069
412	0.5383**	0.0458	-0.1667	0.5581**	0.4754**	0.0897
414	0.2707	0.8540***	0.0000	0.7714***	-0.7801***	0.4827**
416	-0.1594	0.0384	0.9688***	0.1303	0.1882	0.5728***
419	0.8792***	0.5345**	0.9449***	0.6263***	0.8663***	0.8558***
420	0.9565***	0.9481***	0.6290***	0.9661***	0.8022***	0.8578***

(Continued)

Table 17. (Continued)

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
423	0.5635**	0.9422***	0.9336***	0.3995*	0.5320**	0.9426***
424	0.7368***	0.2795	0.9167***	-0.0407	0.9394***	0.9076***
426	0.9782***	-0.9774***	0.9122***	0.9985***	0.9953***	0.9821***
427	0.9502***	0.4703**	0.8812***	0.8859***	0.8631***	0.8791***
429	0.9197***	0.8220***	0.8974***	0.8631***	0.9165***	0.9140***
431	0.9312***	0.8311***	0.9759***	0.7862***	0.8481***	0.8107***
433	-0.7210***	0.6133***	0.6621***	0.7472***	0.5472**	0.8928***
434	0.8969***	0.7398***	0.9569***	0.9399***	0.9442***	0.7599***
435	0.8607***	0.9719***	0.9129***	0.9790***	0.7303***	0.9496***
436	0.7866***	0.9144***	0.7717***	0.9483***	0.7002***	0.8629***
437	0.7311***	0.6881***	0.9182***	-0.0257	0.8620***	0.8956***
439	0.9371***	0.7771***	0.7531***	0.3870*	0.8579***	0.9261***
440	0.8122***	0.9286***	0.9990***	0.8418***	0.7367***	0.9853***
441	0.7546***	0.9167***	0.8018***	0.7815***	0.3935*	0.9567***
Average	0.9012***	0.8340***	0.9203***	0.8164***	0.8475***	0.9306***
444	0.9746***	0.7573***	0.8898***	0.6656***	0.8661***	0.0709
447	0.4426*	0.8952***	0.0801	0.9431***	0.8837***	0.8081***
449	0.9090***	0.6580***	0.9733***	0.7666***	0.9595***	0.9803***
451	0.9427***	0.9801***	0.8452***	0.9630***	0.9517***	0.8857***
452	0.7643***	0.6455***	0.0000	0.7509***	0.7600***	0.8090***
454	0.6708***	0.9946***	0.7334***	0.9357***	-0.1732	0.9970***
455	0.9177***	0.3385	0.9742***	-0.8619***	0.9968***	0.8525***
Average	0.9884***	0.9596***	0.8270*	0.7624*	0.8743*	0.8278*
Average of both groups	0.9405***	0.8833***	0.9051***	0.8125***	0.8224***	0.9229***

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

whole showed significances, which was the same as in case of the 5th item.

In **NI** (Table 4), 3, 15, 18; 3, 3; 1, 3, 4; 1, 8 and 9 strains showed significances at 0.1% (8, 9, 10), 1% (9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 72.4 and 73.5% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 5), 1, 1, 3 and 2 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (11). 71.4% strains of the whole showed significances. In **SE** (Table 6), 14, 2, 16; 4, 1, 5; 11, 1, 12; 6, 3 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, 13, 14), respectively. 82.9, 57.1 and 78.6% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 49, 70, 35, 35; 10, 25, 16, 9; 20, 35, 16, 19; 28, 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, 35, 36), respectively. 73.8, 68.4, 62.6 and 75.9% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of

Table 18. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Nigeria, *O. breviligulata*, 328-334 in 1984 and 344-380 in 1985

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
328	0.9111***	0.9353***	0.9440***	0.7492***	0.9314***	0.9616***
329	0.9233***	0.9597***	0.8517***	0.9455***	0.9304***	0.9718***
330	0.9314***	0.9262***	0.9227***	0.9381***	0.8713***	0.9257***
331	0.9403***	0.7672***	0.7663***	0.8014***	0.8191***	0.8135***
332	0.8058***	0.5009**	0.9092***	0.7069***	0.8883***	0.8608***
333	0.8197***	0.9540***	0.8775***	0.9426***	0.8818***	0.9656***
334	0.8487***	0.7340***	0.8533***	0.7653***	0.9003***	0.8483***
Average	0.9941***	0.9553***	0.9873***	0.9954***	0.9934***	0.8605*
344	0.7035***	-0.1364	0.8574***	0.2414	0.8335***	0.8180***
347	0.6868***	0.8774***	0.9347***	0.6770***	0.9241***	0.9273***
350	0.9512***	0.8828***	0.8944***	0.9439***	0.7219***	0.9419***
351	0.8315***	0.0616	0.9598***	-0.0185	0.9180***	0.6146***
353	0.9470***	0.9429***	0.8116***	0.9265***	0.8430***	0.9300***
356	0.9067***	0.7538***	0.8390***	0.8242***	0.8385***	0.9379***
359	0.9418***	0.8490***	0.8891***	0.6774***	0.9322***	0.9325***
361	0.9403***	0.4293*	0.9243***	0.5777***	0.8210***	0.8964***
363	0.8084***	0.1942	0.9513***	0.3056	0.9201***	0.8630***
366	0.8017***	0.3813*	0.7523***	0.3824*	0.6961***	0.8940***
367	0.8654***	0.8807***	0.9581***	0.7304***	0.8389***	0.8497***
368	0.8082***	0.6954***	0.9023***	0.4314*	0.7751***	0.6494***
370	0.8921***	0.8987***	0.7983***	0.8719***	0.8200***	0.8743***
372	0.8749***	0.9357***	0.9357***	0.9248***	0.8712***	0.8521***
374	0.8569***	0.8905***	0.9287***	0.7815***	0.8658***	0.9493***
376	0.9054***	0.8726***	0.5499**	0.8834***	0.7697***	0.8409***
380	0.8983***	0.5623**	0.8934***	0.7982***	0.9461***	0.8345***
Average	0.9698***	0.9908***	0.9667***	0.9882***	0.9775***	0.7038**
Average of both groups	0.9753***	0.9833***	0.9744***	0.9891***	0.9802***	0.8183***

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

West Africa (35) showed remarkably higher significances than those of East Africa (34), which was the same as in cases of the 1st, 2nd and 3rd items.

In group level (Table 11), 1, 2 and 10 groups showed significances at 1% and 5% levels and no significance even at 5% level, respectively. In summed-up group, 34 showed significance at 0.1% level, but 15, 16 and 35 showed no significance even at 5% level.

7. Lengths of UHG and HG

C.c. and l.r. of L of HG on L of UHG in the same strains were calculated, and c.c. are shown in the leftmost columns of Tables 12 to 17. In MD (Table 12), 9, 9, 18; 7, 7; 11, 11; 4, 20 and 24 strains showed significances at 0.1% (1, 2, 3), 1% (2, 3) and 5% (2, 3) levels and no

Table 19. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/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	Width	Thickness	L/W	L/T	W/T
398	0.9258***	-0.3750*	0.9654***	0.9089***	0.9456***	0.8647***
403	0.8582***	0.7458***	0.8908***	0.6810***	0.7748***	0.9692***
404	0.8470***	0.7254***	0.8702***	0.7288***	0.7164***	0.9101***
405	0.9473***	0.7618***	0.9113***	0.6017***	0.8653***	0.8492***
410	0.9130***	0.8540***	0.9432***	0.5949***	0.8876***	0.9025***
413	0.8933***	0.8504***	0.6455***	0.4696**	0.8420***	0.8933***
415	0.8768***	0.6497***	0.7712***	0.7826***	0.7020***	0.7916***
417	0.7000***	0.8729***	0.9688***	0.7159***	0.6368***	0.9978***
418	0.8248***	0.7417***	0.9546***	0.6365***	0.9045***	0.8875***
421	0.7593***	0.3908*	0.8279***	0.1264	0.6366***	0.7940***
422	0.7707***	0.5588**	0.7638***	0.7815***	-0.2713	0.6902***
425	0.6760***	0.4900**	0.7392***	0.3154	0.7079***	0.7181***
428	0.3825*	0.2215	0.3043	0.2682	0.6664***	0.7852***
430	0.9256***	0.8135***	0.7987***	0.9298***	0.5340**	0.8547***
432	0.8512***	0.8952***	0.9566***	0.9077***	0.9327***	0.9716***
438	0.4370*	-0.4901**	0.6455***	0.4755**	0.8144***	0.8663***
442	0.9070***	-0.0916	0.9153***	0.3207	0.7709***	0.7812***
Average	0.9910***	0.9671***	0.9708***	0.9515***	0.9304***	0.9122***
443	0.7558***	0.4526*	0.8378***	0.5632**	0.8206***	0.7897***
445	0.7640***	0.8131***	0.8293***	0.6663***	0.7950***	0.8392***
446	0.8587***	0.7964***	0.8969***	0.8240***	0.7525***	0.9571***
448	0.6389***	0.8308***	0.9100***	0.7882***	0.8917***	0.9377***
450	0.9219***	0.8413***	0.8077***	0.9125***	0.6312***	0.8602***
453	0.8444***	0.8295***	0.9339***	0.8209***	0.8728***	0.8990***
456	0.7498***	0.5794***	0.9227***	0.6672***	0.8966***	0.9238***
Average	0.9882***	0.9290**	0.9376**	0.9976***	0.9949***	0.8193*
Average of both groups	0.9891***	0.9692***	0.9538***	0.9650***	0.9429***	0.8953***
475	0.4530*	0.7564***	0.7918***	0.6014***	0.7423***	0.7650***

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

significance even at 5% level (1, 2, 3), respectively. 69.2, 57.5 and 60.0% strains of the whole showed significances in 1, 2 and 3, respectively. In TA (Table 13), 1, 11, 12; 3, 3; 5, 5; 17 and 17 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, 52.8 and 54.1% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 14), 4 (= 40.0% of the whole) and 6 (= 60.0%) strains showed significances at 0.1% level and no significance even at 5% level, respectively (7).

In NI (Table 15), 2, 19, 21; 2, 2; 1, 1, 2; 2, 7 and 9 strains showed significances at 0.1%

Table 20. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Tanzania, *O. punctata*, 457-459 in 1984 and 2084-2109 in 1988

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
457	0.7508***	0.4724**	0.3114	0.2438	0.2683	0.1960
458	0.1699	0.6400***	0.3244	0.1901	0.2025	0.7149***
459	0.7757***	0.7786***	-0.0218	0.8152***	0.4814**	0.0896
Average	0.9168	0.5000	-0.0524	0.9846	0.6866	0.8660
2084	0.1874	0.2920	0.3247	0.2837	0.0990	0.1889
2085	0.3755*	0.6724***	0.4066*	0.5086**	0.0591	0.9746***
2086	-0.0178	0.2530	0.1664	0.2295	-0.0475	0.1572
2087	0.4332*	0.4467*	0.0322	0.3621*	0.4301*	0.2243
2088	0.0452	0.7573***	0.3585	0.6200***	-0.1866	0.2658
2089	0.3757*	0.3294	0.5138**	0.0242	0.3258	0.1129
2090	0.2864	0.6059***	0.4894**	0.5784***	0.4042*	0.5615**
2091	-0.3972*	0.5474**	0.4668**	0.2528	-0.2186	0.4732**
2092	-0.1192	0.4269*	0.2593	0.2554	-0.0923	0.4288*
2093	0.4631**	0.3249	0.3739*	0.3214	0.5557**	0.3611*
2094	0.5523**	0.1244	0.7074***	0.1345	0.3987*	0.0211
2095	0.3397	0.6298***	0.6064***	0.5560**	0.3265	0.5448**
2096	0.5590**	0.6214***	0.6430***	0.5940***	0.3120	0.7352***
2097	0.2804	0.2312	0.4503*	0.3666*	0.3631*	0.2506
2098	0.7325***	0.2840	0.2684	0.4010*	0.4220*	0.1316
2099	0.4121*	0.5865***	0.4399*	0.4132*	0.4545*	0.3933*
2100	0.4932**	0.5868***	0.1056	0.7335***	0.2171	0.3846*
2101	0.2675	0.0444	0.2167	0.2791	0.4891**	0.0186
2102	0.3351	0.3024	0.3713*	0.1405	0.4114*	0.6226***
2103	0.6510***	0.2412	0.5328**	0.3009	0.6521***	0.3061
2104	0.2240	0.4917**	0.3459	0.5480**	0.3887*	0.3938*
2105	0.1476	0.3079	0.2930	0.3512	0.2544	0.5443**
2106	0.5406**	0.3293	0.7569***	0.5242**	0.4558*	0.3908*
2107	0.2740	0.4634**	0.2809	0.3198	-0.0731	0.2318
2108	0.4154*	0.3664*	0.1039	0.5385**	0.0373	0.2303
2109	0.3019	0.3694*	0.5172**	0.0290	0.4515*	0.3436
Average	0.7634***	0.8066***	0.9059***	0.7245***	0.8437***	0.7892***
Average of both groups	0.8256***	0.8486***	0.8840***	0.7393***	0.7844***	0.7336***

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

(8, 9, 10), 1% (9, 10) and 5% (8, 9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 60.0, 75.9 and 73.5% strains of the whole showed significances in 8, 9 and 10, respectively. In IV (Table 16), 2, 2 and 3 strains showed significances at 0.1% and 1% levels and no significances even at 5% level, respectively (11). 57.1% strains of the whole showed

Table 21. Correlation coefficient of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T; collected in Kenya, *O. punctata*, 460-464 in 1984 and 465-474 in 1985

Accession No.	Length	Width	Thickness	L/W	L/T	W/T
460	0.7434***	0.1781	0.4242*	0.5173**	0.5423**	0.3129
461	0.3422	0.1502	0.1786	0.0875	0.0893	0.1509
462	0.9338***	0.3241	0.7976***	0.7639***	0.8210***	0.6634***
463	0.6416***	0.2485	0.0968	0.5541**	0.6929***	0.0960
464	0.6713***	0.7654***	0.7632***	0.6629***	0.1832	0.7424***
Average	0.9876**	0.8644	0.5374	0.9484*	0.3761	0.4222
465	0.8193***	0.3571	0.5404**	0.5758***	0.6630***	0.6429***
466	0.6894***	0.9083***	0.1453	0.6051***	0.2411	0.5032**
467	0.6898***	0.1572	0.5342**	0.4655**	0.5663**	0.4214*
468	0.9147***	0.8915***	0.1407	0.7736***	0.3133	0.0323
469	0.6724***	0.5071**	0.2803	0.4918**	0.3414	0.4672**
470	0.7992***	0.3694*	0.1542	0.0254	0.3323	0.5380**
471	0.8758***	0.6350***	0.1243	0.8237***	0.5903***	0.5760***
472	0.7154***	0.6305***	0.4746**	0.7343***	0.3877*	0.5562**
473	0.0643	0.0990	0.8765***	0.6258***	0.9098***	0.7555***
474	0.7987***	0.8552***	0.4835**	0.8933***	0.6836***	0.3883*
Average	0.9860***	0.4713	0.8233**	0.9409***	0.9211***	0.4345
Average of both groups	0.9797***	0.5644*	0.6956**	0.9341***	0.8327***	0.3677

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

significances. In SE (Table 17), 26, 6, 32; 2, 2; 1, 1, 2; 6 and 6 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, 14), respectively. 82.9, 100.0 and 85.7% strains of the whole showed significances in 12, 13 and 14, respectively, displaying the highest values throughout the former 7 items.

In SUM, 69, 89, 34, 55; 6, 16, 10, 6; 4, 20, 16, 4; 28, 65, 47 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. 73.8, 65.8, 56.1 and 78.3% strains of the whole showed significances in 15, 16, 34 and 35, respectively, which were nearly the same as in case of the sixth item. The strains of East Africa (34) showed clearly lower significances than those of West Africa (35), which was the same tendency as in the 1st, 2nd, 3rd and 6th items.

In group level (Table 22), whole of the groups (= 13) showed significances at 0.1% level. 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 3rd, 4th and 5th items.

8. Widths of UHG and HG

C.c. and l.r. of W of HG on W of UHG 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), 8, 7, 15; 2, 7, 9; 9, 9; 3, 24 and 27 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (2, 3)

Table 22. Group averages of the six characters of unhusked on husked grains; length, width, thickness, L/W, L/T and W/T. Country and group marks were noted in the text.

Country	Group mark	Length	Width	Thickness	L/W	L/T	W/T
MD	1	0.9265***	0.8896***	0.9693***	0.7972**	0.8172***	0.8208***
	2	0.8769***	0.9328***	0.9358***	0.7571***	0.6695***	0.8070***
	3	0.9115***	0.9166***	0.9041***	0.7669***	0.6983***	0.7847***
TA	5	0.6351***	0.8897***	0.5432***	0.8423***	0.6760***	0.8650***
	6	0.6439***	0.8959***	0.5575***	0.8395***	0.6907***	0.8505***
KE	7	0.8924***	0.9815***	0.9733***	0.6989*	0.3621	0.8916***
NI	8	0.9922***	0.9970***	0.9951***	0.9438*	0.6360	0.9804**
	9	0.9572***	0.7414***	0.8831***	0.8813***	0.9501***	0.8724***
IV	10	0.9590***	0.8984***	0.9324***	0.8898***	0.9266***	0.8993***
	11	0.9633***	0.9120**	0.9167**	0.9231**	0.9276**	0.7679*
SE	12	0.9012***	0.8340***	0.9203***	0.8164***	0.8475***	0.9306***
	13	0.9884***	0.9596***	0.8270*	0.7624*	0.8743*	0.8278*
	14	0.9405***	0.8833***	0.9051***	0.8125***	0.8224***	0.9229***
SUM	15	0.9365***	0.8799***	0.8780***	0.8081***	0.8395***	0.8835***
	16	0.9111***	0.8667***	0.8977***	0.7763***	0.7860***	0.8267***
NI	17	0.9941***	0.9553***	0.9873***	0.9954***	0.9934***	0.8605*
	18	0.9698***	0.9908***	0.9667***	0.9882***	0.9775***	0.7038**
	19	0.9753***	0.9833***	0.9744***	0.9891***	0.9802***	0.8183***
SE	21	0.9910***	0.9671***	0.9708***	0.9515***	0.9304***	0.9122***
	22	0.9882***	0.9290**	0.9376**	0.9976***	0.9949***	0.8193*
	23	0.9891***	0.9692***	0.9538***	0.9650***	0.9429***	0.8953***
SUM	24	0.9793***	0.9673***	0.9566***	0.8551***	0.9393***	0.9267***
TA	25	0.9168	0.5000	0.0524	0.9846	0.6866	0.8660
	26	0.7634***	0.8066***	0.9059***	0.7245***	0.8437***	0.7892***
	27	0.8256***	0.8486***	0.8840***	0.7393***	0.7844***	0.7336***
KE	28	0.9876**	0.8644	0.5374	0.9484*	0.3761	0.4222
	29	0.9860***	0.4713	0.8233**	0.9409***	0.9211***	0.4345
	30	0.9797***	0.5644*	0.6956**	0.9341***	0.8327***	0.3677
SUM	31	0.9768***	0.6429**	0.7218***	0.9346***	0.8010***	0.3464
	32	0.9308***	0.7881***	0.7551***	0.8441***	0.8000***	0.5993***

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

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

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. In TA (Table 13), 1, 5, 6; 6, 6; 10, 10; 15 and 15 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, 58.3 and 59.5% strains of the whole showed significances in 4, 5 and 6, respectively. In KE (Table 14), 5, 1, 1 and 3 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively

(7). 70.0% strains of the whole showed significances, which was the same as in case of the 4th item.

In **NI** (Table 15), 4, 18, 22; 3, 3; 4, 4; 1, 4 and 5 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. 80.0, 86.2 and 85.3% strains of the whole showed significances in 8, 9 and 10, respectively, in which the first figure was the same as in cases of the 4th and the 6th items. In **IV** (Table 16), 3, 1, 2 and 1 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (11). 85.7% strains of the whole showed significances, which was the same as in cases of the 4th and the 5th items. In **SE** (Table 17), 23, 6, 29; 7, 7; 2, 2; 3, 1 and 4 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. 91.4, 85.7 and 90.5% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 68, 80, 26, 54; 14, 27, 16, 11; 9, 28, 20, 8; 16, 55, 45 and 10 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. 85.1, 71.1, 57.9 and 88.0% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that strains of West Africa (35) showed remarkably higher significances than those of East Africa (34), which was the same as in cases of the 1st, 2nd, 3rd, 6th and 7th items, and the last figure (= 88.0%) was the highest value throughout the former 8 items.

In group level (Table 22), 12 and 1 groups showed significances at 0.1% and 1% levels, respectively. In other words, the whole groups showed significances, which was the same as in case of the 7th item. 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 3rd, 4th, 5th and 7th items.

9. Thicknesses of UHG and HG

C.c. and l.r. of T of HG on T of UHG 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), 8, 23, 31; 1, 8, 9; 8, 8; 4, 8 and 12 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, 83.0 and 80.0% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 13), 1, 17, 18; 8, 8; 5, 5; 6 and 6 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, 83.3 and 83.3% strains of the whole showed significances in 4, 5 and 6, respectively, which were looked upon as nearly the same in case of the 5th item. In **KE** (Table 14), 6, 1, 1 and 2 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (7). 80.0% strains of the whole showed significances, which was the same as in cases of the 5th and the 6th items.

In **NI** (Table 15), 4, 19, 23; 1, 4, 5; 1, 1; 5 and 5 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 (9, 10), respectively. 100.0, 82.8 and 85.3% strains of the whole showed significances in 8, 9 and 10, respectively. In **IV** (Table 16), 2, 2, 2 and 1 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively (11). 85.7% strains of the whole showed significances, which was the same as in cases of the 4th, 5th and 8th items. In **SE** (Table 17), 27, 5, 32; 1, 1; 1, 1; 6, 2 and 8 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, 71.4 and 81.0% strains of the whole showed significances in 12, 13 and 14, respectively.

In **SUM**, 72, 112, 55, 57; 10, 26, 18, 8; 5, 18, 14, 4; 20, 34, 20 and 14 strains showed

significances at 0.1% (15, 16, 34, 35), 1% (15, 16, 34, 35) and 5% (15, 16, 34, 35) levels and no significance even at 5% level (15, 16, 34, 35), respectively. 81.3, 82.1, 81.3 and 83.1% strains of the whole showed significances in 15, 16, 34 and 35, respectively. It was noticed that the values were looked upon as nearly the same throughout 15, 16, 34 and 35.

In group level (Table 22), 11, 1 and 1 groups showed significances at 0.1%, 1% and 5% levels, respectively. In other words, the whole groups showed significances, which was the same as in cases of the 7th and the 8th items. 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 3rd, 4th, 5th, 7th and 8th items.

10. L/W of UHG and HG

C.c. and l.r. of L/W of HG on L/W of UHG 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), 6, 2, 8; 1, 7, 8; 2, 15, 17; 4, 23 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. 69.2, 51.1 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 7th item. In TA (Table 13), 1, 9, 10; 7, 7; 5, 5; 15 and 15 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, 58.3 and 59.5% strains of the whole showed significances in 4, 5 and 6, respectively, which were quite the same as in case of the 8th item. In KE (Table 14), 5, 1 and 4 strains showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively (7). 60.0% strains of the whole showed significances.

In NI (Table 15), 3, 19, 22; 1, 2, 3; 1, 1; 1, 7 and 8 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. 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 case of the 6th item. In IV (Table 16), 4 (= 57.1% of the whole) and 3 (= 42.9%) strains showed significances at 0.1% and no significance even at 5% level, respectively (11). In SE (Table 17), 24, 7, 31; 2, 2; 3, 3; 6 and 6 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, 14), respectively. 82.9, 100.0 and 85.7% strains of the whole showed significances in 12, 13 and 14, respectively, which were quite the same as in case of the 7th item.

In SUM, 69, 80, 23, 57; 6, 20, 15, 5; 7, 27, 23, 4; 25, 63, 46 and 17 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. 76.6, 66.8, 57.0 and 79.5% strains of the whole showed significances in 15, 16, 34 and 35, respectively, which were nearly the same as in case of the 7th item. It was noticed that strains of West Africa (35) showed higher significances than those of East Africa (34), which was the same as in cases of the 1st, 2nd, 3rd, 6th, 7th and 8th items.

In group level (Table 22), 8, 2 and 3 groups showed significances at 0.1%, 1% and 5% levels, respectively. In other words, the whole groups showed significances, which was the same as in cases of the 7th, 8th and 9th items. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as those noted in cases from the 3rd to 5th and from the 7th to 9th items.

11. L/T of UHG and HG

C.c. and l.r. of L/T of HG on L/T of UHG 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, 11, 20; 1, 12, 13; 9, 9; 3, 15 and 18 strains showed significances at 0.1% (1, 2, 3), 1% (1, 2, 3) and 5% (2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 76.9, 68.1 and 70.0% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 13), 1, 11, 12; 4, 4; 9, 9; 12 and 12 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, 66.7 and 67.6% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 14), 7 (= 70.0% of the whole) and 3 (= 30.0%) showed significances at 0.1% level and no significance even at 5% level, respectively (7).

In **NI** (Table 15), 2, 16, 18; 2, 4, 6; 2, 2; 1, 7 and 8 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. 80.0, 75.9 and 76.5% strains of the whole showed significances in 8, 9 and 10, respectively, which were quite and nearly the same as in cases of the 10th and 6th items, respectively. In **IV** (Table 16), 1, 1 and 5 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively (11). 28.6% strains of the whole showed significances, which was the same as in case of the 3rd item. In **SE** (Table 17), 24, 6, 30; 4, 4; 2, 2; 5, 1 and 6 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. 85.7% strains of the whole showed significances in the whole of 12, 13 and 14.

In **SUM**, 66, 88, 39, 49; 12, 28, 17, 11; 4, 22, 18, 4; 25, 52, 33 and 19 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. 76.6, 72.6, 69.2 and 77.7% strains of the whole showed significances in 15, 16, 34, 35, respectively, which were nearly the same as in case of the 6th item. It was noticed that the strains of West Africa (35) showed higher significances than those of East Africa (34), which was the same as in cases of the 1st, 2nd, 3rd, 6th, 7th, 8th and 10th items.

In group level (Table 22), 9, 1, 1 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, which was the same as those noted in cases from the 3rd to 5th and from the 7th to 10 items.

12. W/T of UHG and HG

C.c. and l.r. of W/T of HG on W/T of UHG in the same strains were calculated, and c.c. are shown in the rightest columns of Tables 12 to 17. In **MD** (Table 12), 10, 10, 20; 8, 8; 1, 9, 10; 2, 20 and 22 strains showed significances at 0.1% (1, 2, 3), 1% (2, 3) and 5% (1, 2, 3) levels and no significance even at 5% level (1, 2, 3), respectively. 84.6, 57.5 and 63.3% strains of the whole showed significances in 1, 2 and 3, respectively. In **TA** (Table 13), 1, 10, 11; 8, 8; 9, 9; 9 and 9 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, 75.0 and 75.7% strains of the whole showed significances in 4, 5 and 6, respectively. In **KE** (Table 14), 4, 1 and 5 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively (7). Just half strains of the whole showed significances, which was the same as in cases of the 1st and 2nd items.

In **NI** (Table 15), 4, 16, 20; 2, 2; 1, 9 and 10 strains showed significances at 0.1% (8, 9, 10) and 5% (9, 10) levels and no significance even at 5% level (8, 9, 10), respectively. 80.0, 69.0 and 70.6% strains of the whole showed significances in 8, 9 and 10, respectively, which were

nearly the same as in case of the 6th item. In **IV** (Table 16), 2, 3 and 2 strains showed significances at 0.1%, 1% and 5% levels, respectively (11). In other words, the whole strains showed significances, which was fixed to be the first case throughout the whole items. In **SE** (Table 17), 25, 6, 31; 4, 4; 1, 1; 5, 1 and 6 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. 85.7% strains of the whole showed significances in the whole of 12, 13 and 14, which was quite the same as in case of the 11th item.

In **SUM**, 68, 88, 35, 53; 12, 28, 17, 11; 4, 22, 19, 3; 23, 52, 36 and 16 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, 72.6, 66.4 and 80.7% strains of the whole showed significances in 15, 16, 34 and 35, respectively, which were nearly the same as in cases of the 10th and 11th items. It was noted that strains of West Africa (35) showed higher significances than those of East Africa (34), which was the same as in cases of the 1st, 2nd, 3rd, 6th, 7th, 8th, 10th and 11th items.

In group level (Table 22), 10, 1 and 2 groups showed significances at 0.1%, 1% and 5% levels, respectively. In other words, the whole strains showed significances, which was the same as those noted in cases from the 7th to 10th items. In summed-up group, the whole of 15, 16, 34 and 35 showed significances at 0.1% level, which was the same as those noted in cases from the 3rd to 5th and from the 7th to 11th items.

13. Further discussion

Through the 12 items, significant cases were found as 72.4% (113/156), 52.3% (295/564), 56.7% (408/720), 66.7% (8/12), 55.6% (240/432), 55.9% (248/444), 60.0% (72/120), 65.0% (39/60), 69.3% (241/348), 68.6% (280/408), 57.1% (48/84), 73.1% (307/420), 82.1% (69/84), 74.6% (376/504), 69.9% (897/1,284), 62.8% (1,432/2,280), 56.7% (728/1,284) and 70.7% (704/996) in the order of the group Nos.1-16 and 34 and 35, respectively. Values of No.13 and No.2 were slightly higher and lower than those of others, respectively. However, there were no fundamental differences throughout the whole items. In comparison with the former data²²⁾, present data were looked upon as showing relatively higher significances than those of the former character-combinations.

In comparison with 15 and 16 groups, the 5th item (L/W and W/T) and 9th item (T of UHG and HG) showed the larger significances in 16 than those in 15. In other 10 items, comparatively larger significances were found in 15 rather than in 16.

In comparison with 34 and 35 groups, only one item, i.e., the 5th (L/W and W/T) item, showed high significances in 34 than those in 35. Two items, i.e., the 4th (L/W and L/T) and the 9th (T of UHG and HG) items, showed nearly the same significances in 34 and 35 groups. Concerning the remaining 9 items, comparatively larger significances were found in 35 rather than those in 34.

In cases of the other wild rices, *O. sativa* var. *spontanea* and *O. perennis*, in northeastern India (= Assam), using 17 strains⁶⁾, 77.9% (159/204) items showed significant relations through the whole cases. In comparison with those data and the present one (70.7%, No.16), there was not any noticeable difference between these. On the other hand, 1 strain of *O. longistaminata* collected in Ethiopia showed significances in 50.0% (6/12) in the same items¹⁴⁾, and this was collected at an area relatively narrow. In addition to these, the existence of different species may be attributed to these differences between them.

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

1. Comparative values of length and width

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), 1, 1; 2, 2, 4; 4, 15 and 19 strains showed significances at 1% (17, 19) and 5% (17, 18, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 42.9, 11.8 and 20.8% strains of the whole showed significances in 17, 18 and 19, respectively. In IV (Table 5), no significant strain was found (20). In SE (Table 8), 2, 1, 3; 2, 1, 3; 4, 1, 5; 9, 4 and 13 strains showed significances at 0.1% (21, 22, 23), 1% (21, 22, 23) and 5% (21, 22, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 47.1, 42.9 and 45.8% 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), 3, 4, 9 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), 1 and 5 groups showed significances at 1% level and no significance even at 5% level, respectively. In summed-up group, no significance was shown even at 5% level.

2. Comparative values of length and thickness

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), 1, 1; 1, 1; 3, 3; 3, 16 and 19 strains showed significances at 0.1% (18, 19), 1% (17, 19) and 5% (17, 19) levels and no significance even at 5% level (17, 18, 19), respectively. 57.1, 5.9 and 20.8% strains of the whole showed significances in 17, 18 and 19, respectively. In IV (Table 5), no significant strain was found (20), which was the same as in case of the former item. In SE (Table 8), 3, 1, 4; 1, 1; 2, 2; 11, 6 and 17 strains showed significances at 0.1% (21, 22, 23), 1% (21, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 35.3, 14.3 and 29.2% strains of the whole showed significances in 21, 22 and 23, respectively.

In SUM, 5, 2, 5 and 37 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 24.5% strains of the whole showed significances. In group level (Table 11), no significant group was found through the whole groups and the summed-up group, in which the latter figure was the same as in case of the former item.

3. Comparative values of width and thickness

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), 5, 5; 2, 1, 3; 1, 1; 4, 11 and 15 strains showed significances at 0.1% (18, 19), 1% (17, 18, 19) and 5% (17, 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 5), no significant strain was found (20), which was the same as in cases of the former two items. In SE (Table 8), 4, 2, 6; 3, 2, 5; 3, 3; 7, 3 and 10 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, 22, 23), respectively. 58.8, 57.1 and 58.3% strains of the whole showed significances in 21, 22 and 23, respectively.

In SUM, 11, 8, 4 and 26 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In the group level (Table 11), 2 and 4 groups showed significances at 0.1% level and no significance even at 5% level, respectively. In the summed-up group, significance was shown at 0.1% level.

4. Comparative values of L/W and L/T

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), 3, 8, 11; 1, 3, 4; 4, 4; 3, 2 and 5 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, 88.2 and 79.2% strains of the whole showed significances in 17, 18 and 19, respectively. In **IV** (Table 5), 1 strain (= 100.0) showed significance at 0.1% level (20). In **SE** (Table 8), 5, 5, 10; 4, 1, 5; 3, 3; 5, 1 and 6 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, 22, 23), respectively. 70.6, 85.7 and 75.0% strains of the whole showed significances in 21, 22 and 23, respectively.

In **SUM**, 22, 9, 7 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 11), 2, 2 and 2 groups showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, significance was shown at 0.1% level, which was the same as in case of the 3rd item.

5. Comparative values of L/W and W/T

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, 9, 12; 2, 2; 2, 5, 7; 2, 1 and 3 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. 71.4, 94.1 and 87.5% strains of the whole showed significances in 17, 18 and 19, respectively, which were the highest values throughout the whole above mentioned items. In **IV** (Table 5), 1 strain (= 100.0%) showed significance at 5% level (20). In **SE** (Table 8), 7, 4, 11; 4, 2, 6; 2, 2; 4, 1 and 5 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, 22, 23), respectively. 76.5, 85.7 and 79.2% strains of the whole showed significances in 21, 22 and 23, respectively, which were the highest values throughout the whole above mentioned items.

In **SUM**, 23, 8, 10 and 8 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 83.7% strains of the whole showed significances, which was the highest value throughout the whole above mentioned items. In the group level (Table 11), 1, 2 and 3 groups showed significances at 1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, no significance was shown even at 5% level, which was the same as in cases of the 1st and 2nd items.

6. Comparative values of L/T and W/T

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 5, 7 and 8. In **NI** (Table 7), 3, 3, 6; 2, 3, 5; 7, 7; 2, 4 and 6 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. 71.4, 76.5 and 75.0% 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 (20). In **SE** (Table 8), 8, 1, 9; 1, 1; 1, 1; 7, 6 and 13 strains showed significances at 0.1% (21, 22, 23), 1% (21, 23) and 5% (21, 23) levels and no significance even at 5% level (21, 22, 23), respectively. 58.8, 14.3 and 45.8% strains of the whole showed significances in 21, 22 and 23, respectively, in which the 1st, 2nd and 3rd figures were the same as in cases of the 3rd, 2nd and 1st items, respectively.

In **SUM**, 15, 7, 8 and 19 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 61.2% strains of the whole showed significances. In the group level (Table 11), 1 and 5 groups showed significance at 5% level and no significance

even at 5% level, respectively. In the summed-up group, no significance was shown even at 5% level, which was the same as in cases of the 1st, 2nd and 5th items.

7. Lengths of UHG and HG

C.c. and l.r. of L of HG on L of UHG in the same strains were calculated, and c.c. are shown in the leftmost columns of Tables 16, 18 and 19. In **NI** (Table 18), 7, 17 and 24 strains showed significances at 0.1% level in **17, 18 and 19**, respectively. It was noticed that the whole strains of the three groups showed significances at 0.1% level, which was ascertained as a particular phenomenon. In **IV** (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level (**20**), which was the same as in case of the 4th item. In **SE** (Table 19), 15, 7, 22; 2 and 2 strains showed significances at 0.1% (**21, 22, 23**) and 5% (**21, 23**) levels, respectively. In other words, the whole strains showed significances.

In **SUM**, 47 and 2 strains showed significances at 0.1% and 5% levels, respectively. The whole strains showed significances, which was a particular phenomenon. In the group level (Table 22), the whole groups (= 6) and the summed-up group (= 1) showed significances at 0.1% level. It was noted to be the first case throughout the whole above mentioned items.

8. Widths of UHG and HG

C.c. and l.r. of W of HG on W of UHG 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), 6, 11, 17; 1, 1, 2; 2, 2; 3 and 3 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 (**18, 19**), respectively. 100.0, 82.4 and 87.5% strains of the whole showed significances in **17, 18 and 19**, respectively. In **IV** (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level (**20**), which was the same as in cases of the 4th and 7th items. In **SE** (Table 19), 10, 6, 16; 3, 3; 2, 1, 3; 2 and 2 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, 23**), respectively. 88.2, 100.0 and 91.7% strains of the whole showed significances in **21, 22 and 23**, respectively.

In **SUM**, 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. In the group level (Table 22), 5 and 1 groups showed significances at 0.1% and 1% levels, respectively. The whole groups (= 6) and the summed-up group showed significances at 0.1% level, which were the same as in case of the 7th item.

9. Thicknesses of UHG and HG

C.c. and l.r. of T of HG on T of UHG 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), 7, 16, 23; 1 and 1 strains showed significances at 0.1% (**17, 18, 19**) and 1% (**18, 19**) levels, respectively. The whole strains showed significances, which were the same as in case of the 7th item. In **IV** (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level (**20**), which was the same as in cases of the 4th, 7th and 8th items. In **SE** (Table 19), 16, 7, 23; 1 and 1 strains showed significances at 0.1% level (**21, 22, 23**) and no significance even at 5% level (**21, 23**), respectively. 94.1, 100.0 and 95.8% strains of the whole showed significances in **21, 22 and 23**, respectively.

In **SUM**, 47, 1 and 1 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. 98.0% strains of the whole showed significances. In the group level (Table 22), 5 and 1 groups showed significances at 0.1% and 1% levels, respectively. The whole groups (= 6) and the summed-up group showed significances at 0.1% level,

which were the same as in cases of the 7th and 8th items.

10. L/W of UHG and HG

C.c. and l.r. of L/W of HG on L/W of UHG 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), 7, 12, 19; 2, 2; 3 and 3 strains showed significances at 0.1% (17, 18, 19) and 5% (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, which were quite the same as in case of the 8th item. In **IV** (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level (20), which was the same as in cases of the 4th, 7th, 8th and 9th items. In **SE** (Table 19), 11, 6, 17; 2, 1, 3; 4 and 4 strains showed significances at 0.1% (21, 22, 23) and 1% (21, 22, 23) levels and no significance even at 5% level (21, 23), respectively. 76.5, 100.0 and 83.3% strains of the whole showed significances in 21, 22 and 23, respectively.

In **SUM**, 37, 3, 2 and 7 strains showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 85.7% strains of the whole showed significances. In group level (Table 22), the whole groups (= 6) and the summed-up group showed significances at 0.1% level, which were the same as in cases of the 7th, 8th and 9th items.

11. L/T of UHG and HG

C.c. and l.r. of L/T of HG on L/T of UHG 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), 7, 17 and 24 strains (= 100.0% of the whole) showed significances at 0.1% level in the whole of 17, 18 and 19, respectively, which were quite the same as in case of the 7th item. In **IV** (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level (20), which was the same as in cases of the 4th and from the 7th to 10th items. In **SE** (Table 19), 15, 7, 22; 1, 1; 1 and 1 strains showed significances at 0.1% (21, 22, 23) and 1% (21, 23) levels and no significance even at 5% level (21, 23), respectively. 94.1, 100.0 and 95.8% strains of the whole showed significances in 21, 22 and 23, respectively, which were quite the same as in case of the 9th item.

In **SUM**, 47, 1 and 1 strains showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively, and 98.0% strains of the whole showed significances, both of which were quite the same as in case of the 9th item. In the group level (Table 22), the whole groups (= 6) and the summed-up group showed significances at 0.1% level, which were the same as in cases from the 7th to 10th items.

12. W/T of UHG and HG

C.c. and l.r. of W/T of HG on W/T of UHG 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), 7, 17 and 24 strains (= 100.0% of the whole) showed significances at 0.1% level in 17, 18 and 19, respectively, which were quite the same as in cases of the 7th and 11th items. In **IV** (Table 16), 1 strain (= 100.0%) showed significance at 0.1% level (20), which was the same as in cases of the 4th and from 7th to 11th items. In **SE** (Table 19), 17, 7 and 24 strains (= 100.0% of the whole) showed significances at 0.1% level in 21, 22 and 23, respectively, being a particular phenomenon in this group and quite the same as in case of the 7th item.

In **SUM**, the whole strains (= 49) showed significances at 0.1% level, which was a particular phenomenon. In group level (Table 22), 4 and 2 groups showed significances at 0.1% and 5% levels, respectively. The whole groups (= 6) and the summed-up group showed significances at 0.1% level, which were the same as in cases from the 7th to 11th items.

13. Further discussion

Through 12 items, significant cases were found as 78.6% (66/84), 73.0% (149/204), 74.7% (215/288), 75.0% (9/12), 75.0% (153/204), 75.0% (63/84), 75.0% (216/288) and 74.8% (440/588) in the order of the group **Nos.17 to 24**, respectively. There were no remarkable differences through the whole items. However, **No.17** showed the highest value through the whole localities, which was noted as a particular phenomenon.

III. *O. punctata* KOTSCHY

1. Comparative values of length and width

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), 4, 4; 3, 22 and 25 strains showed significances at 5% level (**26, 27**) and no significance even at 5% level (**25, 26, 27**), respectively. 0.0, 15.4 and 13.8% strains of the whole showed significances in **25, 26** and **27**, respectively. In **KE** (Table 10), 2, 2; 2, 1, 3; 3, 7 and 10 strains showed significances at 0.1% (**29, 30**) and 5% (**28, 29, 30**) levels and no significance even at 5% level (**28, 29, 30**), respectively. 40.0, 30.0 and 33.3% strains of the whole showed significances in **28, 29** and **30**, respectively.

In **SUM**, 2, 2; 3, 7; 13 and 35 strains showed significances at 0.1% (1984 and 1985 in the two countries [18 strains], abbreviated as **31**; 1984, 1985 and 1988 in the two countries [44 strains], abbreviated as **32**) 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 the group level (Table 11), no significance was found through the whole groups. In the summed-up group, significance was found neither in **31** nor in **32**.

2. Comparative values of length and thickness

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; 3, 25 and 28 strains showed significances at 5% level (**26, 27**) and no significance even at 5% level (**25, 26, 27**), respectively. 0.0, 3.9 and 3.5% 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 former item. In **KE** (Table 10), 2, 2; 2, 1, 3; 1, 1, 2; 2, 6 and 8 strains showed significances at 0.1% (**29, 30**), 1% (**28, 29, 30**) and 5% (**28, 29, 30**) levels and no significance even at 5% level (**28, 29, 30**), respectively. 60.0, 40.0 and 46.7% strains of the whole showed significances in **28, 29** and **30**, respectively.

In **SUM**, 2, 2; 3, 3; 2, 3; 11 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. 38.9 and 18.2% strains of the whole showed significances in **31** and **32**, respectively. In the group level (Table 11), the whole groups (= 6) and the summed-up group showed no significance even at 5% level both in **31** and in **32**, which were the same as in case of the former item.

3. Comparative values of width and thickness

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; 3, 3; 2, 22 and 24 strains showed significances at 1% (**25, 26, 27**) and 5% (**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 **KE** (Table 10), 1, 1, 2; 1, 1, 2; 1, 1; 3, 7 and 10 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. 40.0, 30.0 and 33.3% strains of the whole showed significances in **28, 29** and **30**, respectively.

In **SUM**, 2, 2; 3, 4; 1, 4; 12 and 34 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 22.7% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 11), the whole groups (= 6) and the summed-up group showed no significance even at 5% level both in 31 and in 32, which were the same as in cases of the 1st and 2nd items.

4. Comparative values of L/W and L/T

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, 10, 12; 4, 4; 1, 5, 6; 7 and 7 strains showed significances at 0.1% (25, 26, 27), 1% (26, 27) and 5% (25, 26, 27) levels and no significance even at 5% level (26, 27), respectively. 100.0, 73.1 and 75.9% strains of the whole showed significances in 25, 26 and 27, respectively. In KE (Table 10), 3, 4, 7; 2, 2; 1, 1; 2, 3 and 5 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, 70.0 and 66.7% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 9, 19; 2, 6; 2, 7; 5 and 12 strains showed significances in 0.1% (31, 32), 1% (31, 32) and 5% (31, 32) levels and no significance even at 5% level (31, 32), respectively. 72.2% strains of the whole showed significances both in 31 and 32. In the group level (Table 11), 2, 1 and 3 groups showed significances at 1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, 32 and 31 groups showed significances at 5% level and no significance even at 5% level, respectively.

5. Comparative values of L/W and W/T

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), 18, 18; 3, 3; 1, 1, 2; 2, 4 and 6 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, 84.6 and 79.3% strains of the whole showed significances in 25, 26 and 27, respectively. In KE (Table 10), 2, 3, 5; 1, 2, 3; 1, 1, 2; 1, 4 and 5 strains showed significances at 0.1% (28, 29, 30), 1% (28, 29, 30) and 5% (28, 29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 80.0, 60.0 and 66.7% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 5, 23; 3, 6; 3, 4; 7 and 11 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. 61.1 and 75.0% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 11), 1, 1, 1 and 3 groups showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, 32 and 31 groups showed significances at 0.1% and 5% levels, respectively.

6. Comparative values of L/T and W/T

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, 5, 7; 1, 7, 8; 3, 3; 11 and 11 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 (26, 27), respectively. 100.0, 57.7 and 62.1% strains of the whole showed significances in 25, 26 and 27, respectively. These were the highest values throughout the 12 items. In KE (Table 10), 2, 8, 10; 2, 2; 1, 2 and 3 strains showed significances at 0.1% (28, 29, 30) and 5% (28, 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.

In SUM, 12, 17; 1, 8; 2, 5; 3 and 14 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 68.2% strains of the whole showed significances in **31** and **32**, respectively, which were the highest values throughout 12 items. In the group level (Table 11), 1, 2 and 3 groups showed significances at 0.1%, and 1% levels and no significance even at 5% level, respectively. In the summed-up group, both of **31** and **32** showed significances at 0.1% level.

7. Lengths of UHG and HG

C.c. and l.r. of L of HG on L of UHG in the same strains were calculated, and c.c. are shown in the leftest columns of Tables 20 and 21. In **TA** (Table 20), 2, 2, 4; 5, 5; 6, 6; 1, 13 and 14 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, 50.0 and 51.7% strains of the whole showed significances in **25, 26** and **27**, respectively. In **KE** (Table 21), 4, 9, 13; 1, 1 and 2 strains showed significances at 0.1% level (**28, 29, 30**) and no significance even at 5% level (**28, 29, 30**), respectively. 80.0, 90.0 and 86.7% strains of the whole showed significances in **28, 29** and **30**, respectively. These were the highest values throughout 12 items.

In **SUM**, 15, 17; 5; 6; 3 and 16 strains showed significances at 0.1% (**31, 32**), 1% (**32**) and 5% (**32**) levels and no significance even at 5% level (**31, 32**), respectively. 83.3 and 63.6% strains of the whole showed significances in **31** and **32**, respectively, in which the first figure was the same as in case of the 6th item. In the group level (Table 22), 4, 1 and 1 groups showed significances at 0.1% and 1% levels and no significance even at 5% level, respectively. In the summed-up group, both of **31** and **32** showed significances at 0.1% level, which were the same as in case of the 6th item.

8. Widths of UHG and HG

C.c. and l.r. of W of HG on W of UHG 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), 2, 7, 9; 1, 3, 4; 4, 4; 12 and 23 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 (**26, 27**), respectively. 100.0, 53.9 and 58.6% strains of the whole showed significances in **25, 26** and **27**, respectively, in which the first figure was particularly large, being the same as in case of the 6th item. In **KE** (Table 21), 1, 5, 6; 1, 1; 1, 1; 4, 3 and 7 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, 70.0 and 53.3% strains of the whole showed significances in **28, 29** and **30**, respectively, in which the first figure was noted to be the lowest value throughout 12 items.

In **SUM**, 8, 15; 2, 5; 1, 5; 7 and 19 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. 61.1 and 56.8% strains of the whole showed significances in **31** and **32**, respectively, in which the first figure was the same as in case of the 5th item. In the group level (Table 22), 2, 1 and 3 groups showed significances at 0.1% and 5% levels and no significances even at 5% level, respectively. In the summed-up group, **32** and **31** groups showed significances at 0.1% and 1% levels, respectively.

9. Thicknesses of UHG and HG

C.c. and l.r. of T of HG on T of UHG 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), 4, 4; 5, 5; 5, 5; 3, 12 and 15 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, 53.9 and 48.3% strains of the whole showed significances in **25, 26** and **27**, respectively, in which the first figure was particularly small, being the same as in cases of the 1st and 2nd items. In **KE** (Table 21), 2, 1,

3; 4, 4; 1, 1; 2, 5 and 7 strains showed significances at 0.1% (28, 29, 30), 1% (29, 30) and 5% (28, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 60.0, 50.0 and 53.3% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 3, 7; 4, 9; 1, 6; 10 and 22 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. 44.4 and 50.0% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 22), 2, 2 and 2 groups showed significances at 0.1% and 1% levels and no significances even at 5% level, respectively. In the summed-up group, both of 31 and 32 showed significances at 0.1% level, which was the same as in cases of the 6th and 7th items.

10. L/W of UHG and HG

C.c. and l.r. of L/W of HG on L/W of UHG 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), 1, 4, 5; 5, 5; 4, 4; 2, 13 and 15 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. 33.3, 50.0 and 48.3% strains of the whole showed significances in 25, 26 and 27, respectively. In KE (Table 21), 2, 7, 9; 2, 2, 4; 1, 1 and 2 strains showed significances at 0.1% (28, 29, 30) and 1% (28, 29, 30) levels and no significance even at 5% level (28, 29, 30), respectively. 80.0, 90.0 and 86.7% strains of the whole showed significances in 28, 29 and 30, respectively, which were quite the same as in case of the 7th item, being the highest values throughout the 12 items.

In SUM, 10, 14; 4, 9; 4, 4 and 17 strains showed significances at 0.1% (31, 32), 1% (31, 32) and 5% (32) levels and no significance even at 5% level (31, 32), respectively. 77.8 and 61.4% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 22), 4, 1 and 1 groups showed significances at 0.1% and 5% levels and no significance even at 5% level, respectively. In the summed-up group, both of 31 and 32 showed significances at 0.1% level, which were the same as in cases of the 6th, 7th and 9th items.

11. L/T of UHG and HG

C.c. and l.r. of L/T of HG on L/T of UHG 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), 1, 1; 1, 2, 3; 10, 10; 2, 13 and 15 strains showed significances at 0.1% (26, 27), 1% (25, 26, 27) and 5% (26, 27) levels and no significance even at 5% level (25, 26, 27), respectively. 33.3, 50.0 and 48.3% strains of the whole showed significances in 25, 26 and 27, respectively, which were quite the same as in case of the 10th item. In KE (Table 21), 2, 4, 6; 1, 1, 2; 1, 1; 2, 4 and 6 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. 66.7, 60.0 and 60.0% strains of the whole showed significances in 28, 29 and 30, respectively.

In SUM, 6, 7; 3, 5; 1, 11; 8 and 21 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 52.3% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 22), 4 and 2 groups showed significances at 0.1% level and no significance even at 5% level, respectively. In the summed-up group, both of 31 and 32 showed significances at 0.1% level, which were the same as in cases of the 6th, 7th, 9th and 10th items.

12. W/T of UHG and HG

C.c. and l.r. of W/T of HG on W/T of UHG in the same strains were calculated, and c.c. are shown in the rightmost columns of Tables 20 and 21. In TA (Table 20), 1, 3, 4; 4, 4; 6, 6; 2, 13 and 15 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. 33.3, 50.0 and 48.3% strains of the whole showed significances in 25, 26 and 27, respectively, which were quite the same as in cases of the 10th and 11th items. In KE (Table 21), 2, 3, 5; 4, 4; 2, 2; 3, 1 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. 40.0, 90.0 and 73.3% strains of the whole showed significances in 28, 29 and 30, respectively, in which the second figure was the highest value throughout the 12 items, being the same as in cases of the 7th and 10th items.

In SUM, 6, 9; 4, 8; 2, 8; 6 and 19 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. 66.7 and 56.8% strains of the whole showed significances in 31 and 32, respectively. In the group level (Table 22), 2 and 4 groups showed significances at 0.1% level and no significance even at 5% level, respectively. In the summed-up group, 32 and 31 showed significance at 0.1% and no significance even at 5% level, respectively.

13. Further discussion

Through the whole items, significant cases were found as 44.4% (16/36), 46.5% (145/312), 46.3% (161/348), 58.3% (35/60), 63.3% (76/120), 61.7% (111/180), 58.8% (127/216) and 51.5% (272/528) in the order of the group Nos.25 to 32, respectively. It was remarkable that the higher significant levels were recognized in the range from Nos.28 to 30, i.e., in KE, than those noted in the range from Nos.25 to 27, i.e., in TA. It may be said that this is to be looked upon as locality specificity.

In comparison with 31 and 32, 3 items, i.e., the 4th item (L/W and L/T), the 5th item (L/W and W/T) and the 9th item (T of UHG and HG), showed comparatively higher significances in 32 rather than in 31, the remaining 9 items showing quite the reversed results.

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

Six items (6th, 8th, 9th, 10th, 11th, 12th), 1 item (5th), 1 item (7th), and 4 items (1st, 2nd, 3rd, 4th) showed significances at 0.1%, 1% and 5% levels and no significance even at 5% level, respectively. 66.7% (8/12) items showed significances, which were nearly the same values as those of the previous 3 species, i.e., *O. longistaminata*, *O. breviligulata* and *O. punctata*.

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 the 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 the character-combinations, 72.4, 52.3, 56.7, 66.7, 55.6, 55.9, 60.0, 65.0, 69.3, 68.6, 57.1, 73.1, 82.1, 74.6, 69.9, 62.8; 78.6, 73.0, 74.7, 75.0, 75.0, 75.0, 75.0, 74.8; 44.4, 46.5, 46.3, 58.3, 63.3, 61.7, 58.8, 51.5; 66.7; 56.7 and 70.7% in the whole strains

showed significant relations in the order of the group **No.1** to **No.35**, respectively. It was confirmed that the values of group **No.13** (=82.1%) and **No.25** (=44.4%) were the highest and the lowest ones throughout the whole groups (=35), respectively.

Species differentiations and character-combinations were extensively found. Moreover, locality-specificities were detected to some extent. For example, strains of West Africa (**35**) showed higher significances than those of East Africa (**34**) in 9 items in *O. longistaminata*. In Tanzania (**4, 5, 6**), the significant values were found to be at the highest levels throughout the whole localities in the 5th items in *O. longistaminata*. In Nigeria (**17, 18, 19**), in *O. breviligulata*, the significant values were found to be at the highest levels throughout the whole localities in the range from 7th to 12 items among the whole species. In *O. punctata*, higher significant levels were recognized in **KE** than those in **TA**, showing a remarkable locality specificity.

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

References

- 1) Bezançon, G.: Synthèse sur les prospections de riz réalisées en Afrique par l'ORSTOM et l'IRAT. *ORSTOM-IRAT*, pp. 13 (1982a)
- 2) Bezançon, G.: Analyse du complexe des espèces annuelles de riz d'origine africaine: Relation entre formes sauvages, adventice et cultivées. *ORSTOM-IRAT*, pp. 16 (1982b)
- 3) Farooq, S., Asghar, M., Iqbal, N. and Shah, T. M.: Variability in salt tolerance of accessions of wild rice species *Oryza punctata* and *O. officinalis*. *Intern. Rice Res. Newsletter*, **17**(6), 16 (1992)
- 4) IRAT/DAP: Liste des échantillons des espèces d'*Oryzae* Africaines et des cultivars traditionnelles d'*Oryza sativa*. *IRAT*, pp. 72 (1979)
- 5) Jaquot, M. et Arnand, M.: Classification numériques de variétés de riz. *l'Agronomie Tropicale*, **34**, 157-173 (1979)
- 6) Katayama, T. C.: Distribution and some morphological characters of the wild rice in northeastern India (IV). *Mem. Fac. Agr. Kagoshima Univ.*, **20**, 19-35 (1984)
- 7) Katayama, T. C.: Preliminary consideration on distribution and some morphological characters of wild rice in African countries. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 1-23 (1987)
- 8) Katayama, T. C., Xavier Roland, R., Nakagama, A. and Sumi, A.: Distribution and some morphological characters of wild rice in Madagascar. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 24-29 (1987)
- 9) Katayama, T. C., Ching'ang'a, H. M. and Nakagama, A.: Distribution and some morphological characters of wild rice in Tanzania. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 30-35 (1987)
- 10) Katayama, T. C., Nakagama, A. and Sumi, A.: Distribution and some morphological characters of wild rice in Kenya. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 36-47 (1987a)
- 11) Katayama, T. C., Nakagama, A. and Sumi, A.: Distribution and some morphological characters of wild rice in Nigeria. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 48-67 (1987b)

- 12) Katayama, T. C. and Nakagama, A.: Distribution of wild rice in Ivory Coast. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 68-71 (1987)
- 13) Katayama, T. C., Ngning, M., Nakagama, A. and Sumi, A.: Distribution and some morphological characters of wild rice in Senegal. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **10**, 72-90 (1987)
- 14) Katayama, T. C.: On the wild rice, *Oryza longistaminata* CHEV. et ROEHR., collected in Ethiopia. *Mem. Kagoshima Univ. Res. Center S. Pac.*, **8**, 157-169 (1987)
- 15) Katayama, T. C.: Distribution and grain morphology of wild rice collected in Madagascar and Tanzania, 1988. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **18**, 1-17 (1990)
- 16) Katayama, T. C., Xavier Roland, R. and Satoh, H.: Distribution and grain morphology of wild rice collected in Madagascar, 1988. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **18**, 18-37 (1990)
- 17) Katayama, T. C., Ching'ang'a, H. M., Ilaila, D. and Satoh, H.: Distribution and grain morphology of wild rice collected in Tanzania, 1988. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **18**, 38-62 (1990)
- 18) Katayama, T. C.: Consideration on distribution and grain morphology of wild rice in African countries. *Kagoshima Univ. Res. Center S. Pac., Occasional Papers*, **18**, 127-172 (1990)
- 19) Katayama, T. C.: Grain morphology of wild rice in African countries (II). *Mem. Fac. Agr. Kagoshima Univ.*, **28**, 15-45 (1992)
- 20) Katayama, T. C.: Grain morphology of wild rice in African countries (III). *Mem. Fac. Agr. Kagoshima Univ.*, **29**, 13-37 (1993)
- 21) Katayama, T. C.: Grain morphology of wild rice in African countries (IV). *Mem. Fac. Agr. Kagoshima Univ.*, **30**, 1-30 (1994)
- 22) Katayama, T. C.: Grain morphology of wild rice in African countries (V). *Mem. Fac. Agr. Kagoshima Univ.*, **31**, 1-43 (1995)
- 23) Reimers, P. J., Consignado, S. and Nelson, R. J.: Wild species of *Oryza* with resistance to rice blast (B1). *Intern. Rice Res. Notes*, **18**(2), 5 (1993)
- 24) Second, G. et Trouslot, P.: Électrophorèse d'enzymes de riz (*Oryza* sp.). *ORSTOM, Travaux et Documents de O.R.S.T.O.M.*, n° **120**, pp. 80 (1980)
- 25) Taillebois, J.: Une nouvelle perspective pour la production de semences hybrides F₁: le transfert des caractères d'allogamie de l'espèce *O. longistaminata* A. CHEV. à l'espèce *O. sativa* L. *l'Agronomie Tropicale*, **38**, 303-307 (1983)
- 26) Tateoka, T.: Taxonomy and chromosome numbers of African representatives of the *Oryza officinalis* Complex. *Bot. Mag., Tokyo*, **78**, 198-201 (1965)
- 27) Vaughan, D. A.: Wild rice (*Oryza* spp.) collection mission in Zambia and Botswana. Los Baños, Philippines, pp. 60 (1993)
- 28) Xw, B., Wang, Y. M., Wu, C. M. and Zhuang, B. C.: Interspecific superoxide dismutase zymogram of genus *Oryza*. *Chin. J. Rice Sci.*, **7**(4), 247-250 (1993) (in Chinese with English Summary)
- 29) Yuan, P. Y., Zhang, Y. Z. and Cai, H. W.: Chinese common wild rice close to the japonica type. *Rice Genet. Newsl.*, **9**, 36-37 (1992)