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Consideration on Distribution and Grain Morphology of Wild Rice in African Countries

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Introduction

During the periods from October to November in 1984, from August to November in 1985, and from May to August in 1988, the writer had been sent to 8 countries of Africa before and after studies in France and England, *i.e.*, Madagascar, Tanzania, Kenya, Nigeria, Ivory Coast, Liberia, Senegal and Gambia, for the collection of wild and cultivated rices, under the project, "Studies on the Distribution and Ecotypic Differentiation of Wild and Cultivated Rice Species in Africa", supported by a Grant from the Ministry of Education, Science and Culture of the Japanese Government. In these opportunities, wild rices distributed in African countries were studied.

On the distribution of wild rice in Africa, some scientific reports have already been published[1~9, 23~26]. Although Africa has been considered to be one of the most important distribution areas of the wild rice in the world, accumulation 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 geographical, seasonal and ecotypic differentiations of wild rice in Africa.

In the previous papers [10~16], the preliminary and advanced data have been published as the results of the first and the second survey trips made in 1984 and 1985, respectively. In the following previous papers, the results obtained in the third survey trip made in 1988 were reported [18~22].

In the present paper, the habitat and the record of the morphological characters of the unhusked grains of wild rices collected in 1984, 1985 and 1988 were described. Their plant- and grain-characters are now being analyzed at Kagoshima University and the research stations of the respective countries. Then, after the further analyses of morphological, physiological, ecological, genetical and evolutional studies in these series, the detailed and fundamental principles on the origin of the cultivated rice and relationships between African and Asian wild rice species and strains might further be ascertained in more details.

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RATIKA MALAGASY, UNITED REPUBLIC OF TANZANIA, REPUBLIC OF KENYA, FEDERAL REPUBLIC OF NIGERIA, RÉPUBLIQUE DE CÔTE D'-IVOIRE, REPUBLIC OF LIBERIA, RÉPUBLIQUE DE SENEGAL, RÉPUBLIQUE FRANCAISE, UNITED KINGDOM. Thanks are also due to the scientists in the respective countries.

Abstract of distribution and habitat of wild *Oryza* species

The localities concerned in these trips in African countries were mentioned in the respective papers [11~16, 19, 20] in detail. In these 8 papers, habitats, not only collected samples but also only observed, were reported, and specificities of locality were mentioned in detail. Geographical situations where wild rice was found were briefly illustrated in Fig. 1. In this figure, countries concerned and Accession No. of the wild rice are given. The strains collected in GAMBIA are included in group of SENEGAL.

Most of the seed samples collected were divided into two parts, one of which was deposited in the scientific organizations in the respective countries, and another one was carried back to Japan. These plant- and grain-characters are analysed and analysing at these respective research organizations and at Kagoshima University, Japan.

Number of strains collected was 284 in the total. They were constituted by 190 of *Oryza longistaminata,* 49 of *O. breviligulata,* 44 of *O. punctata* and 1 of *O. brachyantha.*

I. *Oryza longistaminata* CHEV. et ROEHR. (190 strains)

Populations of the species were found in a lot of localities of 6 countries, *i.e.*, 60 strains in Madagascar, 37 strains in Tanzania, 10 strains in Kenya, 34 strains in Nigeria, 7 strains in Ivory Coast, 42 strains in Senegal including of Gambia, and many other populations were observed but not collected in these trips. They had briefly creeping growth in the pond, swamp, irrigation canal, embankment, small stream, and waste land. They were sometimes adjacent to the rice field, being separated by an embankment or not. Some populations are sympatrically growing with the cultivated rice species.

II. *Oryza breviligulata* CHEV. et ROEHR. (49 strains)

Populations of the species were found in several districts of 3 countries, *i.e.*, 24 strains in Nigeria, 1 strain in Ivory Coast and 24 strains in Senegal, and many other populations were observed but not collected in these trips. They were found in paddy field, waste land, pond, swamp, along river, upland field, and road-side ditch. Sometimes it grows as a serious weed for the cultivated rice species.

III. *Oryza punctata* KOTSHY (44 strains)

Populations of the species were found in several districts of 2 countries, *i.e.*, 29 strains in Tanzania and 15 strains in Kenya, and many other populations were observed

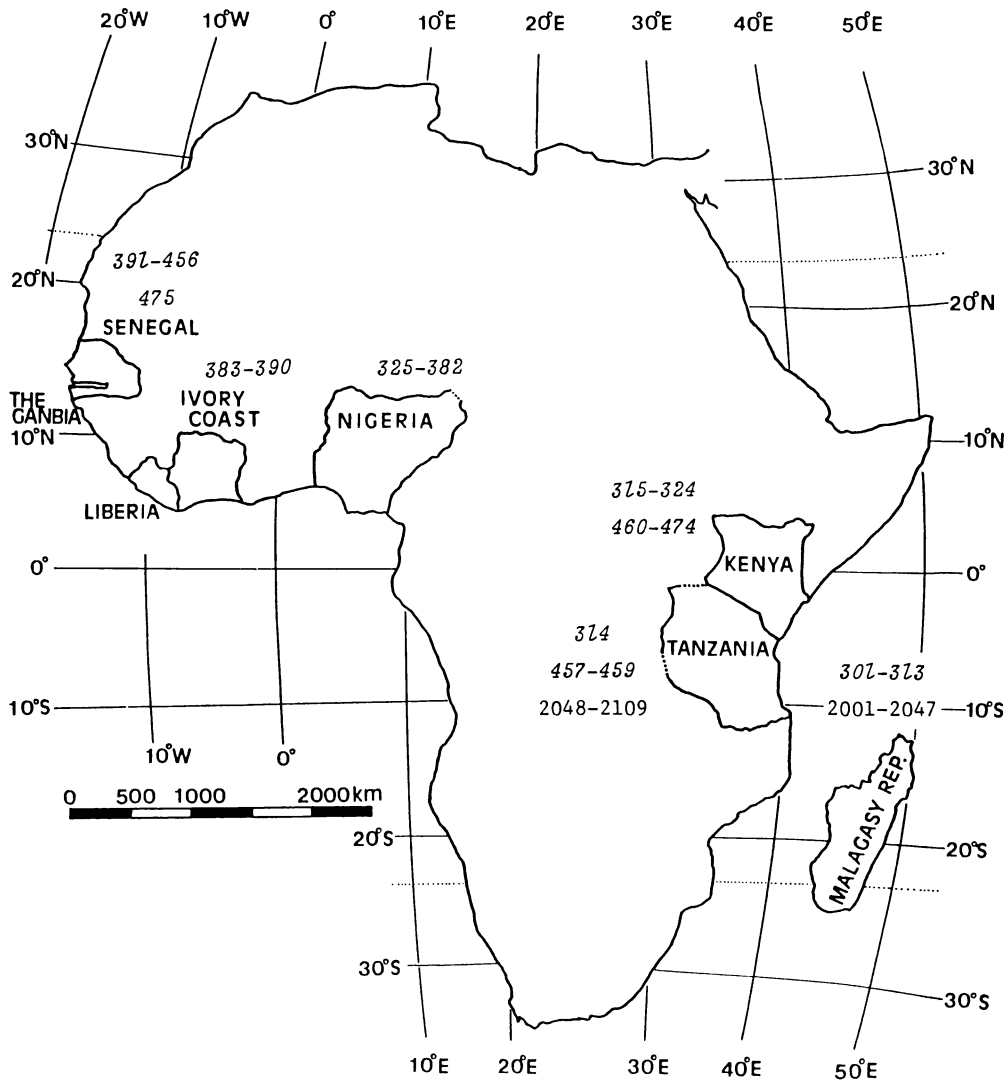

Fig. 1. Map showing the countries where collection and observation of the wild rice were made in Africa. Code numbers used in the figure are corresponding to the accession numbers used in the tables. *Italic* and roman letters show the strains collected in 1984 and 1985, and 1988, respectively.

but not collected in these trips. They were found in a road-side ditch, edge of swamp of pond, waste land, and bush. They were sometimes adjacent to the rice field or upland crop field, being separated by an embankment or not. Sometimes it is serious weed for the cultivated rice species.

IV. *Oryza brachyantha* CHEV. et ROEHR. (1 strain)

Population of the species was found only in 1 locality in Senegal. The habitat was surrounded by grass land, forest. It shows dia. 50 meter pond.

Distributions of wild rices collected were listed up in Table 1. In this table, Accession No., species name, year, month and date of collection, abstract of locality and brief information of habitat were described. These detailed data are also found in the respective papers [11~16, 19, 20]. Populations observed but not collected were omitted in the table, which could be ascertained in the respective papers [11~16, 19, 20].

Table 1. Abstract on distribution and habitat of wild rice collected in 7 countries of Africa; Madagascar in 1985 and 1988, Tanzania in 1984 and 1988, Kenya in 1984 and 1985, Nigeria in 1984 and 1985, Ivory Coast in 1984, Senegal in 1985. Abbreviations: **L**; *Oryza longistaminata* CHEV. et ROEHR., **B**; *Oryza breviligulata* CHEV. et ROEHR., **P**; *Oryza punctata* KOTSCHY, **R**; *Oryza brachyantha* CHEV. et ROEHR., m; meter or meters, km; kilometer or kilometers

Accession No.	Species	Date	Place	Detailed locality, habitat and remarks
MADAGASCAR in 1985				
301	**L**	Aug. 31	Marovoay	ca. 2 km south of trifurcated road, Antananarivo, Marovoay, Mahajanga. Swampy area near paddy field.
302	**L**	Sep. 1	Marovoay	Ambodimadiro-Befanpisy Village. 6 km east from Marovoay and 500 m north from the Telephone Publik. Swampy area.
303	**L**	Sep. 1	Marovoay	ca. 5 km north of a trifurcated road. Paddy field and waste land.
304	**L**	Sep. 1	Mahajanga	ca. 7 km east from airport of Mahajanga. Paddy field.
305	**L**	Sep. 1	Mahajanga	Mangatsa Village. Pond, dia. 500 m.
306	**L**	Sep. 2	Marovoay	Tananbon Village. Swampy area, dia. 500 m.
307	**L**	Sep. 3	Antananarivo	Befotoana-Ampijoroa. Swamps, 100 m×100 m and 100 m×50 m.
308	**L**	Sep. 5	Antsapanimahazo	100 m north from Antsapanimahazo. Along irrigation canal, 5 m width.
309	**L**	Sep. 5	Antsapanimahazo	2 km east from Antsapanimahazo. Dried-up irrigation canal, 5 m width.
310	**L**	Sep. 5	Anororo	100 m west from Anororo, west shore of lac Alaotra. Swampy area, dia. 500 m, and small pool dia. 10 m.
311	**L**	Sep. 6	Ambatondrazaka	Experimental Field of CALA, FOFIFA, Complexe Agronomique du lac Alaotra. Irrigation canal and embankment.
312	**L**	Sep. 6	Imerimandroso	Just south of Imerimandroso, north of Madiorano. Swamp, 100 m×200 m.
313	**L**	Sep. 6	Antanifutsy	Near Antanifutsy. Small river, jointed swamp, 100 m×500 m.
MADAGASCAR in 1988				
2001	**L**	June 4	Mahajanga	8 km northeast from Mahajanga. Paddy field, 100 m×200 m.
2002	**L**	June 4	Mahajanga	10 km northeast from Mahajanga. Paddy field, 300 m×400 m. Small pond in the middle position.

2003 **L** June 4 Mahajanga Near the place and similar habitat of **2002.**

2004 **L** June 4 Mahajanga 20 km northeast from Mahajanga. Waste land, 200 m×300 m.

2005 **L** June 4 Mahajanga 21 km northeast from Mahajanga. Along the river.

2006 **L** June 4 Mahajanga 9 km southeast from Mahajanga. Paddy field, 100 m×200 m. Pre-matured grains.

2007 **L** June 4 Marovoay 10 km from Marovoay. Experimental Farm of FOFIFA. Swamp, 50 m×100 m.

2008 **L** June 4 Marovoay 21 km north from Marovoay. Paddy field, dia. ca. 200 m. Located between road and waste land.

2009 **L** June 5 Marovoay 51 km east from Marovoay. Terraced paddy fields, 100 m× 200 m in east and 200 m×300 m in west sides.

2010 **L** June 5 Ambondma 16 km northeast from Ambondma. Pond, 20 m × 50 m, separated 50 m from main road. Small pool, 5 m×10 m.

2011 **L** June 5 Mampikony 33 km southeast from Mampikony. Pond, 100 m × 200 m. Paddy field in east side.

2012 **L** June 5 Mampikony 27 km southeast from Mampikony. Paddy field, 300 m×500 m.

2013 **L** June 5 Mampikony 20 km southeast from Mampikony. Pond, 50 m ~ 100 m × 400 m. Highly seed sterile.

2014 **L** June 5 Mampikony Near Mampikony Town. Paddy field, 100 m × 200 m. Too much dry.

2015 **L** June 6 Mampikony 9 km north from Mampikony. Paddy field, 200 m×1 km.

2016 **L** June 6 Port Berge 19 km northeast from Port Berge Vaovao. Waste land, 400 m×400 m, and pond, dia. 100 m.

2017 **L** June 6 Port Berge 32 km northeast from Port Berge Vaovao. Paddy field.

2018 **L** June 6 Antsohihy 47 km southwest from Antsohihy. Paddy field and small canal.

2019 **L** June 7 Antsohihy 8 km east from Antsohihy. Paddy field, 300 m×200 m, and small pond. Presumed intra-population-diversity in view of flowering period, temporal isolation, pollen- and seed-fertilities.

2020 **L** June 7 Antsohihy 34 km east from Antsohihy and 5 km east from junction to Befandrianana. Paddy field, 100 m×200 m, and small pond, 20 m×50 m.

2021 **L** June 8 Befandrianana 25 km west from Befandrianana. Paddy field, 50 m to 100 m ×300 m.

2022 **L** June 8 Befandrianana 9 km west from Befandrianana. Paddy field, 200 m×1 km.

2023 **L** June 8 Befandrianana 4 km west from Befandrianana. Dried-up paddy field, 500 m ×800 m.

2024 **L** June 8 Befandrianana 4.5 km west from Befandrianana. Dried-up paddy field, 300 m×1 km. Nearly the same habitat of **2023**.

2025 **L** June 8 Antsohihy 25 km southwest from Antsohihy. Waste lands, 1 km×300 m. Small paddy fields.

2026 **L** June 9 Mampikony 11 km southwest from Mampikony. Paddy fields, 100 m × 150 m, and also 100 m×150 m.

2027 **L** June 9 Ambondramamy 3 km south from Ambondramamy. Paddy field, 300 m×200 m, having small stream in the middle part.

2028 **L** June 9 Ambondramamy 21 km south from Ambondramamy. Paddy field, 100 m × 150 m.

2029 **L** June 9 Ambondramamy 22 km south from Ambondramamy. Slightly sloped paddy field, 100 m×200 m, having small pool.

2030 **L** June 9 Ambondramamy 27 km south from Ambondramamy. Small stream across the main road.

2031 **L** June 9 Ambondramamy 28 km south from Ambondramamy. Irregularly shaped paddy field, 100 m×300 m.

2032 **L** June 11 Antananarivo In the City. Paddy field, waste land, and originated water pool.

2033 **L** June 14 Tsinjoarivo 29 km west from Ambatondrazaka. Paddy field. Only along the embankment.

2034 **L** June 14 Morarano 40 km north from Tsinjoarivo. Small stream, sub-road and pond, 200 m×100 m.

2035 **L** June 14 Ambahitarivo 1 km south from Ambahitarivo. Paddy field and pond.

2036 **L** June 14 Anororo 2 km east from Antsapanimahazo and 6 km west from Anororo. Paddy field. Presumed temporal isolation.

2037 **L** June 14 Anororo 6 km east from Antsapanimahazo and 6 km west from Anororo. Paddy field. Sympatrically with cultivated rice (Accession No.**1036**).

2038 **L** June 14 Anororo 7 km west from Antsapanimahazo and 1 km west from Anororo. Paddy field, 200 m width. Sympatrically with cultivated rice (Accession No.**1037**).

2039 **L** June 14 Vohitraivo 33 km northeast from Antsapanimahazo and 1 km southwest from Vohitraivo. Paddy field and small stream.

2040 **L** June 15 Alaotra In CALA, Complexe Agronomique du lac Alaotra. Experimental Rice Field.

2041 **L** June 15 Imerimandroso 3 km south from Imerimandroso and 4 km north from Madiorano. Paddy field.

2042 **L** June 15 Madiorano Near Rice Mill. Bevondrona Village. Paddy field.

2043 **L** June 17 Tamatave 5 km north from Tamatave. Swamp, 50 m×200 m.

2044 **L** June 17 Tamatave 10 km north from Tamatave. Large river, paddy field and waste land.

2045 **L** June 19 Tamatave 57 km south from Fenerive and 35 km north from Tamatave. River side and swamp.

2046 **L** June 19 Tamatave 59 km south from Fenerive and 33 km north from Tamatave. River side and swamp. Nearest plant growing 150 m far from Indian Sea shore.

2047 **L** June 19 Tamatave 60 km south from Fenerive and 32 km north from Tamatave. River side. Nearest plant located 200 m from Indian Sea shore.

TANZANIA in 1984

457 **P** Nov. 20 Dar es Salaam Kimara Village. Large pond, 100 m×200 m.

314 **L** Nov. 20 Kibaha Kibaha Village. Half-dried up pond, 100 m×200 m.

458 **P** Nov. 20 Chalinze ca. 10 km east from Chalinze. Road-side pasture, slowly down from the road.

459 **P** Nov. 23 Dakawa In field of Dakawa Research Station. Swampy area, 5 m×20 m.

TANZANIA in 1988

2048 **L** July 4 Kibaha 31 km west from edge of the town of Dar es Salaam and 62 km east from Chalinze. Pond, dia. 200 m.

2049 **L** July 5 Ifakara 1 km south from the gate of TARO, Tanzania Agricultural Research Organization, Lumeno. Paddy field, 200 m×50 m.

2050 **L** July 5 Ifakara 12 km east from the gate of TARO, and 1 km east from CCM. Paddy field of TAC, Tanganyika Agricultural Cooperation.
2051 **L** July 5 Ifakara 4 km from TAC, Mahutansa. Small stream.
2052 **L** July 5 Ifakara 5 km northeast from Mahutansa. Shallow water paddy field, 300 m×200 m.
2053 **L** July 8 Kyela 117 km south from Mbeya, and 2 km south from Kyela. Paddy field and a lotus pond, 200 m×50 m.

2054 **L** July 8 Kyela 12 km south from Kyela. Swamp, 300 m×1 km.
2055 **L** July 8 Kyela 5 km south from Kyela. Paddy field and large pond.
2056 **L** July 9 Ihahi 14 km north from Chimala. Meandering road through large areas of *Miscanthus* sp. field.
2057 **L** July 9 Mbarari NAFCO, National Agriculture and Food Corporation, in Mbarari. 20 km north from Igawa. Stocked-seeds in the office.
2084 **P** July 9 Mbarari NAFCO in Mbarari. 20 km north from Igawa. Stocked-seeds in the office.

2085 **P** July 13 Dodoma 56 km west from Dodoma and 14 km east from Bahi Swamp. Paddy field.
2086 **P** July 13 Manyoni 102 km west from Dodoma and 15 km east from Manyoni. Small river.
2087 **P** July 13 Issuna 5 km north from Issuna and 50 km north from Manyoni. Man-created pond, 20 m×50 m.
2088 **P** July 14 Singida 68 km northwest from Singida and 23 km southeast from Shelui. Half-dried up irrigation canal.
2058 **L** July 14 Shelui 15 km west from Shelui. Paddy field.

2059 **L** July 15 Nzega 17 km northwest from Nzega. Large pond, 500 m×200 m.
2060 **L** July 15 Kahama 36 km west from Kahama. Road-side swamps, 10 m × 500 m, 10 m×10 m and 10 m×100 m.
2061 **L** July 16 Kigoma 6 km east from Kigoma. Small pond, 3 m × 10 m and the flowing small stream.
2062 **L** July 16 Kigoma 6 km east from Kigoma. Small pond, 10 m × 50 m. Connected with **2061** site by small stream-pipe under main road.
2063 **L** July 17 Ujiji 1 km south from Ujiji City. Waste land. *Cyperus* sp. dominant.

2064 **L** July 17 Ujiji 1 km south from Ujiji City. 200 m far from shore of the Lake Tanganyika. Waste land, 200 m×200 m.
2065 **L** July 17 Ujiji 1 km south from Ujiji City. Waste land, 200 m×300 m.
2066 **L** July 19 Uvinza 95 km east from Kigoma and 39 km north from Uvinza. Waste land, 50 m×300 m.
2089 **P** July 19 Uvinza 95 km east from Kigoma and 39 km north from Uvinza. Waste land, 40 m far from main road. No boundary between habitats of **2066** and **2089**, but growing allopatrically.
2067 **L** July 19 Uvinza In Uvinza City. Waste land, 50 m width. Riverbed of Malagarasi River.

2068 **L** July 20 Kasulu 8 km north from Kasulu. Waste land and small stream.
2069 **L** July 21 Ibada 22 km east from Geita. Ibada Village. Swamps, 500 m × 1 km in north and south sides each.
2070 **L** July 22 Kakurgusi 10 km northwest from Sengerema. Kakurgusi Village. Shallow water paddy fields.

2071 **L** July 22 Mhaluzi 30 km northwest from Sengerema, 20 km northwest from Kakurgusi, and 5 km southeast from Nyakalilo. Waste land.

2072 **L** July 23 Mwanza 13 km east from Mwanza. Paddy field.

2073 **L** July 23 Mwanza 43 km east from Mwanza and 10 km east from Nyanguge Village. Swampy area, 10 m×300 m.

2074 **L** July 23 Mwanza 43 km east from Mwanza and 10 km east from Nyanguge Village. The same habitat as **2073**, but differentiated.

2090 **P** July 23 Mwanza 43 km east from Mwanza and 10 km east from Nyanguge Village. Nearly the same habitats of **2073** and **2074**.

2075 **L** July 23 Mwanza 54 km east from Mwanza and turned northward for 3 km, and further 300 m walked. 200 m south from shore of Lake Victoria. Black soil. Upland rice field. Irrigation canal.

2091 **P** July 23 Mwanza Nearly the same habitat of **2075**. Mainly along water canal, and a few plants in paddy field.

2076 **L** July 23 Mwanza 54 km east from Mwanza. Entrance position for the habitats of **2075** and **2091**. Waste grass land and small pond, dia. 10 m, *Cyperus* sp. dominant. Paddy field.

2092 **P** July 23 Mwanza 54 km east from Mwanza. Entrance position for the habitats of **2075** and **2091**. Nearly the same habitat of **2076**. Small pond of *Cyperus* sp. dominant.

2093 **P** July 23 Mwanza 54 km east from Mwanza. Entrance position for the habitats of **2075** and **2091**. Paddy field.

2094 **P** July 23 Mwanza 54 km east from Mwanza. Entrance position for the habitats of **2075** and **2091**. Waste land, 500 m×200 m. 100 m far from main road.

2077 **L** Aug. 1 Mtwango Mtwango Village. Swamp, 100 m × 300 m in one side and paddy field in another side.

2095 **P** Aug. 1 Mtwango Mtwango Village. Swamp, 100 m×2 km. Paddy field.

2096 **P** Aug. 1 Kilombero Just south village of Kilombero. Waste land and cultivated rice species, *O. glaberrima* (Accession No.**1406**). Field of Experimental Station. Waste land. Sympatrically with *O. glaberrima* to some extent.

2078 **L** Aug. 1 Kilombero Kilombero Village. Picked the seeds up from cultivated rice grains, spread on mat for drying.

2097 **P** Aug. 1 Upenja Just south of Upenja Village. Paddy field, 4 km north from habitat of **2078**.

2098 **P** Aug. 1 Upenja Upenja Village. Paddy field and waste land.

2099 **P** Aug. 1 Upenja Upenja Village. Waste land and road. Just west side of site of **2098**.

2079 **L** Aug. 1 Bumbwi Bumbwi Village. Waste land.

2100 **P** Aug. 1 Bumbwi Bumbwi Village. Waste land. Growing allopatrically with **2079**.

2080 **L** Aug. 1 Bumbwi Bumbwi Village. Road-side irrigation canal, 2 m width, 1 m depth, 50 cm water depth.

2101 **P** Aug. 2 Mwanakombo Mwanakombo Village. 10 km south from Mkokotoni Village. Waste land, and already harvested upland rice field.

2102 **P** Aug. 2 Kasole Kasole Village, and 3 km south from Mwanakombo Village. Waste land.

2081 **L** Aug. 2 Kibombani Kibombani Village in Kasole region, 3 km south from Kasole Village. Upland agricultural fields. Upland rice field.

2103 **P** Aug. 4 Kibirinzi Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy

field.

2082 **L** Aug. 4 Kibirinzi Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy field. 300 m north from site of **2103**, but continuous paddy field from there.

2104 **P** Aug. 4 Kibirinzi Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy field. Partially growing sympatrically with *O. longistaminata* (**2082**).

2083 **L** Aug. 4 Kibirinzi Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy field, separated about 300 m from the sites of wild rice species, **2082**, **2103** and **2104**.

2105 **P** Aug. 4 Ole Ole City. Ole Agricultural Experiment Station. Waste land and upland rice field.

2106 **P** Aug. 4 Ole Just northwest from Ole Agricultural Experiment Station. Paddy field of the station.

2107 **P** Aug. 5 Ruvu Ruvu Village. Paddy field of NAFCO, National Agriculture and Food Corporation.

2108 **P** Aug. 5 Ruvu Ruvu Village. Paddy field of NAFCO. 50 m far from the site of **2107**.

2109 **P** Aug. 5 Ruvu Ruvu Village, 2 km north from NAFCO, and 3 km south from the junction of main road, Morogoro and Dar es Salaam. Waste lands, 100 m×200 m and 50 m×200 m.

KENYA in 1984

460 **P** Nov. 14 Mombasa 9 km south from Mombasa Ferry. Road-side swampy area, 50 m×150 m.

461 **P** Nov. 14 Mombasa 2 km west from a joint to Kwale and Ukunda. Waste land, dia. 50 m. Small pool jointed.

462 **P** Nov. 16 Mariakani 5 km east from Mariakani. Near railway. Waste lands, 20 m ×200 m, 10 m×50 m.

463 **P** Nov. 16 Mariakani 11 km west from Mariakani. Dried-up waste lands, 10 m× 100 m, 3 m×10 m.

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464 **P** Nov. 16 Samburi Just west entrance of Samburi. Dried-up waste land, 10 m× 30 m, pool, indefinite form about dia. 100 m, partially covered by bush trees.

KENYA in 1985

315 **L** Sep. 16 Bunyala Bunyala Irrigation Schemes. Irrigation canal, 5 m width.

465 **P** Sep. 20 Samburi Just west intrance of Samburi. Dried-up waste land, 10 m× 30 m, pool, indefinite form about dia. 100 m and dia. 5 m, partially covered by low bush.

466 **P** Sep. 20 Mariakani 11 km west from Mariakani. Dried-up waste lands, 10 m× 100 m and 10 m×10 m, 3 m×10 m. Paddy field and pond, 50 m×10 m.

467 **P** Sep. 20 Mariakani 5 km east from Mariakani. Near railway. Waste lands, 20 m ×200 m, dia. 5 m, and 10 m×50 m, having small stream.

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468 **P** Sep. 20 Mombasa 9 km south from Mombasa Ferry. Road-side swampy area, 50 m×150 m.

469 **P** Sep. 20 Mombasa 2 km west from a joint of Kwale and Ukunda. Waste land, dia. 50 m, partially shaded by large trees. Small pool jointed.

316 **L** Sep. 20 Mombasa 7 km west from a joint of Kwale and Ukunda. Paddy field.

470 **P** Sep. 20 Mombasa 7 km west from a joint of Kwale and Ukunda. Paddy field, small stream. Allopatrically with **316**, *O. longistaminata*.

471 **P** Sep. 20 Mombasa 11 km west from a joint of Kwale and Ukunda. Between Waa Secondary School and Matuga Girls High School. Paddy field located in small valley. Lower portion of irrigation canal.

317 L Sep. 20 Ngao 8 km east from a joint of Garsen and Minjila, and 5 km west from Ngao. Swamp, 500 m×1 km, jointed Lake Shakababo. Swampy area, dia. 50 m×500 m.

318 L Sep. 22 Ngao In Ngao Village. Embankment of paddy field and *Poa* sp. growing area.

319 L Sep. 22 Ngao Over the Tana River. Waste land under trees, 20 m×20 m; edge of paddy field, 10 m×20 m, partially covered by large trees.

320 L Sep. 23 Saironi In Saironi Village. Road-side ditch, temporary irrigation canal, 3 m×20 m.

321 L Sep. 23 Ngao Just south side of Golbanti. Post harvested paddy field.

322 L Sep. 23 Ngao Just south side of Golbanti. Post harvested paddy field. Further west side of **321**.

323 L Sep. 23 Ngao ca. 2 km south of Golbanti. Waste land, relatively lower region, and adjanct to paddy field.

324 L Sep. 23 Ngao ca. 4 km south of Golbanti. Gradual slopping upland field. Adjacent to paddy field.

472 P Sep. 25 Mariakani 2 km north of Mbongo. Waste land. Adjacent to seasonal river, and connected with **473** by bridge.

473 P Sep. 25 Mariakani 2 km north of Mbongo. Waste land. Adjacent to seasonal river, and connected with **472** by bridge.

474 P Sep. 25 Mariakani 2 km north of Mbongo. Waste land. Adjacent to seasonal river, connected with **472** by bridge, and separated from **473** by tall trees.

NIGERIA in 1984

325 L Nov. 7 Zaria 7 km south from Zaria. Road across the small river, 5 m width. *Leersia* sp. growing together.

326 L Nov. 7 Zaria 1 km south from Zaria. Pond, 50 m×150 m.

327 L Nov. 7 Zaria 10 km north from Zaria. Pond, 20 m×200 m. Together with a few plants of *O. glaberrima.*

328 B Nov. 7 Zaria 63 km northeast from Zaria. Together with *O. glaberrima.*

329 B Nov. 7 Zaria 63 km northeast from Zaria. Together with *O. glaberrima.*

330 B Nov. 7 Zaria 72 km northeast from Zaria. Paddy field of *O. glaberrima.*

331 B Nov. 7 Zaria 72 km northeast from Zaria. Paddy field of *O. sativa.*

332 B Nov. 7 Chiramawa 4 km northeast from Chiramawa. Small ponds, 2 m×5 m, 5 m×10 m, surrounded by waste lands.

333 B Nov. 8 Maiduguri 27 km northeast from Maiduguri. Paddy field of *O. glaberrima.*

334 B Nov. 8 Maiduguri 49 km northeast from Maiduguri. Pond, 100 m×200 m.

335 L Nov. 8 Dikwa 7 km northeast from Dikwa. Pond, 100 m×200 m, neighbouring upland rice field of *O. sativa.*

336 L Nov. 9 Dikwa 4 km north from Dikwa. Pond, connected with two parts, 100 m×200 m and 50 m×100 m.

NIGERIA in 1985

337 L Oct. 1 Bida 18 km west from Bida. Pond, 100 m×600 m; Ministry of National Resources, Fisheries Section Wuya Fish Farmer, Niger State.

338 L Oct. 1 Bida 12 km east from crossroad of Bida, and 1 km east from Cereals Research Station, entrance of Rice Research Station. Pool, 200 m×200 m.

339 **L** Oct. 1 Bida 15 km east from crossroad of Bida. Large pond, 100 m×500 m. Paddy fields of *O. sativa* and *O. glaberrima*, Foundation Seed Multiplication, FARO. Irrigation canal.

340 **L** Oct. 1 Bida 7 km north from Bida. Swampy area, running river in the middle portion. Connected both of the swamps by bridge, 300 m×500 m each.

341 **L** Oct. 1 Wushishi 15 km south from Wushishi. Swampy areas, jointing old and new roads, 100 m×200 m, 50 m×150 m triangle and waste land.

342 **L** Oct. 1 Wushishi 31 km north from Wushishi. Swamp, 200 m×300 m.

343 **L** Oct. 2 Bin Yauri 12 km north from Bin Yauri. Paddy field of *O. glaberrima*. Allopatrically with **344**, *O. breviligulata*..

344 **B** Oct. 2 Bin Yauri 12 km north from Bin Yauri. Paddy field of *O. glaberrima*, allopatrically with **343**, *O. longistaminata*.

345 **L** Oct. 2 Bin Yauri 35 km north from Bin Yauri. Near Yelwa. Pond, 5 m×10 m. Joint of old and new roads, neighbouring paddy field of *O. glaberrima*.

346 **L** Oct. 2 Koko 29 km north from Koko. Small pool, dia. 20 m. Swampy area, dia. 200 m. Both areas located at 2 m lower level than the main road.

347 **B** Oct. 2 Koko 29 km north from Koko. Swampy area, dia. 200 m. Allopatrically with **346**, *O. longistaminata*.

348 **L** Oct. 3 Bunza 5 km northeast of Bunza. Swamp, very large. Along the river, sailing boat of transport of pearl millet products.

349 **L** Oct. 3 Yarma 13 km south from Yarma. Pond, 100 m×100 m, neighbouring sorghum field, and **350**, *O. breviligulata*.

350 **B** Oct. 3 Yarma 13 km south from Yarma. Pond, 100 m×100 m. Neighbouring **349**, *O. longistaminata* growing area.

351 **B** Oct. 3 Zaga 2 km northwest from Zaga. Paddy fields, 100 m×200 m, of *O. sativa* and *O. glaberrima*..

352 **L** Oct. 3 Kende In Kende Town. Very large swamp, and along the river.

353 **B** Oct. 3 Kende In Kende Town. Very large swamp. The same habitat of **352**, *O. longistaminata*, but only along the river.

354 **L** Oct. 4 Birnin Kebbi 30 km northeast of Birnin Kebbi. L-shaped swamp, 1.5 km ×400 m, surrounded by upland field.

355 **L** Oct. 4 Argungu 40 km northeast from Argungu, 1 km southwest from Sainyiana. Pond, 100 m×300 m, where growing lotus in the central region. Paddy field of *O. sativa*. Pond, 100 m×500 m, having small island in the central region, where cultivated *O. sativa* and pearl millet.

356 **B** Oct. 4 Argungu 40 km northeast from Argungu and 1 km southwest from Sainyiana. Pond, 100 m×500 m, having small island in the central region, where cultivated *O. sativa* and pearl millet.

357 **L** Oct. 4 Sokoto 18 km north from Sokoto. Swamp, 200 m×100 m. Partially growing *O. glaberrima*. Pond, 10 m×20 m, surrounded by barbwire fence, and surrounded by sorghum and pearl millet fields.

358 **L** Oct. 4 Sokoto 24 km north from Sokoto. Swampy area and small pool, and swampy area surrounded by sorghum field. Paddy fields of *O. sativa* and *O. glaberrima*, and swamp, 1 km×200 m.

359 **B** Oct. 4 Sokoto 24 km north from Sokoto. Swampy area, 10 m×50 m, and swampy area surrounded by sorghum field and paddy fields of *O. sativa* and *O. glaberrima*. Alloparticaly with **358**, *O. longistaminata*.

360 **L** Oct. 5 Rabah 8 km northwest from Rabah. Upland fields of *O. sativa* and

O. glaberrima, 20 m×30 m, and 20 m×50 m, surrounded by sorghum field.

361 **B** Oct. 5 Rabah 8 km northwest from Rabah. Upland rice fields of *O. sativa* and *O. glaberrima*, 20 m×50 m, surrounded by sorghum field. Allopatrically with **360**, *O. longistaminata*.

362 **L** Oct. 5 Rabah Just west of Rabah. Joint of old and new roads. Swampy area, 500 m×2 km, constituted by pond, paddy fields of *O. sativa* and *O. glaberrima* and waste land. Pond, 200 m×500 m, where growing lotus. Paddy fields of *O. sativa* and *O. glaberrima*, neighbouring sorghum and beans fields and deep swamp.

363 **B** Oct. 5 Rabah Just west of Rabah. Pond, 200 m×500 m, growing lotus. Paddy fields of *O. sativa* and *O. glaberrima*, neighbouring sorghum and beans fields and deep swamp.

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364 **L** Oct. 5 Wurno 100 km west from Wurno Port of basin. Just facing coastal road of the basin. Waste land, 100 m×1 km, neighbouring sorghum field.

365 **L** Oct. 5 Wurno 6 km north from Wurno Town. Paddy fields of *O. glaberrima* and *O. sativa*, and irrigation canal.

366 **B** Oct. 5 Wurno 6 km north from Wurno Town. Paddy fields of *O. glaberrima* and *O. sativa*.

367 **B** Oct. 5 Goronyo 16 km southwest from Goronyo. Dried-up waste land, 100 m×20 m.

368 **B** Oct. 5 Goronyo 16 km southwest from Goronyo. Dried-up waste land, 10 m ×30 m.

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369 **L** Oct. 5 Goronyo 8 km southwest from Goronyo. Ponds, 10 m×50 m, 1 m×2 m.

370 **B** Oct. 5 Goronyo 8 km southwest from Goronyo. Paddy field of *O. glaberrima*. Neighbouring small pool of **369**, *O. longistaminata*.

371 **L** Oct. 6 Tureta 23 km northwest from a joint of Tureta. Large pond, 100 m ×300 m. Damaged severely by fungi.

372 **B** Oct. 6 Tureta 23 km northwest from a joint of Tureta. Large ponds, 100 m×200 m, 100 m×300 m.

373 **L** Oct. 6 Talata Mafara 8 km northwest from Talata Mafara. Pond, 200 m×500 m, where cultivated *O. glaberrima* in edge. Surrounded by sorghum and beans fields, and shallow water type of *O. sativa*.

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374 **B** Oct. 6 Talata Mafara 8 km northwest from Talata Mafara. Pond, 200 m×500 m, where cultivated *O. glaberrima* in edge.

375 **L** Oct. 6 Talata Mafara 4 km southeast from Talata Mafara. Paddy fields of *O. sativa* and *O. glaberrima*, 100 m×200 m, surrounded by sorghum and beans fields. Partially sympatrically with **376**, *O. breviligulata*.

376 **B** Oct. 6 Talata Mafara 4 km southeast from Talata Mafara. Paddy fields of *O. sativa* and *O. glaberrima*, 100 m×200 m, surrounded by sorghum and beans fields. Partially sympatrically with **375**, *O. longistaminata*.

377 **L** Oct. 6 Funtua 72 km southeast from Funtua. Lotus pond, 30 m×100 m, gourd-shaped. Surrounded by roads and sorghum fields.

378 **L** Oct. 7 Zaria 5 km southeast from Zaria. Road-side ditches, 10 m×100 m. Neighbouring sorghum fields.

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379 **L** Oct. 7 Pambeguwa 17 km northwest from a joint of Pambeguwa. Grass land near stream, connecting swamps. Swamp, irregularly shaped, 400 m×300 m, having lotus pond in central region.

380 **B** Oct. 7 Jengle 1 km southeast from Jengle. Swamp, 10 m×200 m, where cultivated *O. glaberrima* in edge.

381 **L** Oct. 8 Makurdi 1 km east from entrance of Makurdi. Swamp, 50 m×100 m, neighbouring paddy field of *O. sativa* and grass land.

382 **L** Oct. 8 Makurdi 22 km east from entrance of Makurdi. Paddy fields of *O. sativa*, inserted by stream between them. Near Benue River.

IVORY COAST in 1984

383 **B** Oct. 31 Sobara 2 km northwest from Sobara. Pond, dia. 100 m. Grass land in other side of road.

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384 **L** Nov. 1 Lokpoho 3.2 km west from Lokpoho. Large ponds, 50 m × 100 m each. Together with *Leersia* sp.

385 **L** Nov. 1 Bandama 2 km west from Bandama. Paddy fields of *O. sativa* and *O. glaberrima.*

386 **L** Nov. 1 Bandama 2 km west from Bandama. Paddy fields of *O. glaberrima.* No wild rice in good managed paddy field.

387 **L** Nov. 1 Korhogo Near Korhogo Town. Paddy fields of *O. glaberrima,* and near irrigation canal.

388 **L** Nov. 1 Korhogo 3 km east of Korhogo. Paddy fields of *O. sativa.* Surrounded by waste land, road, embankment, irrigation canal and other paddy field.

389 **L** Nov. 1 Korhogo 3 km east of Korhogo. Semi-dried-up paddy fields of *O. sativa.* Surrounded by waste land, road, irrigation canal and other paddy field.

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390 **L** Nov. 1 Korhogo 3 km east of Korhogo. Paddy fields of *O. glaberrima,* separated by waste land, 10 m width, road, and semi-dried-up rice field.

SENEGAL in 1985

391 **L** Oct. 30 Zuiguinchor 2 km east from Zuiguinchor. Paddy fields of *O. sativa,* neighbouring building. Road-side ditch.

392 **L** Oct. 30 Zuiguinchor 11 km east from Zuiguinchor. Paddy fields, half-damaged owing to salt.

393 **L** Oct. 30 Zuiguinchor 18 km east from Zuiguinchor. Guidel Village. Grass land, inside of the road, neighbouring palm yard.

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394 **L** Oct. 30 Zuiguinchor 24 km east from Zuiguinchor. Rain-fed paddy fields of *O. sativa,* inside of the road, neighbouring *O. glaberrima* cultivation.

395 **L** Oct. 30 Zuiguinchor 29 km east from Zuiguinchor. Boutaupa Village. Paddy field.

396 **L** Oct. 30 Zuiguinchor 37 km east from Zuiguinchor. Swampy area, inside of road.

397 **L** Oct. 30 Zuiguinchor 33 km east from Zuiguinchor. Paddy fields of *O. sativa* and *O. glaberrima,* separated by grass land from road. Near *O. glaberrima* field. Allopatrically with **398**, *O. breviligulata.*

398 **B** Oct. 30 Zuiguinchor 33 km east from Zuiguinchor. Paddy fields of *O. sativa* and *O. glaberrima,* separated by grass land from road. Allopatrically with **397**, *O. longistaminata.*

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399 **L** Oct. 31 Zuiguinchor 12 km east from Zuiguinchor. Small pool, 1 m×10 m, about 200 m, inside of road. Near mangrove trees.

400 **L** Oct. 31 Zuiguinchor 16 km east from Zuiguinchor. Large swamp, 200 m×500 m, gourd-shaped, where cultivated *O. sativa* in edge.

401 **L** Oct. 31 Zuiguinchor 31 km east from Zuiguinchor. Grass land, neighbouring paddy field and clear pond. Grass land, embankment of paddy field of *O. sativa* and baobab tree's land.

402 **L** Oct. 31 Zuiguinchor 41 km east from Zuiguinchor. Paddy field of *O. sativa*, and grass land.

403 **B** Oct. 31 Zuiguinchor 41 km east from Zuiguinchor. Paddy field of *O. sativa*.

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404 **B** Oct. 31 Zuiguinchor 54 km east from Zuiguinchor. Swamp, having pond in central region. Paddy fields of *O. sativa* and *O. glaberrima* in around.

405 **B** Nov. 1 Goudomp 6 km east from Goudomp. Paddy field, partially maturing, and after harvested. Separated by grass land from road about 200 m.

406 **L** Nov. 1 Simbandi 1 km west from Simbandi. Paddy fields of *O. sativa* and *O. glaberrima*, 20 cm water depth. Neighbouring palm yard and waste land owing to salt damage.

407 **L** Nov. 1 Simbandi 19 km east from Simbandi. Paddy field and joint of old and new roads.

408 **L** Nov. 1 Tanaff 29 km west from Tanaff. Paddy field of *O. sativa*. Neighbouring forest and nursery bed of rice.

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409 **L** Nov. 1 Tanaff 17 km west from Tanaff. Paddy field of *O. sativa*. Surrounded by paddy field and pond. Allopatrically with *O. breviligulata*.

410 **B** Nov. 1 Tanaff 3 km west from Tanaff. Swamp, and got space between palm fields. Allopatrically with *O. longistaminata*.

411 **L** Nov. 1 Tanaff 4 km east from Tanaff. Pond, dia. 100 m, touched by an arch bridge in north side.

412 **L** Nov. 1 Tanaff 7 km east from Tanaff. Paddy fields of *O. sativa* and *O. glaberrima*. Allopatrically with *O. breviligulata*, **413**.

413 **B** Nov. 1 Tanaff 7 km east from Tanaff. Paddy fields of *O. sativa* and *O. glaberrima*. Allopatrically with *O. longistaminata*, **412**.

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414 **L** Nov. 1 Kolda 8 km west from Kolda. Paddy fields of *O. sativa* and *O. glaberrima*. Allopatrically with *O. breviligulata*, **415**.

415 **B** Nov. 1 Kolda 8 km west from Kolda. Paddy fields of *O. sativa* and *O. glaberrima*. Allopatrically with *O. longistaminata*, **414**. Pond, 100 m×200 m, neighbouring paddy field and upland cultivation field.

416 **L** Nov. 2 Saresara Saresara Village, 300 m inside from road. Swamp, 200 m× 200 m, surrounded by paddy field of *O. sativa* and upland field of *O. sativa*.

417 **B** Nov. 2 Tiapa 6 km east from Tiapa. Paddy field of *O. glaberrima*, 30 cm water depth. Surrounded by palm yards in 3 sides.

418 **B** Nov. 2 Tiapa 28 km east from Tiapa. Swamp, dia. 200 m.

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419 **L** Nov. 2 Tiapa 54 km east from Tiapa. Forest, under shade. *Hygroryza* sp. growing dominantly. Neighbouring large pond.

420 **L** Nov. 3 Bassé, GAMBIA In Bassé Town. Pond, dia. 50 m, adjacent to Gambia River with 100 m width road.

421 **B** Nov. 3 Biaobe 4 km north from crossroad to Anambe, 41 km southwest from Velingara. Paddy field of *O. sativa*, surrounded by palm field and grass land.

422 **B** Nov. 3 Biaobe 3 km northwest from the locality of **421**. Paddy field, neighbouring road, irrigation canal, which was recently developed by the government.

423 **L** Nov. 3 Dabo 1 km north from Dabo. Stream, half-dried-up, 3 m width.

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475 **R** Nov. 3 Anambe 2 km south from Anambe. Shallow pond, dia. 50 m, surrounded by grass land, presumed seasonal pond in some time, heavy forest, and bush road. *O. breviligulata* growing in opposite side.

424 **L** Nov. 3 Anambe 20 km north from Anambe. Paddy fields of *O. sativa* and *O. glaberrima*, surrounded by upland cultivation fields.

425 **B** Nov. 3 Anambe 20 km north from Anambe. Paddy fields of *O. sativa* and *O. glaberrima*, surrounded by upland cultivation fields. Neighbouring *O. longistaminata*, **424**.

426 **L** Nov. 4 Kolda 29 km west from Kolda. Rain-fed paddy field, separated

from road by irrigated paddy field, 100 m width. Surrounded by another rain-fed paddy field, waste land and forest.

427 **L** Nov. 4 Kolda 44 km west from Kolda. Paddy field of *O. sativa,* having lotus pond in central region. Connected with another paddy field, and got space between road and bridge.

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428 **B** Nov. 4 Kolda 44 km west from Kolda. Paddy field of *O. sativa*, having lotus pond in central region, neighbouring pond. Separated from *O. longistaminata*, **427**.

429 **L** Nov. 4 Kolda 50 km west from Kolda. Paddy field of *O. sativa*, having dried-up pond. Sympatrically with *O. breviligulata*, **430**.

430 **B** Nov. 4 Kolda 50 km west from Kolda. Paddy field of *O. sativa*, having dried-up pond. Sympatrically with *O. longistaminata*, **429**.

431 **L** Nov. 4 Sefa 11 km east from Sefa. Paddy field of *O. sativa*, connected with waste land.

432 **B** Nov. 4 Sefa 11 km east from Sefa. Boundary of paddy field, where growing *O. longistaminata*, **431**, and waste land. Connected with pond and waste land damaged owing to salt.

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433 **L** Nov. 4 Bounkiling 24 km west from Bounkiling. Paddy field of *O. sativa*, 10 cm water depth.

434 **L** Nov. 4 Tangouri 20 km east from Tangouri. Paddy field of *O. sativa*.

435 **L** Nov. 5 Bignona 22 km northwest from Bignona. Paddy field of *O. sativa*. Conspicuous high ridge cultivation for avoiding salt damage.

436 **L** Nov. 6 Faraba Banta, GAMBIA 1 km north from Faraba Banta. Paddy field of *O. sativa*.

437 **L** Nov. 6 Kafuta, GAMBIA 2 km north from Kafuta. Near Gambia River in north side. Paddy field of *O. sativa*.

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438 **B** Nov. 6 Kafuta, GAMBIA 2 km north from Kafuta. Near Gambia River in north side. Paddy field of *O. sativa*. Allopatrically with *O. longistaminata*, **437**.

439 **L** Nov. 6 Brikama, GAMBIA 17 km north from Brikama. Swamp, and got space between new and old roads, just south of Office of Conservation of Nature.

440 **L** Nov. 7 Kafoutine Near Kafoutine Village. Paddy field, having pond, lotus swamp, and work room. Swamp, 10 m×5 m. Waste land and small road.

441 **L** Nov. 7 Dioloulou 9 km east from Dioloulou. Paddy field of *O. sativa*. Waste land and road-side ditch.

442 **B** Nov. 7 Dioloulou 9 km east from Dioloulou. Pond, 30 m × 40 m, separated about 50 m from road by waste land, where growing *O. longistaminata*, a part of **441**.

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443 **B** Nov. 8 St. Louis 21 km northeast from St. Louis. Paddy field, established 10 years ago. Road-side pool.

444 **L** Nov. 10 Richard Toll 22 km south of ISRA Office in Richard Toll. Colonat Village, 300 inside from main irrigation canal. Paddy fields, sub-irrigation canal, and waste land.

445 **B** Nov. 10 Richard Toll 22 km south of ISRA Office in Richard Toll. Colonat Village and suburbs. Paddy fields. Along the road.

446 **B** Nov. 10 Richard Toll 19 km south of ISRA Office in Richard Toll. Paddy field and swamp. Along irrigation canal.

447 **L** Nov. 10 lac de Guiers 32 km south from Richard Toll. Upland field, swamp, dike and lac Guiers. Waste lands between dike and sub-irrigation canal, and embankment of upland fields.

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448 **B** Nov. 11 Matam 3 km southeast from Matam. Over a tributary of Senegal River. MAURITANIA on the other side of the river. Dried-up upland fields, after harvested of sorghum.

449 **L** Nov. 11 Matam 19 km southeast from crossroad of Ourosogui. Inside of Juc Village. Upland rice field. Sympatrically with *O. breviligulata*, **450**.

450 **B** Nov. 11 Matam 19 km southeast from crossroad of Ourosogui. Inside of Juc Village. Upland rice field. Partially sympatrically with *O. longistaminata*, **449**.

451 **L** Nov. 11 N'Dioum 2 km inside of main road, and 12 km west from N'Dioum. Irrigation canal between paddy field of *O. sativa* and road.

452 **L** Nov. 12 Nianga In Project Field of Nianga. Paddy fields of *O. sativa* and *O. glaberrima*, and irrigation canal.

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453 **B** Nov. 12 Nianga In Project Field of Nianga. Paddy fields of *O. sativa* and *O. glaberrima*, and the secondary irrigation canal.

454 **L** Nov. 12 Nianga In Project Field of Nianga. Lotus pond, waste land, dike, and the third irrigation canal.

455 **L** Nov. 12 Nianga In Project Field of Nianga. Lotus pond and paddy field.

456 **B** Nov. 12 Nianga In Project Field of Nianga. Paddy field. Inside of site of *O. longistaminata*, **455**.

Some morphological characters of the unhusked grains

190 strains of *Oryza longistaminata*, 49 strains of *Oryza breviligulata*, 44 strains of *Oryza punctata* and 1 strain of *Oryza brachyantha* were collected in these trips, and they were used for morphological investigations of the unhusked grains.

In the previous papers, however, grains of 10 strains were unmatured and inadequate to be used for measurement, *i.e.*, 7 of *O. longistaminata* (2 strains in Madagascar, strain Nos.302 and 312 [11]; 3 strains in Kenya, Nos.315, 316 and 317 [13]; 1 strain in Nigeria, No.325 [14]; 1 strain of Senegal, No.401 [16]), and 3 of *O. breviligulata* in Nigeria, strain Nos.332, 333 and and 334 [14]. Moreover, 8 strains (7 strains of *O. longistaminata* and 1 of *O. breviligulata)* collected in Ivory Coast [15] were counted a few seeds and also put out in the previous papers, and were remained for the future measurement.

These strains omitted in the previous papers were fortunately used for the measurement in the present study. Moreover, number of grains used were increased for detail analyses in several strains, even *O. breviligulata*, which has no relation to the third trip.

The revised data are given in Tables 2 to 9, *i.e.*, Table 2 --- *O. longistaminata* (Accession Nos.301~313 in 1985) in Madagascar, Table 3 --- *O. longistaminata* (No.314 in 1984) and *O. punctata* (Nos.457~459 in 1984) in Tanzania, Table 4 --- *O. longistaminata* (Nos.315~324 in 1985) and *O. punctata* (Nos.460~464 in 1984) and Nos.465~474 in 1985) in Kenya, Table 5 --- *O. longistaminata* (Nos.325 ~ 336 in 1984 and Nos.337~382 in 1985) in Nigeria, Table 6 --- *O. breviligulata* (Nos.328~ 334 in 1984 and Nos.344 ~380 in 1985) in Nigeria, Table 7 --- *O. longistaminata* (Nos.384~390 in 1984) and *O. breviligulata* (No.383 in 1984) in Ivory Coast, Table 8 --- *O. longistaminata* (Nos.391~455 in 1985) in Senegal including Gambia, Table 9 --- *O. breviligulata* (Nos.398 ~ 456 in 1985) in Senegal including Gambia, and *O. brachyantha* (No.475 in

Table 2. Six morphological characters of unhusked grains collected in Madagscar in 1985, *O. longistaminata* (301-313)

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W1	301	9.03±0.23	2.47±0.02	1.63±0.02	3.66±0.07	5.53±0.08	1.51±0.02
W2	302	7.58±0.44	2.02±0.15	1.44±0.07	3.76±0.32	5.29±0.36	1.41±0.10
W3	303	6.67±0.33	2.01±0.17	1.41±0.09	3.34±0.33	4.76±0.32	1.43±0.13
W4	304	9.00±0.18	2.50±0.03	1.65±0.03	3.60±0.10	5.46±0.19	1.52±0.04
W5	305	9.15±0.24	2.53±0.09	1.58±0.05	3.62±0.17	5.80±0.20	1.60±0.06
W6	306	9.14±0.28	2.56±0.06	1.61±0.09	3.57±0.09	5.70±0.42	1.59±0.09
W7	307	8.79±0.35	2.51±0.07	1.85±0.07	3.50±0.12	4.75±0.18	1.36±0.05
W8	308	9.28±0.17	2.37±0.06	1.65±0.11	3.93±0.11	5.65±0.40	1.44±0.14
W9	309	8.73±0.37	2.28±0.10	1.58±0.04	3.84±0.22	5.53±0.30	1.45±0.09
W10	310	8.47±0.17	2.32±0.06	1.58±0.05	3.66±0.13	5.35±0.10	1.47±0.08
W11	311	8.90±0.28	2.41±0.12	1.58±0.02	3.70±0.21	5.63±0.18	1.53±0.09
W12	312	8.22±0.52	2.26±0.13	1.53±0.10	3.65±0.31	5.40±0.51	1.48±0.13
W13	313	8.03±0.06	2.23±0.02	1.52±0.05	3.60±0.06	5.30±0.20	1.47±0.03
Whole	Average	8.54±0.72	2.34±0.17	1.59±0.10	3.65±0.14	5.40±0.31	1.48±0.07

Table 3. Six morphological characters of unhusked grains collected in Tanzania in 1984, *O. longistaminata* (314) and *O. punctata* (457-459)

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W14	314	9.05±0.46	2.58±0.07	1.79±0.09	3.50±0.14	5.07±0.32	1.45±0.07
W157	457	6.70±0.54	2.47±0.10	1.55±0.09	2.71±0.19	4.33±0.38	1.60±0.11
W158	458	6.19±0.22	2.53±0.10	1.58±0.14	2.45±0.13	3.95±0.36	1.61±0.16
W159	459	6.32±0.34	2.50±0.16	1.56±0.10	2.54±0.27	4.08±0.40	1.61±0.08
Average of *O. punctata*	–	6.40±0.22	2.50±0.02	1.56±0.01	2.57±0.11	4.12±0.16	1.61±0.01

1985).

Thirty grains were used for the measurement of each strain. Measurements were done in length, width and thickness of grains, and done at the most eminent section of the respective characters. Calculations were done for ratios of length to width, of length to thickness, and of width to thickness. The whole data referring to the six characters were illustrated by the average value in the whole strains.

The results of analyses using materials collected in 1988 were mentioned in the previous papers, *i.e.*, *O. longistaminata* of Madagascar --- in Table 2 [19], *O. longistaminata* of Tanzania --- Table 2 [20], *O. puntata* of Tanzania --- Table 3 [20].

For summing-up the data, the results mentioned above in the Tables in the previous papers [19, 20] and the present paper were used. The results are given in Table 10 for the practical value and in Table 11 for the standard deviations, but not given for the individual grain level. In these tables, 6 morphological characters of the unhusked grains

Table 4. Six morphological characters of unhusked grains collected in Kenya, *O. longistaminata* (315-324) in 1985, *O. punctata* (460-464) in 1984 and (465-474) in 1985

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W15	315	7.80±0.47	2.45±0.12	1.51±0.14	3.20±0.24	5.20±0.62	1.63±0.15
W16	316	7.81±0.51	2.17±0.17	1.49±0.09	3.63±0.35	5.27±0.45	1.46±0.13
W17	317	7.67±0.57	2.17±0.14	1.44±0.09	3.54±0.31	5.36±0.48	1.52±0.16
W18	318	8.84±0.50	2.61±0.10	1.71±0.05	3.39±0.12	5.17±0.26	1.53±0.04
W19	319	8.14±0.46	2.25±0.18	1.56±0.10	3.64±0.33	5.25±0.37	1.46±0.16
W20	320	8.41±0.20	2.50±0.10	1.65±0.03	3.37±0.18	5.10±0.21	1.52±0.07
W21	321	8.52±0.07	2.79±0.10	1.66±0.04	3.06±0.13	5.14±0.15	1.68±0.05
W22	322	8.68±0.25	2.59±0.09	1.72±0.04	3.36±0.16	5.05±0.15	1.51±0.08
W23	323	8.70±0.35	2.70±0.10	1.73±0.06	3.23±0.21	5.04±0.31	1.56±0.04
W24	324	8.32±0.19	2.57±0.02	1.62±0.02	3.24±0.06	5.15±0.10	1.59±0.01
Whole	Average	8.29±0.40	2.48±0.21	1.61±0.10	3.37±0.18	5.17±0.10	1.55±0.07
W161	460	6.22±0.43	2.35±0.17	1.53±0.10	2.65±0.14	4.09±0.28	1.54±0.10
W161	461	5.77±0.23	2.48±0.12	1.48±0.22	2.34±0.16	3.99±0.56	1.71±0.24
W162	462	6.46±0.49	2.48±0.14	1.53±0.16	2.62±0.25	4.25±0.44	1.63±0.12
W163	463	7.01±0.60	2.48±0.13	1.57±0.08	2.83±0.28	4.47±0.40	1.58±0.06
W164	464	6.47±0.43	2.53±0.17	1.49±0.06	2.58±0.28	4.33±0.27	1.70±0.14
Whole	Average	6.39±0.40	2.46±0.06	1.52±0.03	2.60±0.16	4.23±0.17	1.63±0.07
W165	465	6.82±0.52	2.38±0.18	1.57±0.13	2.88±0.30	4.38±0.51	1.53±0.19
W166	466	6.09±0.38	2.45±0.11	1.59±0.12	2.49±0.16	3.86±0.46	1.55±0.15
W167	467	6.32±0.57	2.35±0.07	1.50±0.16	2.69±0.27	4.27±0.56	1.59±0.21
W168	468	5.51±0.33	2.24±0.11	1.48±0.17	2.47±0.18	3.79±0.57	1.53±0.19
W169	469	5.69±0.23	2.41±0.17	1.41±0.18	2.37±0.19	4.11±0.49	1.74±0.22
W170	470	5.57±0.30	2.53±0.15	1.56±0.08	2.20±0.08	3.58±0.10	1.63±0.07
W171	471	5.67±0.46	2.45±0.11	1.55±0.09	2.32±0.16	3.67±0.33	1.59±0.12
W172	472	6.06±0.49	2.32±0.10	1.50±0.13	2.62±0.27	4.07±0.42	1.56±0.16
W173	473	7.31±0.29	2.46±0.07	1.58±0.15	2.98±0.13	4.67±0.59	1.57±0.17
W174	474	7.15±0.66	2.41±0.07	1.55±0.09	2.97±0.27	4.65±0.67	1.56±0.10
Whole	Average	6.22±0.63	2.40±0.08	1.53±0.05	2.60±0.26	4.11±0.37	1.59±0.06
Average of *O. punctata*	–	6.27±0.57	2.42±0.08	1.53±0.05	2.60±0.23	4.15±0.32	1.60±0.07

were illustrated by average values of the respective groups; *i.e.*, *O. longistaminata* in the first column --- **1**: Madagascar collected in 1985 [13 strains]; **2**: the same collected in 1988 [47 strains]; **3**: the same collected in both years [60 strains]; **4**: Tanzania collected in 1984 [1 strain]; **5**: the same collected in 1988 [36 strains]; **6**: the same collected in both years [37 strains]; **7**: Kenya collected in 1985 [10 strains]; **8**: Nigeria collected in 1984 [5 strains]; **9**: the same collected in 1985 [29 strains]; **10**: the same collected in both years [34 strains]; **11**: Ivory Coast collected in 1984 [7 strains]; **12**: Senegal collected in 1985 in Casamance region [35 strains]; **13**: the same in 1985 in northern region [7 strains]; **14**: the same of both regions [42 strains]; **15**: the summed-up data of strains collected in 1984 and 1985 in the whole countries [107 strains]; **16**: the summed-up data of strains

Table 5. Six morphological characters of unhusked grains collected in Nigeria, *O. longistaminata* (325-336) in 1984 and (337-382) in 1985

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W25	325	7.81±0.51	1.23±0.18	1.53±0.11	3.52±0.39	5.13±0.45	1.46±0.11
W26	326	8.44±0.24	2.58±0.11	1.77±0.08	3.27±0.17	4.79±0.22	1.46±0.07
W27	327	8.56±0.69	2.51±0.13	1.71±0.07	3.44±0.43	5.03±0.54	1.47±0.08
W35	335	10.02±0.70	2.99±0.17	1.87±0.12	3.35±0.23	5.37±0.37	1.61±0.10
W36	336	10.19±0.60	3.15±0.18	1.94±0.17	3.24±0.23	5.27±0.47	1.63±0.10
Whole	Average	9.00±0.94	2.69±0.33	1.76±0.14	3.36±0.10	5.12±0.20	1.53±0.08
W37	337	9.53±0.33	2.58±0.05	1.78±0.04	3.70±0.17	5.36±0.28	1.45±0.03
W38	338	8.32±0.24	2.31±0.12	1.56±0.10	3.61±0.17	5.35±0.21	1.48±0.07
W39	339	8.76±0.26	2.69±0.10	1.66±0.06	3.26±0.10	5.28±0.23	1.62±0.06
W40	340	8.12±0.18	2.23±0.02	1.72±0.05	3.64±0.09	4.73±0.20	1.30±0.05
W41	341	8.45±0.22	2.52±0.17	1.60±0.06	3.37±0.24	5.28±0.12	1.58±0.12
W42	342	8.19±0.19	2.39±0.09	1.75±0.07	3.43±0.07	4.69±0.22	1.37±0.09
W43	343	7.99±0.15	2.38±0.08	1.73±0.11	3.36±0.13	4.64±0.36	1.38±0.12
W45	345	8.25±0.29	2.51±0.11	1.76±0.07	3.29±0.17	4.69±0.18	1.43±0.07
W46	346	8.38±0.46	2.28±0.21	1.53±0.11	3.71±0.43	5.51±0.55	1.49±0.12
W48	348	8.98±0.39	2.66±0.07	1.76±0.07	3.38±0.16	5.11±0.22	1.51±0.06
W49	349	8.22±0.19	2.33±0.09	1.75±0.05	3.53±0.14	4.70±0.19	1.33±0.08
W52	352	7.87±0.37	2.24±0.18	1.51±0.10	3.53±0.29	5.23±0.41	1.49±0.16
W54	354	7.72±0.46	2.24±0.09	1.56±0.11	3.45±0.24	4.97±0.42	1.44±0.12
W55	355	8.13±0.26	2.55±0.14	1.73±0.05	3.19±0.13	4.70±0.04	1.47±0.05
W57	357	8.41±0.04	2.60±0.07	1.75±0.03	3.24±0.09	4.81±0.09	1.49±0.04
W58	358	8.24±0.22	2.33±0.08	1.76±0.06	3.54±0.16	4.69±0.14	1.33±0.06
W60	360	8.32±0.33	2.37±0.08	1.72±0.04	3.51±0.15	4.84±0.12	1.38±0.06
W62	362	8.51±0.46	2.34±0.07	1.62±0.06	3.64±0.24	5.27±0.42	1.45±0.06
W64	364	8.46±0.10	2.25±0.13	1.67±0.05	3.77±0.22	5.07±0.21	1.35±0.10
W65	365	9.01±0.38	2.53±0.05	1.72±0.02	3.57±0.20	5.24±0.29	1.47±0.03
W69	369	9.73±0.20	2.51±0.04	1.68±0.07	3.88±0.12	5.80±0.18	1.50±0.07
W71	371	7.71±0.66	2.24±0.16	1.55±0.10	3.46±0.38	5.00±0.58	1.45±0.15
W73	373	8.59±0.20	2.30±0.06	1.59±0.04	3.74±0.09	5.41±0.20	1.45±0.04
W75	375	9.79±0.30	2.44±0.14	1.67±0.05	4.03±0.26	5.87±0.20	1.46±0.05
W77	377	9.58±0.23	2.18±0.07	1.62±0.05	4.40±0.16	5.92±0.16	1.35±0.02
W78	378	9.43±0.25	2.34±0.09	1.62±0.05	4.04±0.19	5.83±0.19	1.45±0.07
W79	379	8.37±0.22	2.74±0.02	1.77±0.02	3.06±0.07	4.73±0.13	1.55±0.02
W81	381	9.51±0.21	2.40±0.06	1.69±0.05	3.96±0.09	5.63±0.21	1.42±0.03
W82	382	8.67±0.14	2.34±0.08	1.67±0.04	3.71±0.19	5.19±0.12	1.40±0.07
Whole	Average	8.59±0.59	2.41±0.15	1.67±0.08	3.59±0.29	5.16±0.39	1.44±0.07
Average of both groups	–	8.65±0.67	2.45±0.21	1.69±0.10	3.55±0.28	5.15±0.37	1.46±0.08

collected in 1984, 1985 and 1988 in the whole countries [190 strains]; *O. breviligulata* in the second column ––– **17**: Nigeria collected in 1984 [7 strains]; **18**: the same collected in 1985 [17 strains]; **19**: the same collected in both years [24 strains]; **20**: Ivory Coast collected in 1984 [1 strain]; **21**: Senegal collected in 1985 in Casamance region [17 strains]; **22**: the same in 1985 in northern region [7 strains]; **23**: the same of both regions

Table 6. Six morphological characters of unhusked grains collected in Nigeria, *O. breviligulata* (328-334) in 1984 and (344-380) in 1985

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W28	328	9.31±0.46	3.27±0.20	2.26±0.12	2.86±0.14	4.13±0.24	1.45±0.12
W29	329	9.07±0.62	3.05±0.14	2.05±0.06	2.97±0.15	4.44±0.33	1.50±0.09
W30	330	9.03±0.37	3.20±0.09	2.13±0.07	2.83±0.13	4.24±0.19	1.50±0.06
W31	331	9.60±0.40	3.02±0.13	2.05±0.06	3.19±0.11	4.70±0.20	1.48±0.07
W32	332	10.36±0.30	3.17±0.10	1.90±0.10	3.27±0.12	5.47±0.29	1.67±0.10
W33	333	11.04±0.24	3.24±0.13	2.03±0.07	3.42±0.15	5.46±0.20	1.60±0.10
W34	334	11.43±0.31	2.79±0.11	1.82±0.06	4.11±0.19	6.30±0.27	1.54±0.09
Whole	Average	9.98±0.90	3.11±0.15	2.03±0.13	3.24±0.41	4.96±0.74	1.53±0.07
W44	344	9.24±0.22	3.55±0.11	2.00±0.07	2.61±0.11	4.62±0.16	1.77±0.10
W47	347	8.81±0.20	3.14±0.12	1.94±0.08	2.81±0.10	4.55±0.20	1.62±0.08
W50	350	10.39±0.42	2.75±0.10	1.82±0.04	3.79±0.25	5.71±0.17	1.51±0.07
W51	351	8.40±0.23	3.06±0.09	1.77±0.10	2.74±0.09	4.76±0.20	1.74±0.11
W53	353	8.52±0.35	3.18±0.19	1.97±0.06	2.69±0.14	4.34±0.20	1.62±0.12
W56	356	9.19±0.27	3.46±0.16	1.98±0.08	2.66±0.13	4.64±0.18	1.75±0.11
W59	359	9.34±0.33	3.11±0.12	1.85±0.07	3.01±0.09	5.05±0.26	1.68±0.11
W61	361	9.05±0.28	3.48±0.15	2.02±0.09	2.61±0.15	4.49±0.16	1.73±0.13
W63	363	9.85±0.30	3.30±0.10	1.87±0.10	2.99±0.12	5.29±0.26	1.77±0.12
W66	366	10.26±0.19	3.35±0.11	1.93±0.08	3.07±0.11	5.33±0.21	1.74±0.10
W67	367	9.02±0.36	2.57±0.15	1.55±0.09	3.53±0.18	5.83±0.24	1.66±0.10
W68	368	9.16±0.38	2.73±0.13	1.58±0.06	3.36±0.14	5.82±0.30	1.73±0.09
W70	370	9.85±0.33	2.76±0.08	1.74±0.04	3.58±0.15	5.67±0.23	1.59±0.07
W72	372	8.91±0.22	2.91±0.15	1.78±0.06	3.07±0.21	5.01±0.22	1.64±0.07
W74	374	9.40±0.43	3.20±0.17	1.97±0.08	2.95±0.17	4.78±0.30	1.63±0.14
W76	376	9.40±0.52	3.24±0.13	2.00±0.05	2.91±0.23	4.71±0.28	1.62±0.08
W80	380	9.13±0.29	3.50±0.12	2.09±0.09	2.61±0.12	4.37±0.17	1.68±0.09
Whole	Average	9.29±0.53	3.13±0.29	1.87±0.15	3.00±0.36	5.00±0.50	1.68±0.07
Average of both groups	–	9.49±0.73	3.13±0.26	1.92±0.16	3.07±0.39	4.99±0.58	1.63±0.10

Table 7. Six morphological characters of unhusked grains collected in Ivory Coast in 1984, *O. longistaminata* (384-390) and *O. breviligulata* (383)

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W84	384	7.88±0.54	2.12±0.22	1.52±0.11	3.76±0.41	5.19±0.40	1.39±0.15
W85	385	8.02±0.55	2.24±0.15	1.63±0.11	3.60±0.35	4.96±0.53	1.38±0.14
W86	386	7.67±0.67	2.30±0.25	1.61±0.10	3.36±0.41	4.80±0.53	1.43±0.13
W87	387	9.03±0.47	2.22±0.20	1.60±0.10	4.11±0.44	5.66±0.37	1.39±0.13
W88	388	8.36±0.42	2.28±0.24	1.66±0.11	3.70±0.36	5.06±0.42	1.38±0.16
W89	389	8.21±0.52	2.41±0.21	1.68±0.11	3.44±0.48	4.93±0.59	1.44±0.11
W90	390	8.53±0.60	2.40±0.19	1.70±0.09	3.58±0.40	5.04±0.42	1.42±0.11
Whole	Average	8.24±0.42	2.28±0.09	1.63±0.06	3.65±0.23	5.09±0.26	1.40±0.02
W83	383	10.23±0.37	2.72±0.06	1.65±0.06	3.76±0.15	6.20±0.27	1.65±0.07

Table 8. Six morphological characters of unhusked grains collected in Senegal in 1985, *O. longistaminata* (391-441) in Casamance region and (444-455) in northern region

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W91	391	8.92±0.50	2.42±0.13	1.62±0.09	3.69±0.26	5.51±0.17	1.50±0.08
W92	392	9.08±0.21	2.45±0.06	1.69±0.08	3.71±0.15	5.38±0.26	1.45±0.07
W93	393	9.09±0.10	2.23±0.11	1.69±0.09	4.09±0.20	5.39±0.28	1.33±0.13
W94	394	7.93±0.32	2.45±0.10	1.62±0.02	3.24±0.14	4.90±0.19	1.51±0.07
W95	395	8.48±0.42	2.42±0.12	1.51±0.09	3.52±0.32	5.63±0.42	1.61±0.14
W96	396	8.90±0.23	2.35±0.05	1.51±0.02	3.79±0.05	5.90±0.21	1.56±0.04
W97	397	8.43±0.22	2.26±0.08	1.57±0.05	3.73±0.15	5.37±0.13	1.44±0.06
W99	399	8.14±0.36	2.21±0.21	1.53±0.12	3.72±0.42	5.35±0.58	1.45±0.16
W100	400	8.87±0.35	2.49±0.02	1.66±0.04	3.56±0.13	5.34±0.13	1.50±0.03
W101	401	8.52±0.52	2.46±0.25	1.66±0.13	3.50±0.42	5.17±0.41	1.49±0.14
W102	402	8.53±0.06	2.42±0.08	1.66±0.07	3.53±0.14	5.15±0.21	1.46±0.11
W106	406	8.35±0.25	2.50±0.14	1.68±0.06	3.35±0.17	4.98±0.29	1.49±0.10
W107	407	8.75±0.21	2.54±0.07	1.63±0.05	3.45±0.08	5.37±0.22	1.56±0.05
W108	408	8.77±0.31	2.33±0.12	1.57±0.07	3.77±0.12	5.59±0.14	1.48±0.05
W109	409	9.21±0.24	2.42±0.08	1.62±0.05	3.81±0.09	5.69±0.27	1.50±0.06
W111	411	8.94±0.13	2.35±0.10	1.61±0.04	3.81±0.15	5.56±0.12	1.46±0.05
W112	412	8.85±0.38	2.14±0.06	1.53±0.02	4.14±0.25	5.79±0.26	1.40±0.04
W114	414	9.25±0.15	2.66±0.07	1.72±0.04	3.48±0.13	5.38±0.08	1.55±0.05
W116	416	8.44±0.25	2.52±0.14	1.26±0.15	3.36±0.26	6.77±0.65	2.04±0.30
W119	419	8.64±0.33	2.43±0.04	1.60±0.06	3.56±0.09	5.41±0.31	1.52±0.07
W120	420	8.77±0.20	2.29±0.10	1.54±0.04	3.84±0.23	5.70±0.24	1.49±0.05
W123	423	8.66±0.11	2.43±0.07	1.67±0.07	3.57±0.10	5.19±0.18	1.46±0.03
W124	424	8.78±0.13	2.45±0.05	1.65±0.13	3.58±0.05	5.36±0.47	1.49±0.11
W126	426	7.97±0.76	2.22±0.05	1.40±0.12	3.59±0.27	5.77±0.96	1.60±0.17
W127	427	9.54±0.40	2.47±0.09	1.67±0.06	3.47±0.16	5.73±0.25	1.65±0.09
W129	429	9.52±0.32	2.76±0.07	1.72±0.05	3.46±0.12	5.54±0.27	1.61±0.07
W131	431	8.67±0.30	2.38±0.11	1.65±0.06	3.65±0.21	5.26±0.18	1.44±0.06
W133	433	8.61±0.17	2.43±0.15	1.54±0.07	3.55±0.17	5.61±0.32	1.58±0.15
W134	434	8.53±0.17	2.31±0.09	1.61±0.07	3.70±0.16	5.31±0.33	1.44±0.06
W135	435	8.67±0.31	2.22±0.19	1.58±0.04	3.94±0.39	5.49±0.26	1.41±0.14
W136	436	8.52±0.21	2.28±0.16	1.51±0.06	3.75±0.25	5.69±0.24	1.51±0.05
W137	437	8.42±0.15	2.31±0.07	1.61±0.13	3.65±0.08	5.26±0.40	1.44±0.08
W139	439	8.47±0.33	2.42±0.07	1.51±0.07	3.50±0.12	5.63±0.45	1.61±0.11
W140	440	9.18±0.09	2.02±0.06	1.62±0.05	4.56±0.11	5.68±0.14	1.25±0.05
W141	441	8.32±0.19	2.40±0.13	1.51±0.04	3.48±0.26	5.51±0.19	1.59±0.09
Whole	Average	8.71±0.37	2.39±0.15	1.59±0.09	3.66±0.25	5.49±0.31	1.51±0.12
W144	444	9.16±0.32	2.46±0.11	1.61±0.05	3.73±0.20	5.70±0.31	1.53±0.06
W147	447	8.62±0.61	2.31±0.15	1.52±0.02	3.76±0.47	5.67±0.33	1.52±0.12
W149	449	10.86±0.44	2.95±0.12	1.75±0.11	3.69±0.18	6.24±0.55	1.70±0.17
W151	451	8.49±0.67	2.38±0.09	1.61±0.04	3.57±0.29	5.28±0.45	1.48±0.07
W152	452	9.19±0.15	2.75±0.03	1.81±0.02	3.34±0.04	5.08±0.07	1.52±0.01
W154	454	9.15±0.20	2.56±0.16	1.79±0.06	3.59±0.25	5.12±0.13	1.43±0.07
W155	455	8.97±0.22	2.68±0.04	1.72±0.08	3.35±0.05	5.23±0.36	1.56±0.09
Whole	Average	9.21±0.72	2.58±0.21	1.69±0.10	3.58±0.16	5.47±0.39	1.53±0.08
Average of both groups	—	8.79±0.49	2.42±0.18	1.61±0.10	3.65±0.24	5.49±0.33	1.51±0.12

Table 9. Six morphological characters of unhusked grains collected in Senegal in 1985, *O. breviligulata* (398-422) in Casamance region and (443-456) in northern region, *O. brachyantha* (475)

Collection No.	Accession No.	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
W98	398	9.16±0.34	2.82±0.04	1.87±0.07	3.25±0.13	4.90±0.24	1.51±0.06
W103	403	7.85±0.37	3.05±0.09	1.91±0.09	2.57±0.12	4.12±0.24	1.61±0.10
W104	404	9.23±0.33	3.07±0.10	1.83±0.07	3.01±0.14	5.06±0.19	1.68±0.16
W105	405	7.86±0.38	3.01±0.12	1.83±0.06	2.61±0.11	4.29±0.24	1.65±0.10
W110	410	9.51±0.19	3.09±0.07	1.71±0.06	3.08±0.05	5.57±0.22	1.81±0.08
W113	413	9.46±0.21	3.03±0.08	1.90±0.03	3.12±0.05	4.98±0.16	1.60±0.05
W115	415	9.38±0.28	3.10±0.07	1.85±0.06	3.03±0.10	5.08±0.19	1.68±0.08
W117	417	8.15±0.16	3.11±0.05	1.97±0.04	2.62±0.09	4.14±0.08	1.58±0.05
W118	418	9.84±0.27	2.84±0.12	1.71±0.08	3.47±0.17	5.76±0.33	1.67±0.12
W121	421	8.11±0.27	3.19±0.10	1.93±0.06	2.54±0.10	4.21±0.13	1.66±0.08
W122	422	10.34±0.20	2.54±0.06	1.73±0.02	4.07±0.15	5.98±0.08	1.47±0.05
W125	425	9.77±0.26	3.00±0.09	1.75±0.07	3.26±0.10	5.58±0.27	1.72±0.10
W128	428	8.65±0.18	2.27±0.17	1.30±0.11	3.83±0.31	6.70±0.58	1.77±0.26
W130	430	8.64±0.42	2.78±0.09	1.74±0.07	3.11±0.13	4.95±0.15	1.60±0.08
W132	432	8.92±0.24	2.89±0.14	1.75±0.09	3.10±0.15	5.12±0.30	1.66±0.15
W138	438	9.46±0.30	2.87±0.02	1.70±0.03	3.30±0.10	5.57±0.15	1.69±0.03
W142	442	8.92±0.41	2.83±0.09	1.62±0.09	3.16±0.16	5.52±0.31	1.75±0.14
Whole	Average	9.01±0.70	2.91±0.22	1.77±0.15	3.13±0.40	5.15±0.69	1.65±0.08
W143	443	8.23±0.24	3.15±0.09	1.92±0.05	2.61±0.11	4.29±0.16	1.64±0.07
W145	445	8.23±0.24	3.20±0.12	1.91±0.05	2.58±0.10	4.31±0.13	1.67±0.08
W146	446	8.34±0.29	3.32±0.15	2.02±0.07	2.52±0.15	4.14±0.13	1.65±0.11
W148	448	8.19±0.23	3.01±0.14	1.95±0.09	2.73±0.15	4.21±0.21	1.55±0.11
W150	450	10.47±0.28	3.05±0.16	1.87±0.05	3.44±0.20	5.60±0.17	1.64±0.11
W153	453	8.48±0.26	3.14±0.11	1.89±0.06	2.71±0.13	4.50±0.18	1.67±0.08
W156	456	8.55±0.31	3.07±0.14	1.86±0.11	2.79±0.15	4.61±0.33	1.66±0.14
Whole	Average	8.64±0.76	3.13±0.10	1.92±0.05	2.77±0.29	4.52±0.46	1.64±0.04
Average of both groups	—	8.91±0.74	2.98±0.22	1.81±0.15	3.02±0.41	4.79±0.69	1.65±0.07
W175	475	9.01±0.33	1.82±0.08	1.40±0.12	4.96±0.29	6.50±0.66	1.31±0.13

Table 10. Six morphological characters of unhusked grains illustrated by average values of the respective groups; *O. longistaminata* --- **1**: Madagascar (MD) collected in 1985 [13 strains]; **2**: the same collected in 1988 [47 strains]; **3**: the same collected in both years [60 strains]; **4**: Tanzania (TA) collected in 1984 [1 strain]; **5**: the same collected in 1988 [36 strains]; **6**: the same collected in both years [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 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 in 1985 in northern region [7 strains]; **14**: the same of both regions [42 strains]; **15**: the summed-up data of strains 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* --- **17**: Nigeria (NI) collected in 1984 [7 strains]; **18**: the same

collected in 1985 [17 strains]; **19**: the same collected in both years [24 strains]; **20**: Ivory Coast (IV) collected in 1984 [1 strain]; **21**: Senegal (SE) collected in 1985 in Casamance region [17 strains]; **22**: the same in 1985 in northern region [7 strains]; **23**: the same of both regions [24 strains]; **24**: the summed-up data of strains collected in 1984 and 1985 in three countries [49 strains]; *O. punctata* --- **25**: Tanzania (TA) collected in 1984 [3 strains]; **26**: the same collected in 1988 [26 strains]; **27**: the same collected in both years [29 strains]; **28**: Kenya (KE) collected in 1984 [5 strains]; **29**: the same collected in 1985 [10 strains]; **30**: the same collected in both years [15 strains]; **31**: the summed-up of starins in 1984 and 1985 in two countries [18 strains]; **32**: the summed-up data of strains in 1984, 1985 and 1988 in two countries [44 strains]; *O. brachyantha*--- **33**: Senegal (SE) collected in 1985 [1 strain]

Country	Group mark	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
MD	**1**	8.54±0.72	2.34±0.17	1.59±0.10	3.65±0.14	5.40±0.31	1.48±0.07
	2	7.93±0.52	2.26±0.19	1.52±0.10	3.54±0.26	5.26±0.30	1.50±0.09
	3	8.06±0.62	2.28±0.19	1.53±0.11	3.56±0.22	5.29±0.31	1.49±0.08
TA	**4**	9.05±0.46	2.58±0.07	1.79±0.09	3.50±0.14	5.07±0.32	1.45±0.07
	5	8.07±0.41	2.34±0.17	1.63±0.07	3.77±0.24	5.37±0.24	1.44±0.07
	6	8.71±0.41	2.34±0.17	1.64±0.08	3.76±0.24	5.36±0.25	1.44±0.07
KE	**7**	8.29±0.40	2.48±0.21	1.61±0.10	3.37±0.18	5.17±0.10	1.55±0.07
NI	**8**	9.00±0.94	2.69±0.33	1.76±0.14	3.36±0.10	5.12±0.20	1.53±0.08
	9	8.59±0.59	2.41±0.15	1.67±0.08	3.59±0.29	5.16±0.39	1.44±0.07
	10	8.65±0.67	2.45±0.21	1.69±0.10	3.55±0.28	5.15±0.37	1.46±0.08
IV	**11**	8.24±0.42	2.28±0.09	1.63±0.06	3.65±0.23	5.09±0.26	1.40±0.02
SE	**12**	8.71±0.37	2.39±0.15	1.59±0.09	3.66±0.25	5.49±0.31	1.51±0.12
	13	9.21±0.72	2.58±0.21	1.69±0.10	3.58±0.16	5.47±0.39	1.53±0.08
	14	8.79±0.49	2.42±0.18	1.61±0.10	3.65±0.24	5.49±0.33	1.51±0.12
SUM	**15**	8.64±0.60	2.42±0.19	1.63±0.10	3.59±0.25	5.31±0.36	1.49±0.10
	16	8.47±0.63	2.36±0.20	1.60±0.11	3.61±0.26	5.31±0.33	1.48±0.09
NI	**17**	9.98±0.90	3.11±0.15	2.03±0.13	3.24±0.41	4.96±0.74	1.53±0.07
	18	9.29±0.53	3.13±0.29	1.87±0.15	3.00±0.36	5.00±0.50	1.68±0.07
	19	9.49±0.73	3.13±0.26	1.92±0.16	3.07±0.39	4.99±0.58	1.63±0.10
IV	**20**	10.23±0.37	2.72±0.06	1.65±0.06	3.76±0.15	6.20±0.27	1.65±0.07
SE	**21**	9.01±0.70	2.91±0.22	1.77±0.15	3.13±0.40	5.15±0.69	1.65±0.08
	22	8.64±0.76	3.13±0.10	1.92±0.05	2.77±0.29	4.52±0.46	1.64±0.04
	23	8.91±0.74	2.98±0.22	1.81±0.15	3.02±0.41	4.97±0.69	1.65±0.07
SUM	**24**	9.22±0.80	3.04±0.25	1.86±0.16	3.06±0.41	5.00±0.66	1.64±0.09
TA	**25**	6.40±0.22	2.50±0.02	1.56±0.01	2.57±0.11	4.12±0.16	1.61±0.01
	26	5.96±0.25	2.29±0.11	1.51±0.05	2.62±0.15	3.96±0.20	1.52±0.07
	27	6.01±0.28	2.31±0.12	1.52±0.05	2.62±0.15	3.98±0.20	1.53±0.07
KE	**28**	6.39±0.40	2.46±0.06	1.52±0.03	2.60±0.16	4.23±0.17	1.63±0.07
	29	6.22±0.63	2.40±0.08	1.53±0.05	2.60±0.26	4.11±0.37	1.59±0.06
	30	6.27±0.57	2.42±0.08	1.53±0.05	2.60±0.23	4.15±0.32	1.60±0.07
SUM	**31**	6.30±0.53	2.43±0.08	1.53±0.05	2.60±0.22	4.14±0.30	1.60±0.06
	32	6.10±0.42	2.35±0.12	1.52±0.05	2.61±0.18	4.04±0.26	1.56±0.08
SE	**33**	9.01±0.33	1.82±0.08	1.40±0.12	4.96±0.29	6.50±0.66	1.31±0.13

Table 11. Standard deviations of unhusked grains illustrated by average values of the respective groups, which were the same as those of Table 10.

Country	Group mark	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
MD	**1**	0.28±0.12	0.08±0.05	0.06±0.03	0.17±0.09	0.26±0.13	0.08±0.04
	2	0.46±0.11	0.16±0.03	0.11±0.03	0.29±0.05	0.45±0.10	0.14±0.03
	3	0.42±0.13	0.14±0.05	0.10±0.03	0.27±0.08	0.41±0.13	0.13±0.04
TA	**4**	0.46±0.00	0.07±0.00	0.09±0.00	0.14±0.00	0.32±0.00	0.07±0.00
	5	0.53±0.11	0.20±0.06	0.12±0.03	0.38±0.08	0.48±0.11	0.14±0.03
	6	0.52±0.11	0.19±0.07	0.12±0.03	0.37±0.08	0.48±0.11	0.14±0.03
KE	**7**	0.36±0.16	0.11±0.04	0.07±0.04	0.21±0.09	0.31±0.16	0.09±0.05
NI	**8**	0.55±0.17	0.15±0.03	0.11±0.04	0.29±0.10	0.41±0.11	0.09±0.01
	9	0.27±0.13	0.09±0.05	0.06±0.03	0.18±0.08	0.24±0.13	0.07±0.04
	10	0.31±0.17	0.10±0.05	0.07±0.03	0.19±0.10	0.26±0.14	0.07±0.04
IV	**11**	0.54±0.08	0.21±0.03	0.10±0.01	0.41±0.04	0.47±0.08	0.13±0.02
SE	**12**	0.27±0.14	0.10±0.05	0.07±0.03	0.18±0.10	0.29±0.17	0.09±0.05
	13	0.37±0.19	0.10±0.05	0.05±0.03	0.21±0.14	0.31±0.16	0.08±0.05
	14	0.29±0.15	0.10±0.05	0.07±0.03	0.19±0.10	0.30±0.17	0.09±0.05
SUM	**15**	0.32±0.16	0.11±0.05	0.07±0.03	0.20±0.11	0.29±0.16	0.09±0.05
	16	0.39±0.17	0.14±0.06	0.09±0.04	0.26±0.12	0.37±0.16	0.11±0.05
NI	**17**	0.39±0.12	0.13±0.03	0.08±0.02	0.14±0.02	0.25±0.05	0.09±0.02
	18	0.31±0.09	0.13±0.03	0.07±0.02	0.15±0.05	0.22±0.05	0.10±0.02
	19	0.33±0.10	0.13±0.03	0.07±0.02	0.15±0.04	0.23±0.05	0.10±0.02
IV	**20**	0.37±0.00	0.06±0.00	0.06±0.00	0.15±0.00	0.27±0.00	0.07±0.00
SE	**21**	0.28±0.08	0.09±0.04	0.06±0.02	0.13±0.06	0.23±0.11	0.10±0.05
	22	0.26±0.03	0.13±0.02	0.07±0.02	0.14±0.03	0.19±0.06	0.10±0.02
	23	0.28±0.07	0.10±0.04	0.07±0.02	0.13±0.05	0.22±0.10	0.10±0.05
SUM	**24**	0.31±0.09	0.11±0.04	0.07±0.02	0.14±0.05	0.22±0.08	0.10±0.03
TA	**25**	0.37±0.13	0.12±0.03	0.11±0.02	0.20±0.06	0.38±0.02	0.12±0.03
	26	0.40±0.07	0.16±0.03	0.08±0.01	0.26±0.08	0.33±0.06	0.13±0.02
	27	0.39±0.08	0.16±0.03	0.09±0.02	0.25±0.08	0.34±0.05	0.13±0.02
KE	**28**	0.44±0.12	0.15±0.02	0.12±0.06	0.22±0.06	0.39±0.11	0.13±0.06
	29	0.42±0.13	0.11±0.04	0.13±0.03	0.20±0.07	0.47±0.15	0.16±0.05
	30	0.43±0.13	0.12±0.04	0.13±0.04	0.21±0.07	0.44±0.14	0.15±0.05
SUM	**31**	0.42±0.13	0.12±0.04	0.13±0.04	0.21±0.07	0.43±0.13	0.14±0.05
	32	0.40±0.10	0.15±0.04	0.10±0.04	0.24±0.08	0.37±0.11	0.14±0.04
SE	**33**	0.33±0.00	0.08±0.00	0.12±0.00	0.29±0.00	0.66±0.00	0.13±0.00

[24 strains]; **24**: the summed-up data of strains collected in 1984 and 1985 in three countries [49 strains]; *O. punctata* in the third column ––– **25**: Tanzania collected in 1984 [3 strains]; **26**: the same collected in 1988 [26 strains]; **27**: the same collected in both years [29 strains]; **28**: Kenya collected in 1984 [5 strains]; **29**: the same collected in 1985 [10 strains]; **30**: the same collected in both years [15 strains]; **31**: the summed-up data of strains in 1984 and 1985 in two countries [18 strains]; **32**: the summed-up data of strains in 1984, 1985 and 1988 in two countries [44 strains]; *O. brachyantha* in the fourth column ––– **33**: Senegal collected in 1985 [1 strain].

As mentioned above, some strains have different meanings in view of physiological,

meteorological and phylogenetical characters, and should be separately considered also in morphological studies. Accordingly, they are divided into two groups, and after that summed-up in the respective countries and groups, in aim of the future analyses. **34**: East Africa of *O. longistaminata*; 107 strains in the total, *i.e.*, Madagascar (**1** [13 strains] and **2** [47 strains]), Tanzania (**4** [1 strain] and **5** [36 strains]) and Kenya (**7** [10 strains]). **35**: West Africa of *O. longistaminata*; 83 strains in the total, *i.e.*, Nigeria (**8** [5 strains] and **9** [29 strains]), Ivory Coast (**11** [7 strains]), Senegal (**12** [35 strains] and **13** [7 strains]).

I. *O. longistaminata*

1. Length

Lengths for the individual grain level ranged from 11.75 mm (strain No.W36 in 1984 and Accession No.336) to 5.80 mm (No.2027). In the strain level, the longest (10.86 mm) was obtained in No.449, followed by No.336 (10.19 mm) and No.335 (10.02 mm). It was noticed that the value of No.449 was very large. The shortest (6.67 mm) was noted in No.303, followed by No.2009 (6.72 mm) and No.2011 (6.85 mm).

In the group level (Table 10), the longest (9.21 mm) was obtained in the strains collected in northern region of Senegal in 1985 (illustrated as mark **13** in Table 10), followed by group **4** [Tanzania in 1984] (9.05 mm) and group **8** [Nigeria in 1984] (9.00 mm). The shortest (7.93 mm) was noted in group **2** [Madagascar in 1988], followed by group **3** [Madagascar in 1985 and 1988] (8.06 mm) and group **11** [Ivory Coast in 1984] (8.24 mm). Averages and those standard deviations through the whole strains belonging to the group **34** (summed-up of groups **1, 2, 4, 5** and **7**, *i.e.*, East Africa) and group **35** (summed-up of groups **8, 9, 11, 12** and **13,** *i.e.*, West Africa) were found to be 8.31 ± 0.62 and 8.70 ± 0.59, respectively.

In the standard deviations of each, *i.e.*, those showing intra-population's variations, the largest (0.76) was obtained in No.426, followed by No.2051 (0.74) and No.2057 (0.72). The smallest (0.04) was noted in No.357, followed by Nos.313 and 402 (0.06). In the group level, the largest (0.94) was obtained in group **8**, followed by groups **1** and **13** (0.72). It was noticed that group **8** showed very large value. The smallest (0.37) was noted in group **12**, followed by group **7** (0.40), and groups **5** and **6** (0.41).

Standard deviations of unhusked grains illustrated by average values of the respective groups were shown in Table 11. The largest (0.55) was obtained in group **8**, followed by group **11** (0.54) and group **5** (0.53). The smallest (0.27) was noted in groups **9** and **12**, followed by group **1** (0.28). Averages and those standard deviations in the whole strains belonging to the groups **34** and **35** were found to be 0.45 ± 0.14 and 0.32 ± 0.17, respectively.

2. Width

Widths for the individual grain level ranged from 3.06 mm (No.336), which was the same as in case of the length, to 1.65 mm (No.384). It was noticeable that value was particularly large in No.336. In the strain level, the widest (3.15 mm) was obtained in

No.336, followed by No.335 (2.99 mm), which was the same as in case of the length, and No.449 (2.95 mm). These combinations of strains (Nos.335, 336 and 449) were found to be the same as in case of the length. The narrowest (1.98 mm) was noted in No. 2002, followed by No.2005 (1.99 mm), and Nos.2001 and 2027 (2.00 mm).

In the group level, the widest (2.69 mm) was obtained in group **8**, followed by groups **4** and **13** (2.58 mm). These combinations of groups (**4**, **8** and **13**) were found to be the same as in case of the length. The narrowest (2.26 mm) was noted in group **2**, which was the same as in case of the length, followed by groups **3** and **11** (2.28 mm), which were also the same as in case of the length. These combinations of groups (**2**, **3** and **11**) were found to be the same as in case of the length. Averages and those standard deviations through the whole strains belonging to the groups **34** and **35** were found to be 2.32 ± 0.20 and 2.42 ± 0.19, respectively.

In the standard deviations of each strain, the largest (0.50) was obtained in No. 2051, followed by No.2056 (0.27) and No.2074 (0.26). It was noticed that the value was particularly large in strain No.2051. The narrowest (0.02) was noted in Nos.301, 313, 324, 340 379 and 400. In the group level, the largest (0.33) was obtained in group **8**, which was the same as in case of the length, followed by groups **7**, **10** and **13** (0.21). The smallest (0.07) was noted in group **4**, followed by group **11** (0.09) and groups **9** and **12** (0.15).

In the standard deviations of each group (Table 11), the largest (0.21) was obtained in group **11**, followed by group **5** (0.20), which was the same as in case of the length, and group **6** (0.19). The smallest (0.07) was noted in group **4**, followed by group **1** (0.08) and group **9** (0.09). Averages and those standard deviations in the whole strains belonging to the groups **34** and **35** were found to be 0.16 ± 0.06 and 0.11 ± 0.06, respectively.

3. Thickness

Thicknesses for the individual grain level ranged from 2.55 mm (No.336), which was the same as in cases of the length and width, to 1.00 mm (No.2062). It was noticed that the value of No.336 was very large, and was 0.45 mm thicker than the value (2.10 mm) of the following strain (No.2045). In the strain level, the thickest (1.94 mm) was obtained in No.336, which was the same as in case of the width, followed by No.335 (1.87 mm), which was the same as in cases of the length and width, and No.307 (1.85 mm). The thinnest (1.26 mm) was noted in No.416, followed by No.2026 (1.36 mm) and No. 2027 (1.37 mm), in which the last one was the same as in case of the width.

In the group level, the thickest (1.79 mm) was obtained in group **4**, followed by group **8** (1.76 mm), which was the same as in case of the length, and groups **10** and **13** (1.69 mm), in which the last one was the same as in case of the width. These combinations of groups (**4**, **8** and **13**) were found to be the same as in cases of the length and width. The thinnest (1.52 mm) was noted in group **2**, which was the same as in cases of the length and width, followed by group **3** (1.53 mm) and group **12** (1.59 mm). Averages and those standard deviations through the whole strains belonging to the groups **34**

and **35** were found to be 1.58±0.11 and 1.64±0.10, respectively.

In the standard deviations of each strain, the largest (0.18) was obtained in Nos. 2043 and 2051, in which the latter was the same as in case of the width, followed by Nos.336, 2007, 2061 and 2062 (0.17). The smallest (0.02) was noted in 10 strains, *i.e.*, Nos.301, 311, 324, 365, 379, 394, 396, 412, 447 and 452. In the group level, the largest (0.14) was obtained in group **8**, which was the same as in cases of the length and width, followed by groups **3** and **16** (0.11). The smallest (0.06) was noted in group **11**, followed by group **5** (0.07), and groups **6** and **9** (0.08).

In the standard deviations of each group (Table 11), the largest (0.12) was obtained in groups **5** and **6**, followed by groups **2** and **8** (0.11). The smallest (0.05) was noted in group **13**, followed by groups **1** and **9** (0.06), which was the same as in case of the width. Averages and those standard deviations in the whole strains belonging to the groups **34** and **35** were found to be 0.10±0.04 and 0.07±0.03, respectively.

4. Ratio of length to width

Ratios of length to width (abbreviated as L/W) for the individual grain level ranged from 5.08 (No.2059) to 2.41 (No.2051). In the strain level, the largest (4.56) was obtained in No.440, followed by No.377 (4.40) and No.412 (4.14). It was noticed that the value was particularly large in strain No.440. The smallest (3.06) was noted in Nos. 321 and 379, followed by No.2046 (3.09).

In the group level, the largest (3.77) was obtained in group **5**, followed by group **6** (3.76) and group **12** (3.66). The smallest (3.36) was noted in group **8**, followed by group **7** (3.37) and group **4** (3.50). Averages and those standard deviations through the whole strains belonging to the groups **34** and **35** were found to be 3.61±0.25 and 3.61±0.26, respectively.

In the standard deviations of each strain, the largest (0.52) was obtained in No. 2051 and No. 2056, in which the former was the same as in cases of the width and thickness, followed by No.2059 (0.51). The smallest (0.04) was noted in No.452, which was the same as in case of the thickness, followed by Nos.396, 424 and 455 (0.05). In the group level, the largest (0.29) was obtained in group **9**, followed by group **10** (0.28), which was the same as in case of the width, and group **2** (0.26). The smallest (0.10) was noted in group **8**, followed by groups **1** and **4** (0.14).

In the standard deviations of each group (Table 11), the largest (0.41) was obtained in group **11**, which was the same as in case of the width, followed by group **5** (0.38) and group **6** (0.37). These orders of groups (**11**>**5**>**6**) were found to be the same as in case of the width. The smallest (0.14) was noted in group **4**, which was also the same as in case of the width, followed by group **1** (0.17) and groups **9** and **12** (0.18). These orders of groups (**4**<**1**<**19**) were also found to be the same as in case of the width. Averages and those standard deviations in the whole strains belonging to the groups **34** and **35** were found to be 0.30±0.10 and 0.21±0.12, respectively.

5. Ratio of length to thickensss

Ratios of length to thickness (abbreviated as L/T) for the individual grain level

ranged from 7.54 (No.2022) to 3.86 (No.371). In the strain level, the largest (6.77) was obtained in No.416, followed by No.449 (6.24) and No.377 (5.92), in which No.449 and No.377 were the same as in cases of width and ratio of length to width (L/W), respectively. It was noticed that the value was particularly large in No.416. The smallest (4.64) was noted in No.343, followed by Nos.342, 345, 358 and 2019 (4.69).

In the group level, the largest (5.49) was obtained in groups **12** and **14**, followed by group **13** (5.47), which was the same as in cases of the width and thickness. The smallest (5.07) was noted in group **4**, followed by group **11** (5.09), which was the same as in cases of the length and width, and group **8** (5.12). Averages and those standard deviations through the whole strains belonging to the groups **34** and **35** were found to be 5.30 $\pm$0.28 and 5.32$\pm$0.38, respectively.

In the standard deviations of each strain, the largest (0.96) was obtained in No.426, which was the same as in case of t8 (0.71). It was noticed that No.426 showed very large value. The smallest (0.04) was noted in No.355, followed by No.452 (0.07), and Nos.301 and 414 (0.08). In the group level, the largest (0.39) was obtained in groups **9** and **13**, in which the former was the same as in case of the ratio of length to width (L/W), followed by group **10** (0.37), which was the same as in cases of the width and the ratio of length to width (L/W). The smallest (0.10) was noted in group **7**, followed by group **8** (0.20) and group **5** (0.24). It was noticed that group **7** showed very small value.

In the standard deviations of each group (Table 11), the largest (0.48) was obtained in groups **5** and **6**, which were the same as in case of the thickness, followed by group **11** (0.47). These combinations of groups (**5, 6** and **11**) were found to the same as in cases of the width and thickness. The smallest (0.24) was noted in group **9**, which was the same as in case of the length, followed by groups **1** and **10** (0.26). Averages and those standard deviations in the whole strains belonging to the groups **34** and **35** were found to be 0.43$\pm$0.14 and 0.30$\pm$0.16, respectively.

6. Ratio of width to thickness

Ratios of width to thickness (abbreviated as W/T) for the individual grain level ranged from 2.40 (No.2062) to 1.03 (No.2001). In the strain level, the largest (2.04) was obtained in No.416, which was the same as in case of the ratio of length to thickness (L/T), followed by No.2023 (1.74) and No.2022 (1.72). It was noted that the value was particularly large in No.416, which was also the same as in case of the ratio of length to thickness (L/T). The smallest (1.25) was noted in No.440, followed by No.340 (1.30), and Nos.349, 358, 393, 2001 and 2067 (1.33), in which No.358 and No.2001 were the same as in cases of ratio of length to thickness (L/T) and the width, respectively.

In the group level, the largest (1.55) was obtained in group **7**, followed by groups **8** and **13** (1.53), in which the former and the latter were the same as in cases of the length and thickness, and length, thickness and the ratio of length to thickness (L/T), respectively. The smallest (1.40) was noted in group **11**, followed by groups **5, 6** and **9** (1.44). Averages and those standard deviations through the whole strains belonging to the groups **34** and **35** were found to be 1.48$\pm$0.08 and 1.48$\pm$0.10, respectively.

In the standard deviations of each strain, the largest (0.52) was obtained in No. 2034, followed by No.416 (0.30) and No.2062 (0.26), in which the latter was the same as in cases of the thickness and the ratio of length to thickness (L/T). It was noticed that the value was particularly large in No.2034. The smallest (0.01) was noted in Nos.324 and 452, in which the former and the latter were the same as in cases of the width and thickness, and thickness and ratio of length to width (L/W), respectively, followed by Nos.301, 377 and 379 (0.02). These combinations of strains (Nos.301, 324 and 452) were found to be the same as in case of the thickness. In the group level, the largest (0.12) was obtained in groups **12** and **14**, followed by groups **15** and **19** (0.10). The smallest (0.02) was noted in group **11**, which was the same as in case of the thickness, followed by groups **1, 4, 5, 6, 7** and **9** (0.07). These combinations of groups (**4, 9** and **11**) and of other groups (**5, 6, 9** and **11**) were the same as in cases of the width and thickness, respectively.

In the standard deviations of each group (Table 11), the largest (0.14) was obtained in groups **2, 5** and **6**. These combinations of groups (**2, 5** and **6**) were found to be the same as in case of the thickness. The smallest (0.07) was noted in groups **4, 9** and **10**, in which the **4** and **9** were the same as in cases of width and ratio of length to width (L/W), and length and ratio of length to thickness (L/T), respectively. Averages and those standard deviations in the whole strains belonging to the groups **34** and **35** were found to be 0.13 ± 0.04 and 0.09 ± 0.05, respectively.

7. Further group comparison

Six character-relations are shown in Figs. 2 and 3, *i.e.*, relations between length and width, length and thickness (Fig. 2), width and thickness, L/W and L/T, L/W and W/T, L/T and W/T (Fig. 3).

To obtain the locality specificity, the comparison was made by the representatives of Madagascar (group **3** in the table), Tanzania (**6**), Kenya (**7**), Nigeria (**10**), Ivory Coast (**11**) and Senegal (**14**), and was shown in Table 12. From the data shown in data of Tables 10, 11 and 12, Figs. 2 and 3, the following specificities were ascertained to some extent.

Grain type, in general, was said to be long in strains collected in Senegal, and large in strains of Nigeria. On the contrary, strains of Madagascar was relatively small.

In case of the strain collected in Fogera Plain, Ethiopia (12° 12′N, 37° 30′E)[17], average values and those standard deviations were found to be 8.86 ± 0.55, 2.73 ± 0.24, 1.75 ± 0.11, 3.26 ± 0.16, 5.07 ± 0.21 and 1.56 ± 0.11 in length, width, thickness, ratios of length to width, of length to thickness, and of width to thickness, respectively. In comparison with the present data (Tables 10, 11 and 12), the strain of Ethiopia showed the following specificities. Average values of 5 characters except ratio of length to width (L/W) showed the largest ones through the whole groups of Africa. On the contrary, the value of ratio of length to width (L/W) showed the smallest one through the whole groups of Africa. The strain of Ethiopia should be located in the position relatively longer the length, wider the width and thicker the thickness of wild rice in the *Oryza longi-*

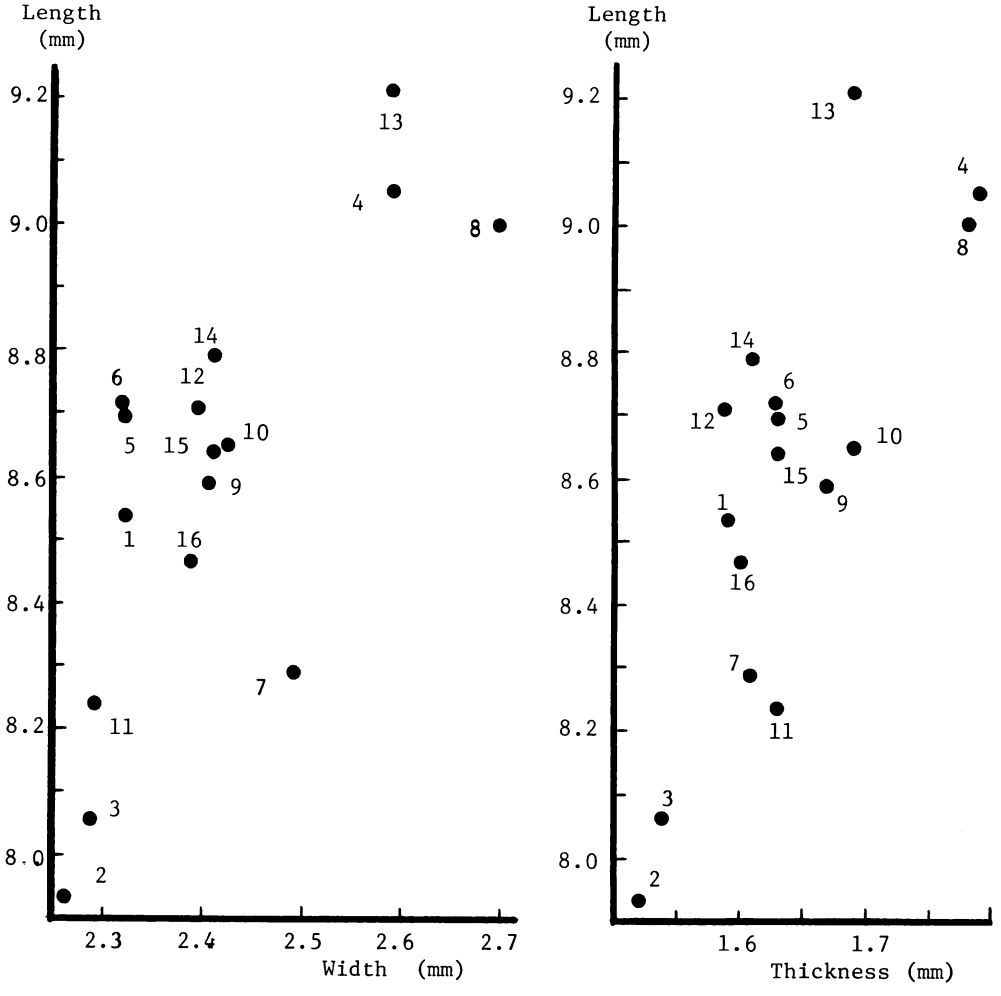

Fig. 2. Relations between length and width (left) and length and thickness (right) of unhusked grains in mm, *O. longistaminata*. Vertical axes; length, abscissa; width (left) and thickness (right). Code numbers used in the figure are corresponding to the group mark which was used in Table 10.

staminata and its relatives distributing in the whole Africa.

II. *O. breviligulata*

1. Length

Lengths for the individual grain level ranged from 12.10 mm (strain No.W34 in 1984 and Accession No.334) to 7.25 mm (No.403). It was noticed that the value of No.334 was very large. In the strain level, the longest (11.43 mm) was obtained in No.334, followed by No.333 (11.04 mm) and No.450 (10.47 mm). It was noticed that the value of No.334 was very large. The shortest (7.85 mm) was noted in No.403, followed by No.421 (8.11 mm) and No.417 (8.15 mm).

In the group level (Table 10), the longest (10.23 mm) was obtained in the strains collected in Ivory Coast in 1984 (illustrated as mark **20** in Table 10), followed by group

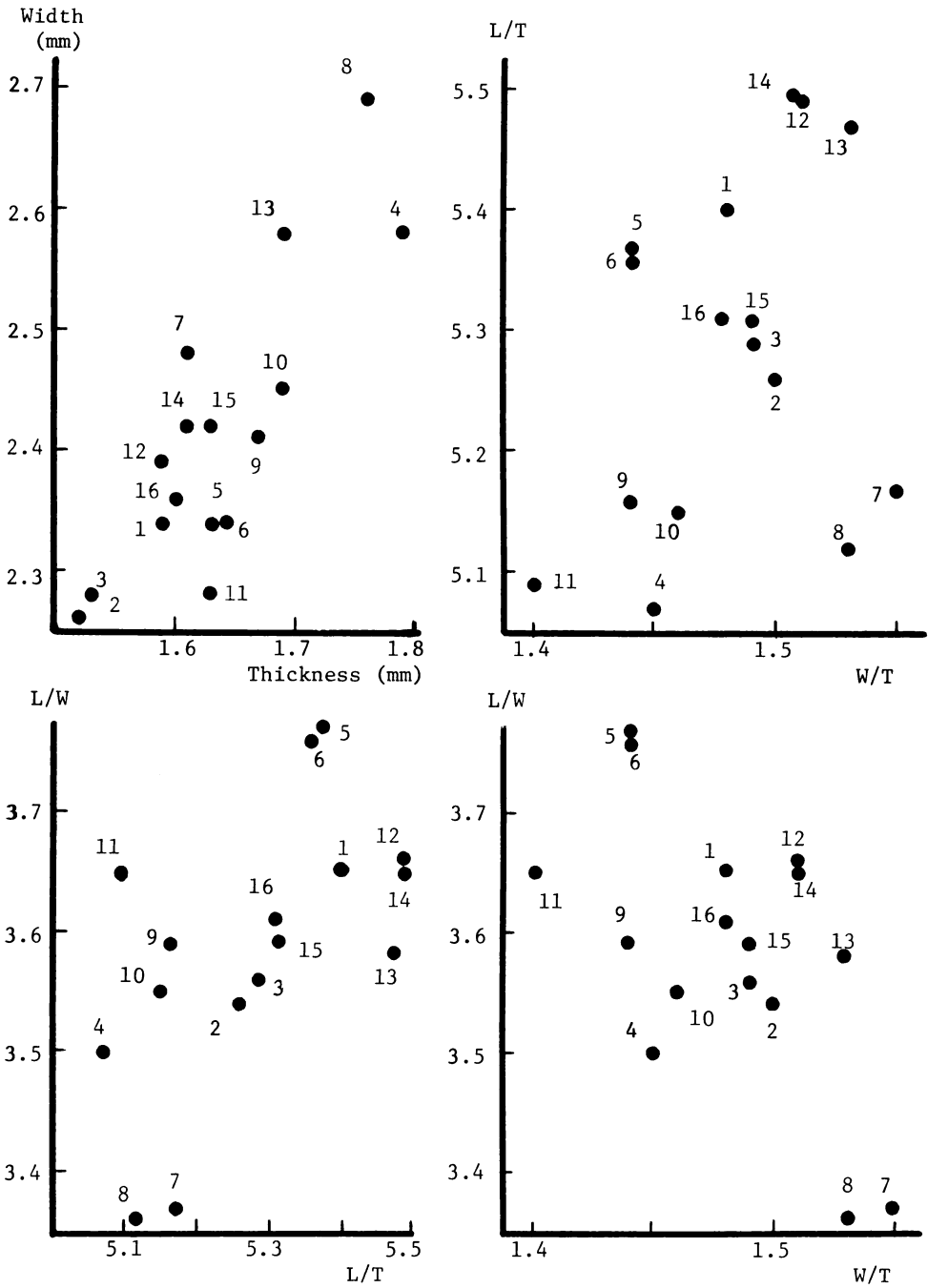

Fig. 3. Relations between the respective two characters of unhusked grains, *O. longistaminata*. Vertical axes; width (upper left), L/T (upper right) and L/W (lowers), abscissa; thickness (upper left), L/T (lower left) and W/T (rights). Code number used in the figure are corresponding to the group mark which was used in Table 10.

Table 12. Comparison of values shown in the respective characters; 1 = the largest, 6 = the smallest. Country and group marks were the same as those of Table 10. Upper column; practical values shown in Table 10, lower column; standard deviations shown in Table 11

Country	Group mark	Practical value						Standard deviations					
		L	W	T	L/W	L/T	W/T	L	W	T	L/W	L/T	W/T
MD	**3**	6	5	6	4	3	3	2	3	1	5	3	2
TA	**6**	2	4	2	1	2	5	5	5	5	2	5	4
KE	**7**	4	1	4	6	4	1	6	1	2	6	6	4
NI	**10**	3	2	1	5	5	4	1	1	2	1	1	2
IV	**11**	5	5	3	2	6	6	4	6	6	4	4	6
SE	**14**	1	3	4	2	1	2	3	4	2	2	2	1
MD	**3**	3	3	2	3	3	2	4	2	2	4	4	3
TA	**6**	2	2	1	2	1	1	5	1	2	4	5	5
KE	**7**	4	4	4	4	4	4	2	5	1	3	2	1
NI	**10**	5	5	4	5	6	6	1	2	2	1	3	3
IV	**11**	1	1	2	1	2	2	6	6	6	6	6	6
SE	**14**	6	5	4	5	5	4	3	2	2	1	1	1

17 [Nigeria in 1984] (9.98 mm) and group **19** [Nigeria in 1984 and 1985] (9.49 mm). The shortest (8.64 mm) was noted in group **22** [northern region of Senegal in 1985], followed by group **23** [both regions of Senegal in 1985] (8.91 mm) and group **21** [Casamance region of Senegal in 1985] (9.01 mm). Average and its standard deviations through the whole strains belonging to the species (group **24** --- summed-up of groups **17, 18, 20, 21** and **22**) were found to be 9.22 ± 0.80.

In the standard deviations of each strain, *i.e.*, those showing intra-population's variations, the largest (0.62) was obtained in No.329, followed by No.376 (0.52) and No.328 (0.46). The smallest (0.16) was noted in No.417, followed by Nos.366 and 410 (0.19). In the group level, the largest (0.90) was obtained in group **17**, followed by group **22** (0.76) and group **19** (0.73). The smallest (0.37) was noted in group **20**, followed by group **18** (0.53) and group **21** (0.70).

Standard deviations of unhusked grains illustrated by average values of the respective groups were shown in Table 11. The largest (0.39) was obtained in group **17**, followed by group **20** (0.37) and group **19** (0.33). The smallest (0.26) was noted in group **22**, followed by groups **21** and **23** (0.28). Average and its standard deviations in the whole strains belonging to the group **24** were found to be 0.31 ± 0.09.

2. Width

Widths for the individual grain level ranged from 3.80 mm (No.361) to 2.00 mm (No.428). In the strain level, thickest (3.55 mm) was obtained in No.344, followed by No.380 (3.50 mm) and No.361 (3.48 mm). The narrowest (2.27 mm) was noted in No.428, followed by No.422 (2.54 mm) and No.367 (2.57 mm).

In the group level, the widest (3.13 mm) was obtained in groups **18, 19** and **22**. The narrowest (2.72 mm) was noted in group **20**, followed by group **21** (2.91 mm) and group **23** (2.98 mm). Average and its standard deviations through the whole strains belonging

to the group **24** were found to be 3.04±0.25.

In the standard deviations of each strain, the largest (0.20) was obtained in No.328, followed by No.353 (0.19), and Nos.374 and 428 (0.17). The smallest (0.02) was noted in No.438, followed by No.398 (0.04) and No.417 (0.05). In the group level, the largest (0.29) was obtained in group **18**, followed by group **19** (0.26) and group **24** (0.25). The smallest (0.06) was noted in group **20**, which was the same as in case of the length, followed by group **22** (0.10) and group **17** (0.15).

In the standard deviations of each group (Table 11), the largest (0.13) was obtained in groups **17, 18, 19** and **22**. The smallest (0.06) was noted in group **20**, followed by group **21** (0.09) and group **23** (0.10). Average and its standard deviations in the whole strains belonging to the group **24** were found to be 0.11±0.04.

3. Thickness

Thicknesses for the individual grain level ranged from 2.50 mm (No.328) to 1.15 mm (No.428), which was the same as in case of the width. In the strain level, the thickest (2.26 mm) was obtained in No.328, followed by No.330 (2.13 mm) and No.380 (2.09 mm), in which the latter was the same as in case of the width. The thinnest (1.30 mm) was noted in No.428, which was the same as in case of the width, followed by No.367 (1.55 mm), which was also the same as in case of the width, and No.368 (1.58 mm).

In the group level, the thickest (2.03 mm) was obtained in group **17**, followed by groups **19** and **22** (1.92 mm). The thinnest (1.65 mm) was noted in group **20**, which was the same as in case of the width, followed by group **21** (1.77 mm) and group **23** (1.81 mm). These orders of groups (**20** < **21** < **23**) were found to be the same as in case of the width. Average and its standard deviations through the whole strains belonging to the group **24** were found to be 1.86±0.16.

In the standard deviations of each strain, the largest (0.12) was obtained in No.328, which was the same as in case of the width, followed by Nos.428 and 456 (0.11), in which the former was the same as in case of the width. The smallest (0.02) was noted in No.422, followed by Nos.413 and 438 (0.03). In the group level, the largest (0.16) was obtained in group **19**, followed by groups **18, 21** and **23** (0.15). These combinations of groups (**18, 19, 21** and **23**) were found to be the same as in case of the width. The smallest (0.05) was noted in group **22**, followed by group **20** (0.06) and group **17** (0.13). These combinations of groups (**17, 20** and **22**) were found to be the same as in case of the width.

In the standard deviations of each group (Table 11), the largest (0.08) was obtained in group **17,** which was the same as in case of the length. The smallest (0.06) was noted in groups **20** and **21**. Average and its standard deviations in the whole strains belonging to the group **24** were found to be 0.07±0.02.

4. Ratio of length to width

Ratios of length to width (abbreviated as L/W) for the individual grain level ranged from 4.62 (No.334), which was the same as in case of the length, to 2.26 (No.446). In the strain level, the largest (4.11) was obtained in No.334, which was the same as in case

of the length, followed by No.422 (4.07) and No.428 (3.83). The smallest (2.52) was noted in No.446, followed by No.421 (2.54) and No.403 (2.57).

In the group level, the largest (3.76) was obtained in group **20**, which was the same as in case of the length, followed by group **17** (3.24) and group **21** (3.13). It was noticed that group **20** showed very large value. The smallest (2.77) was noted in group **22**, which was also the same as in case of the length, followed by group **18** (3.00) and group **33** (3.02). Average and its standard deviations through the whole strains belonging to the group **24** were found to be 3.06 ± 0.41.

In the standard deviations of each strain, the largest (0.31) was obtained in No.428, followed by No.350 (0.25) and No.376 (0.23). The smallest (0.05) was noted in Nos.410 and 413, followed by Nos.359 and 417 (0.09). In the group level, the largest (0.41) was obtained in groups **17, 23** and **24**. The smallest (0.15) was noted in group **20**, which was the same as in cases of the length and width, followed by group **22** (0.29) and group **18** (0.36).

In the standard deviations of each group (Table 11), the largest (0.15) was obtained in groups **18, 19** and **20**, in which the former two were the same as in case of the width. The smallest (0.13) was noted in groups **21** and **23**. Average and the its standard deviations in the whole strains belonging to the group **24** were found to be 0.14 ± 0.05.

5. Ratio of length to thickness

Ratios of length to thickness (abbreviated as L/T) for the individual grain level ranged from 7.70 (No.428) to 3.63 (No.405). It was noticed that the value of No.428 was particularly large, and was 0.73 larger than the value (6.97) of the following strain (No.383). In the strain level, the largest (6.70) was obtained in No.428, followed by No.334 (6.30) and No.383 (6.20). The smallest (4.12) was noted in No.403, which was the same as in case of the length, followed by No.328 (4.13), and Nos.417 and 446 (4.14), in which the former was also the same as in case of the length.

In the group level, the largest (6.20) was obtained in group **20**, which was the same as in cases of the length and the ratio of length to width (L/W), followed by group **21** (5.15), and groups **18** and **24** (5.00). The smallest (4.52) was noted in group **22**, which was also the same as in cases of the length and the ratio of length to width (L/W), followed by group **17** (4.96) and group **23** (4.97). Average and its standard deviations through the whole strains belonging to the group **24** were found to be 5.00 ± 0.66.

In the standard deviations of each strain, the largest (0.58) was obtained in No.428, which was the same as in case of the ratio of length to width (L/W), followed by Nos.329, 418 and 456 (0.33), in which the last one was the same as in case of the thickness. It was noticed that the value of No.428 was particularly large, which was the same as in case of the own practical value. The smallest (0.08) was noted in Nos.417 and 422, in which the former and the latter were the same as in cases of the length and thickness, respectively, followed by Nos.421, 445 and 446 (0.13). In the group level, the largest (0.74) was obtained in group **17**, which was the same as in cases of the length and the ratio of length to width (L/W), followed by groups **21** and **23** (0.69). The smallest (0.27)

was noted in group **20**, which was the same as in cases of the length, width and the ratio of length to width (L/W), followed by group **22** (0.46) and group **18** (0.50). These orders of groups (**20** < **22** < **18**) were found to be the same as in case of the ratio of length to width (L/W).

In the standard deviations of each group (Table 11), the largest (0.27) was obtained in group **20**, followed by group **17** (0.25), and groups **19** and **21** (0.23). These combinations of groups (**17, 19** and **20**) were found to be the same as in case of the length. Average and its standard deviations in the whole strains belonging to the group **24** were found to be 0.22 ± 0.08.

6. Ratio of width to thickness

Ratios of width to thickness (abbreviated as W/T) for the individual grain level ranged from 2.17 (No.428), which was the same as in case of the ratio of length to thickness (L/T), to 1.22 (No.328). In the strain level, the largest (1.81) was obtained in No.410, followed by Nos.344, 363 and 428 (1.77), in which the last one was the same as in case of the ratio of length to width (L/W). The smallest (1.45) was noted in No.328, followed by No. 422 (1.47) and No.331 (1.48), in which the former was the same as in case of the width.

In the group level, the largest (1.68) was obtained in group **18**, which was the same as in case of the width, followed by groups **20, 21** and **23** (1.65). These combinations of groups (**18, 20** and **21**) were found to be the same as in case of the ratio of length to thickness (L/T). The smallest (1.53) was noted in group **17**, followed by group **19** (1.63) and groups **22** and **24** (1.64). Average and its standard deviations through the whole strains belonging to the group **24** were found to be 1.64 ± 0.09.

In the standard deviations of each strain, the largest (0.26) was obtained in No.428, which was the same as in cases of the ratios of length to width (L/W) and of length to thickness (L/T), followed by No.432 (0.15), and Nos.374, 442 and 456 (0.14), in which No.374 and No.456 were the same as in cases of the width, and the thickness and the ratio of length to thickness (L/T), respectively. The smallest (0.03) was noted in No.438, which was the same as in case of the width, followed by Nos.413, 417 and 422 (0.05). These combinations of strains (Nos.413, 422 and 438) were found to be the same as in case of the thickness. In the group level, the largest (0.10) was obtained in group **19**, which was the same as in case of the thickness, followed by group **24** (0.09) and group **21** (0.08). The smallest (0.04) was noted in group **22**, which was the same as in case of the thickness.

In the standard deviations of each group (Table 11), the difference between the largest (0.10) and the smallest (0.07) was ascertained to be very small. Average and its standard deviations in the whole strains belonging to the group **24** were found to be 0.10 ± 0.03.

7. Further group comparison

Six character-relations are shown in Figs. 4 and 5, *i.e.*, relations between length and width, length and thickness (Fig. 4), width and thickness, L/W and L/T, L/W and W/T,

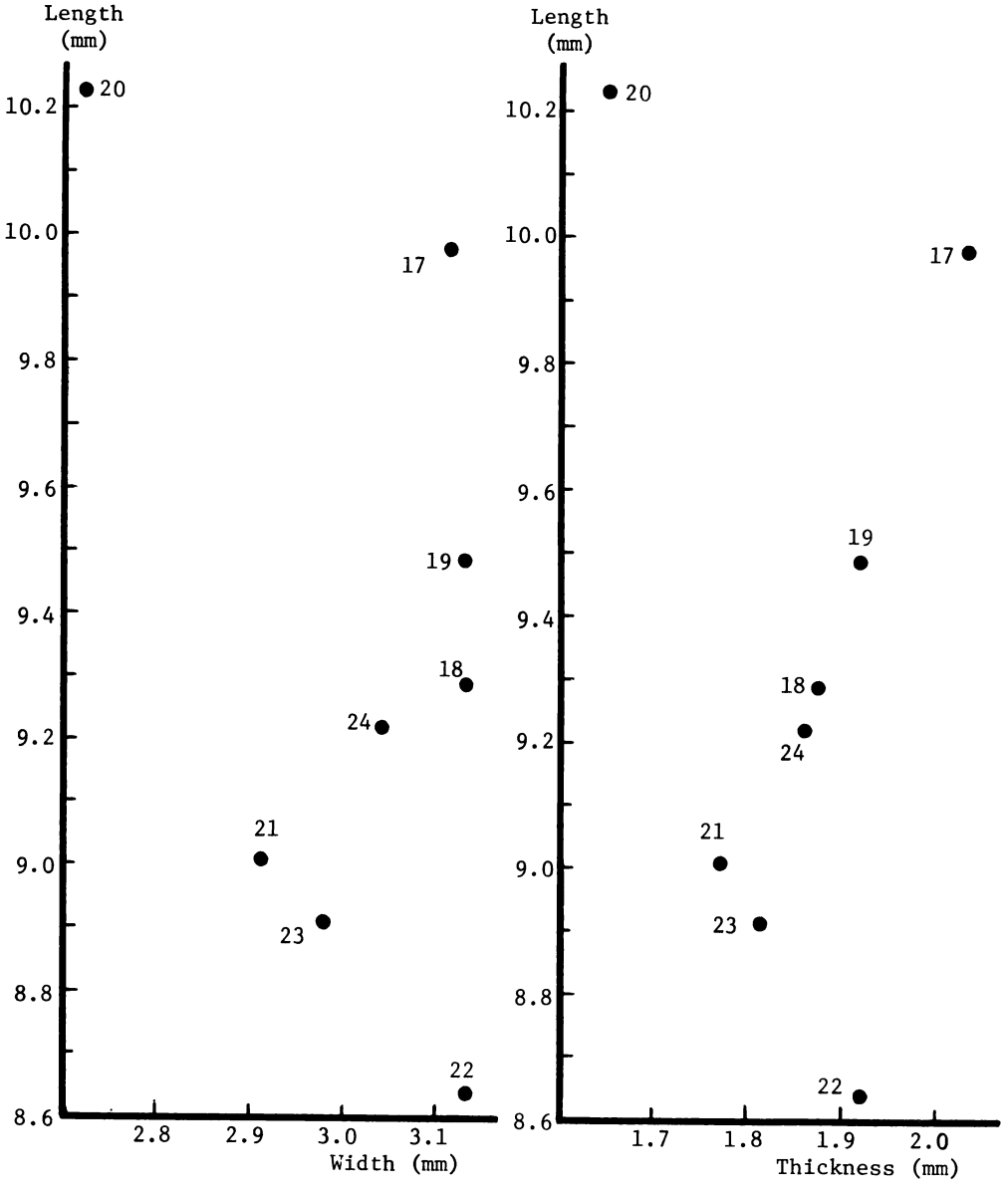

Fig. 4. Relations between length and width (left) and length and thickness (right) of unhusked grains in mm, *O. breviligulata*. Vertical axes; length, abscissa; width (left) and thickness (right). Code numbers used in the figure are corresponding to the group mark which was used in Table 10.

L/T and W/T (Fig. 5).

To obtain the locality specificity, the comparison was made with the representatives of Nigeria (group **19** in the table), Ivory Coast (group **20**) and Senegal (group **23**). From the data shown in data of Tables 10 and 11, Figs. 4 and 5, the following specificities were ascertained to some extent.

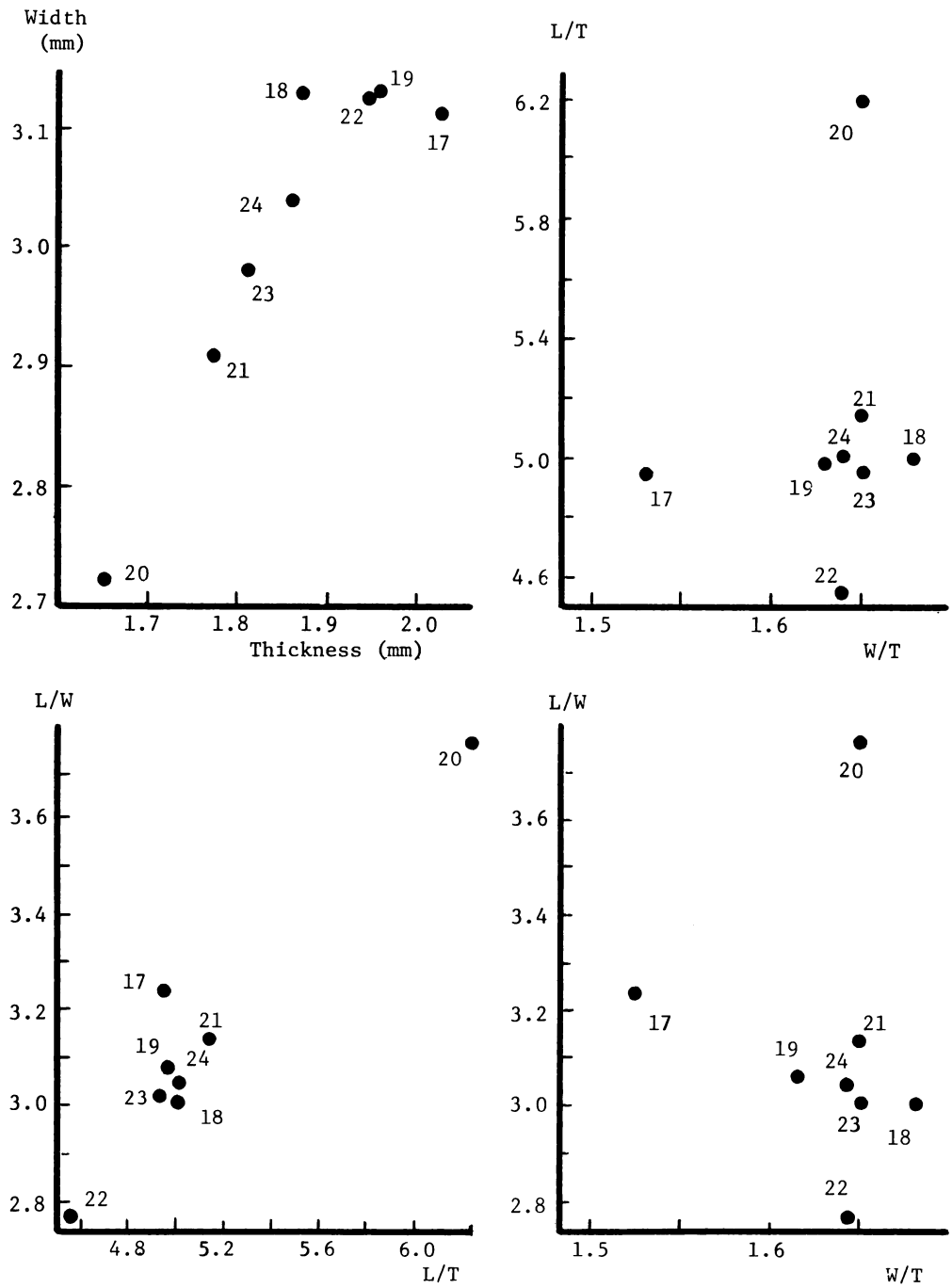

Fig. 5. Relations between the respective two characters of unhusked grains, *O. breviligulata*. Vertical axes; width (upper left), L/T (upper right) and L/W (lowers), abscissa; thickness (upper left), L/T (lower left) and W/T (rights). Code numbers used in the figure are corresponding to the group mark which was used in Table 10.

Grain type, in general, was said to be longer in Ivory Coast, wider and thicker in Nigeria. Ratios of length to width, of length to thickness and of width to thickness were found to be the largest in strains of Ivory Coast.

III. *O. punctata*

1. Length

Lengths for the individual grain level ranged from 7.90 mm (strain No.W157 in 1984 and Accession No.457, strain No.W163 in 1984 and Accession No.463, strain No.W174 in 1985 and Accession No.474) to 4.80 mm (Nos.2100 and 2106). In the strain level, the longest (7.31 mm) was obtained in No.473, followed by No.474 (7.15 mm) and No.463 (7.01 mm). The shortest (5.51 mm) was noted in Nos.468 and 2090, followed by No.2106 (5.52 mm).

In the group level (Table 10), the longest (6.40 mm) was obtained in the strains collected in Tanzania in 1984 (illustrated as mark **25** in Table 10), followed by group **28** [Kenya in 1984] (6.39 mm) and group **31** [summed-up of strains in 1984 and 1985 in Tanzania and Kenya] (6.30 mm). The shortest (5.96 mm) was noted in group **26** [Tanzania in 1988] , followed by group **27** [Tanzania in 1984 and 1988] (6.01 mm) and group **32** [summed-up of strains in 1984, 1985 and 1988 in Tanzania and Kenya] (6.10 mm). Average and its standard deviations through the whole strains belonging to the species (group **32** --- summed-up the groups **25, 26, 28** and **29**) were found to be 6.10 $\pm$0.42.

In the standard deviations of each strain, *i.e.*, those showing intra-population's variations, the largest (0.66) was obtained in No.474, followed by No.463 (0.60) and No.467 (0.57). The smallest (0.22) was noted in No.458, followed by Nos.461 and 469 (0.23). In the group level, the largest (0.63) was obtained in group **29,** followed by group **30** (0.57) and group **31** (0.53). The smallest (0.22) was noted in group **25**, followed by group **26** (0.25) and group **27** (0.28).

Standard deviations of unhusked grains illustrated by average values of the respective groups were shown in Table 11. The largest (0.44) was obtained in group **28**, followed by group **30** (0.43), and groups **29** and **31** (0.42). The smallest (0.37) was noted in group **25**, followed by group **27** (0.39) and group **26** (0.40). Average and its standard deviations in the whole strains belonging to the group **32** were found to be 0.40$\pm$0.10.

2. Width

Widths for the individual grain level ranged from 2.80 mm (Nos.459, 460, 462, 465, 470, 2085 and 2098) to 1.70 mm (No.2089). In the strain level, the widest (2.53 mm) was obtained in Nos.458, 464 and 470. The narrowest (2.04 mm) was noted in No.2089, followed by No.2090 (2.12 mm) and No.2105 (2.16 mm).

In the group level, the widest (2.50 mm) was obtained in group **25**, which was the same as in case of the length, followed by group **28** (2.46 mm) and group **31** (2.43 mm). These orders of groups (**25** > **28** > **31**) were found to be the same as in case of the length. The narrowest (2.29 mm) was noted in group **26**, which was also the same as in

case of the length, followed by group **27** (2.31 mm) and group **32** (2.35 mm). These orders of groups (**26** < **27** < **32**) were also found to be the same as in case of the length. Average and its standard deviations through the whole strains belonging to the group **32** were found to be 2.35±0.12.

In the standard deviations of each strain, the largest (0.21) was obtained in No.2108, followed by No.2088 (0.20), and Nos.2087, 2092, 2094, 2095 and 2099 (0.19). The smallest (0.07) was noted in Nos.467, 473 and 474. In the group level, the largest (0.12) was obtained in groups **27** and **32**, followed by group **26** (0.11). The smallest (0.02) was noted in group **25**, which was the same as in case of the length, followed by group **28** (0.06).

In the standard deviations of each group (Table 11), the largest (0.16) was obtained in groups **26** and **27**, followed by groups **28** and **32** (0.15). The smallest (0.11) was noted in group **29**, followed by groups **25, 30** and **31** (0.12). Average and its standard deviations in the whole strains belonging to the group **32** were found to be 0.15±0.04.

3. Thickness

Thicknesses for the individual grain level ranged from 1.85 mm (Nos.458, 462, 465 and 473, in which Nos.462 and 465 were the same as in case of the width) to 1.15 mm (Nos.461, 467, 468 and 469). In the strain level, the thickest (1.61 mm) was obtained in Nos.2085 and 2098, followed by No.2088 (1.60 mm). The thinnest (1.41 mm) was noted in No.469, followed by Nos.2090 and 2105 (1.43 mm).

In the group level, the thickest (1.56 mm) was obtained in group **25**, which was the same as in cases of the length and width, followed by groups **29, 30** and **31** (1.53 mm). The narrowest (1.51 mm) was noted in group **26**, which was also the same as in cases of the length and width, followed by groups **27, 28** and **32** (1.52 mm). Average and its standard deviations through the whole strains belonging to the group **32** were found to be 1.52 ± 0.05.

In the standard deviations of each strain, the largest (0.22) was obtained in No.461, followed by No.469 (0.18) and No.468 (0.17). The smallest (0.06) was noted in Nos.464, 2087, 2095, 2099 and 2104. In the group level, the largest (0.05) was obtained in groups **26, 27, 29** and **30**, in which group **27** and group **29** were the same as in cases of the width and length, respectively. The smallest (0.01) was noted in group **25**, which was the same as in cases of the length and width, followed by group **28** (0.03). These orders of groups (**25** < **28**) were found to be the same as in case of the width.

In the standard deviations of each group (Table 11), the largest (0.13) was obtained in groups **29, 30** and **31**. The smallest (0.08) was noted in group **26**, followed by group **27** (0.09) and group **32** (0.10). Average and its standard deviations in the whole strains belonging to the group **32** were found to be 0.10±0.04.

4. Ratio of length to width

Ratios of length to width (abbreviated as L/W) for the individual grain level ranged from 3.70 (No.2091) to 1.91 (No.2099). In the strain level, the largest (2.98) was obtained in No.473, which was the same as in case of the length, followed by No.474 (2.97),

which was also the same as in case of the length, and No.2091 (2.96). The smallest (2.20) was noted in No.470, followed by No.471 (2.32) and No.461 (2.34). It was noted that the value of No.470 was very small.

In the group level, the largest (2.62) was obtained in groups **26** and **27**, followed by group **32** (2.61). The smallest (2.57) was noted in group **25**. Average and its standard deviations through the whole strains belonging to the group **32** were found to be 2.61 ± 0.18.

In the standard deviations of each strain, the largest (0.41) was obtained in No.2108, which was the same as in case of the width, followed by Nos.2089 and 2095 (0.36), in which the latter was the same as in case of the width. The smallest (0.08) was noted in No.470, followed by Nos.458 and 473 (0.13). It was noticed that the value of No.470 was particularly small, which was the same as in case of the own practical value. In the group level, the largest (0.26) was obtained in group **29**, which was the same as in cases of the length and thickness, followed by group **30** (0.23) and group **31** (0.22). These orders of groups (**29** > **30** > **31**) were found to be the same as in case of the length. The smallest (0.11) was noted in group **25**, which was the same as in cases of the length, width and thickness, followed groups **26** and **27** (0.15). These combinations of groups (**25, 26** and **27**) were found to be the same as in case of the length.

In the standard deviations of each group (Table 11), the largest (0.26) was obtained in group **26**, which was the same as in case of the width followed by group **27** (0.25) and group **32** (0.24). These combinations of groups (**26, 27** and **32**) were found to be the same as in case of the width. The smallest (0.20) was noted in groups **25** and **29**, in which the former and the latter were the same as in cases of the length and width, respectively, followed by groups **30** and **31** (0.21). These combinations of groups (**25, 29, 30** and **31**) were found to be the same as in case of the width. Average and its standard deviations in the whole strains belonging to the group **32** were found to be 0.24 ± 0.08.

5. Ratio of length to thickness

Ratios of length to thickness (abbreviated as L/T) for the individual grain level ranged from 5.67 (No.473) to 2.97 (No.468), both of which were the same as in case of the thickness. In the strain level, the largest (4.67) was obtained in No.473, which was the same as in cases of the length and ratio of length to width (L/W), followed by No.474 (4.65) and No.463 (4.47). These orders of strains (473 > 474 > 463) were found to be the same as in case of the length. The smallest (3.58) was noted in No.470, followed by No.2106 (3.65) and No.471 (3.67), in which No.2106 was the same as in case of the length.

In the group level, the largest (4.23) was obtained in group **28**, followed by group **30** (4.15) and group **31** (4.14), in which the latter was the same as in cases of the length and width. The smallest (3.96) was noted in group **26**, which was the same as in cases of the length, width and thickness, followed by group **27** (3.98) and group **32** (4.04). These orders of groups (**26** < **27** < **32**) were found to be the same as in cases of the length and width. Average and its standard deviations through the whole strains belonging to

the group **32** were found to be 4.04±0.26.

In the standard deviations of each strain, the largest (0.67) was obtained in No.474, which was the same as in case of the length, followed by No.473 (0.59) and No.468 (0.57), in which the latter was the same as in case of the thickness. The smallest (0.10) was noted in No.470, which was the same as in case of the ratio of length to width (L/W), followed by No.2098 (0.25), and Nos.464 and 2096 (0.27). It was noticed that the value of No.470 was very small. In the group level, the largest (0.37) was obtained in group **29**, which was the same as in cases of the length, thickness and ratio of length to width (L/W), followed by group **30** (0.32) and group **31** (0.30). These orders of groups (**29** > **30** > **31**) were found to be the same as in cases of the length and ratio of length to width (L/W). The smallest (0.16) was noted in group **25**, which was the same as in cases of the length, width, thickness, and ratio of length to width (L/W), followed by group **28** (0.17), and groups **26** and **27** (0.20). These orders of groups (**25** < **28**) were found to be the same as in cases of the width and thickness.

In the standard deviations of each group (Table 11), the largest (0.47) was obtained in group **29**, followed group **30** (0.44) and group **31** (0.43). These combinations of groups (**29, 30** and **31**) were found to be the same as in case of the thickness. The smallest (0.33) was noted in group **26**, which was the same as in case of the thickness, followed by group **27** (0.34) and group **32** (0.37). These orders of groups (**26** < **27** < **32**) were found to be the same as in case of the thickness. Average and its standard deviations in the whole strains belonging to the group **32** were found to be 0.37±0.11.

6. Ratio of width to thickness

Ratios of width to thickness (abbreviated as W/T) for the individual grain level ranged from 2.25 (No.469) to 1.15 (Nos.2095 and 2100), in which No.2100 was the same as in case of the length. In the strain level, the largest (1.76) was obtained in No.2102, followed by No.469 (1.74) and No.461 (1.71). The smallest (1.39) was noted in No.2095, followed by No.2089 (1.41), and Nos.2091 and 2107 (1.46).

In the group level, the largest (1.63) was obtained in group **28**, which was the same as in case of the ratio of length to thickness (L/T), followed by group **25** (1.61), and groups **30** and **31** (1.60). These combinations of groups (**25, 28** and **31**) were found to be the same as in cases of the length and width. The smallest (1.52) was noted in group **26**, which was the same as in cases of the length, width, thickness and ratio of length to thickness (L/T), followed by group **27** (1.53) and group **32** (1.56). These orders of groups (**26** < **27** < **32**) were found to be the same as in cases of the length, width, and ratio of length to thickness (L/T). Average and its standard deviations through the whole strains belonging to the group **32** were found to be 1.56±0.08.

In the standard deviations of each strain, the largest (0.24) was obtained in No.461, which was the same as in case of the thickness, followed by No.469 (0.22) and No.467 (0.21). These orders of strains (461 < 469 < 467) were found to be the same as in case of the thickness. The smallest (0.06) was noted in No.463, followed by No.470 (0.07) and No.459 (0.08). In the group level, the largest (0.08) was obtained in group **32**. The

smallest (0.01) was noted in group **25**, which was the same as in cases of the whole of the former 5 characters, and was noted as very small value.

In the standard deviations of each group (Table 11), the largest (0.16) was obtained in group **29**, which was the same as in case of the ratio of length to thickness (L/T), followed by group **30** (0.15), and groups **31** and **32** (0.14). These orders of groups (**29** > **30** > **31**) were found to be the same as in case of the ratio of the length to thickness (L/T). Moreover, these combinations of groups (**29, 30** and **31**) were found to be the same as in case of the thickness. Average and its standard deviations in the whole strains belonging to the group **32** were found to be 0.14 ± 0.04.

7. Further group comparison

Six character-relations are shown in Figs. 6 and 7, *i.e.*, relations between length and width, length and thickness (Fig. 6), width and thickness, L/W and L/T, L/W and W/T, L/T and W/T (Fig. 7).

It was noticeable that the practical values of group **26** showed the smallest ones in 5 characters, except the ratio of length to width (L/W). Standard deviations of group **25** showed the smallest ones in the whole characters (= 6).

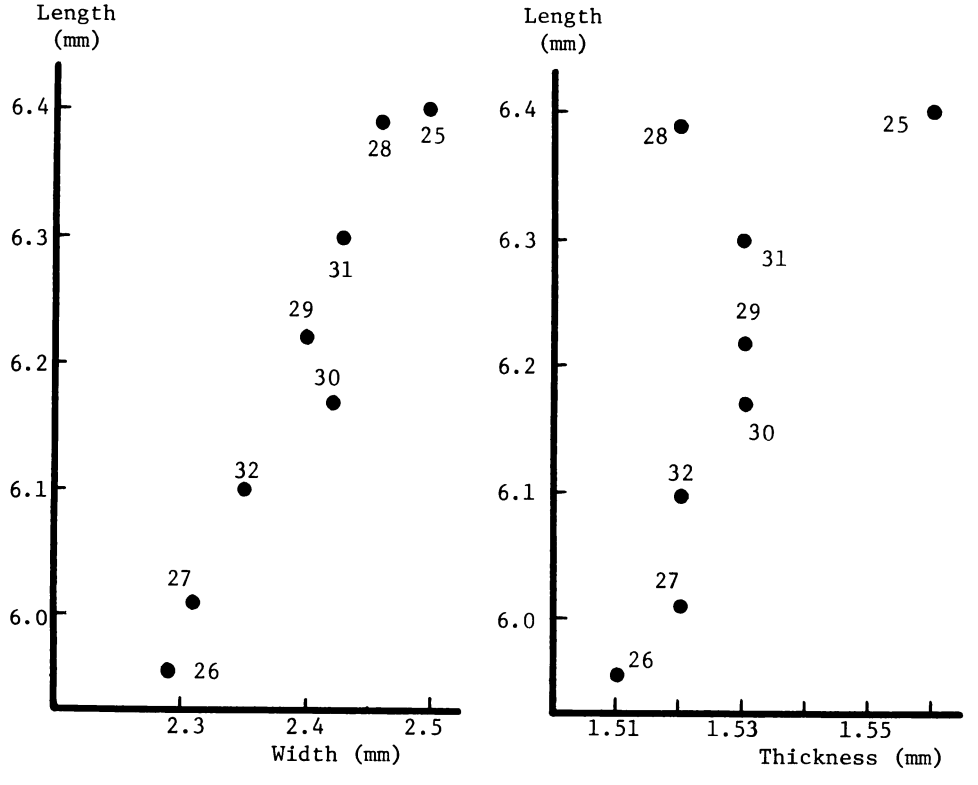

Fig. 6. Relations between length and width (left) and length and thickness (right) of unhusked grains in mm, *O. punctata*. Vertical axes; length, abscissa; width (left) and thickness (right). Code numbers used in the figure are corresponding to the group mark which was used in Table 10.

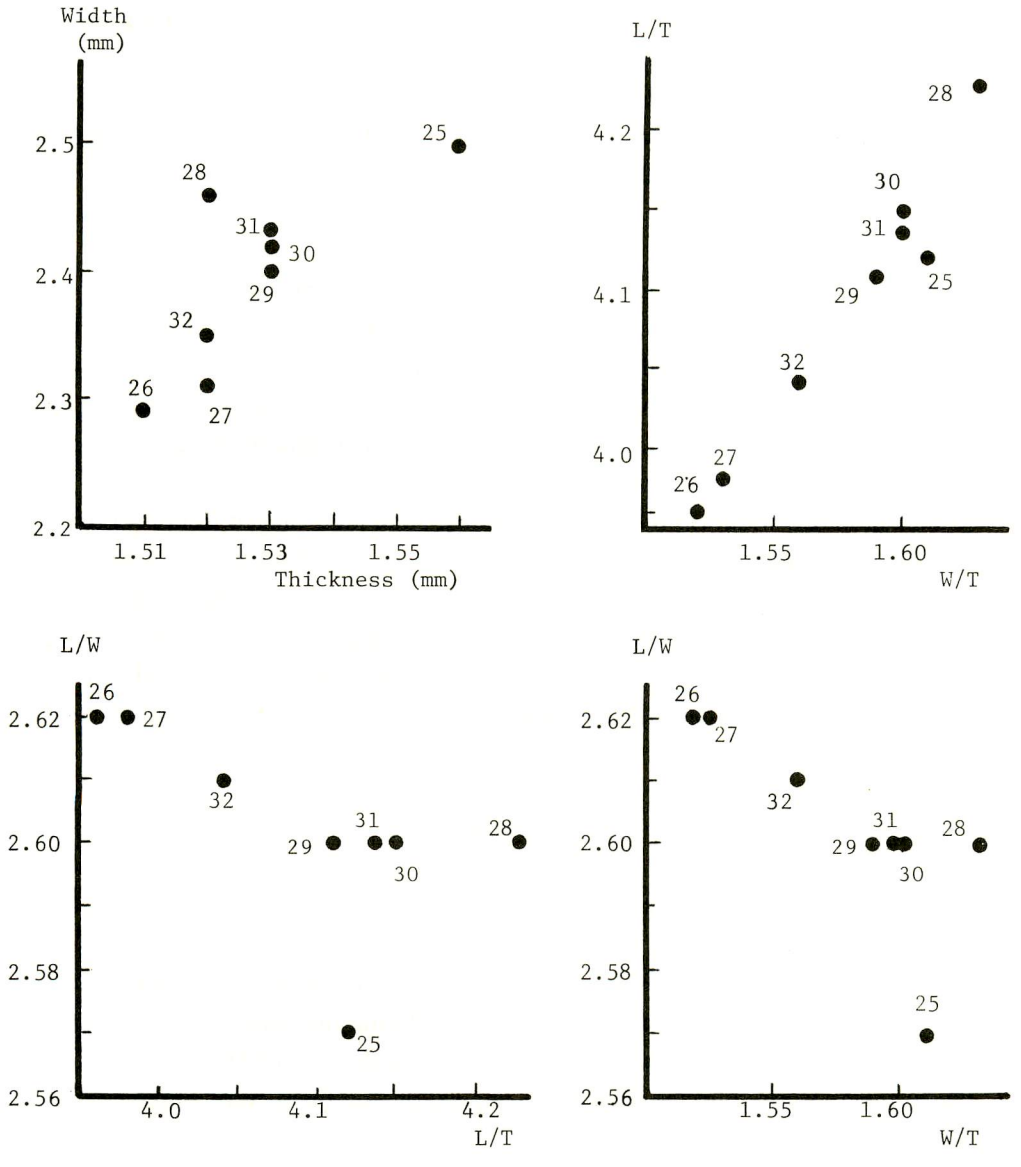

Fig. 7. Relations between the respective two characters of unhusked grains, *O. punctata*. Vertical axes; width (upper left), L/T (upper right) and L/W (lowers), abscissa; thickness (upper left), L/T (lower left) and W/T (rights). Code numbers used in the figure are corresponding to the group mark which was used in Table 10.

To obtained the locality specificity, the comparison was made with the representatives of Tanzania (group **27** in the table) and Kenya (group **30**). From the data shown in data of Tables 10 and 11, Figs. 6 and 7, the following specificities were ascertained to some extent.

Grain type, in general, was said to be longer, wider and thicker in Kenya. Ratios of length to thickness (L/T) and of width to thickness (W/T) were found to be larger in

Kenya. On the contrary, the ratio of length to width (L/W) was larger in Tanzania than those of Kenya.

In the standard deviations, length, thickness, ratios of length to thickness (L/T) and of width to thickness (W/T) showed larger values in Kenya. On the contrary, width and ratio of length to width (L/W) were found smaller in Kenya.

IV. *O. brachyantha*

Lengths for the individual grain level ranged from 9.60 mm to 8.60 mm. Average and its standard deviations in the whole grains were found to be 9.01±0.33. Widths for the individual grain level ranged from 1.95 mm to 1.60 mm. Average and its standard deviations in the whole grains were found to be 1.82 ± 0.08. Thicknesses for the individual grain level ranged from 1.55 mm to 1.20 mm. Average and its standard deviations in the whole grains were found to be 1.40±0.12.

Ratios of length width (L/W) for the individual grain level ranged from 5.49 to 4.46. Average and its standard deviations in the whole grains were found to be 4.96 ± 0.29. Ratios of length to thickness (L/T) for the individual grain level ranged from 8.00 to 5.50. Average and its standard deviations in the whole grains were found to be 6.50 ± 0.66. Ratios of width to thickness (W/T) for the individual grain level ranged from 1.58 to 1.13. Average and its standard deviations in the whole grains were found to be 1.31 ±0.13.

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 had been sent to 8 countries of Africa, *i.e.*, Madagascar, Tanzania, Kenya, Nigeria, Ivory Coast, Liberia, Senegal and Gambia, for collection of the wild and cultivated rices. During the trips, 284 strains of wild rice, *i.e.*, 190 of *Oryza longistaminata,* 49 of *O. breviligulata,* 44 of *O. punctata* and 1 of *O. brachyantha*, were collected and many populations of them were observed. Their localities and habitats were reported briefly.

From the analyses of grain characters of the unhusked grains, average values and the standard deviations in the whole strains were found to be 8.47 mm± 0.63. 2.36 mm ±0.20, 1.60 mm±0.11, 3.61±0.26, 5.31±0.33 and 1.48±0.09 in length, width, thickness, ratios of length to width, of length to thickness, and of width to thickness, respectively, in case of the *O. longistaminata.* In general, strains collected in Senegal, Nigeria and Madagascar were ascertained to be long, large and small types, respectively.

In case of the *O. breviligulata,* average values and the standard deviations in the whole strains were found to be 9.22 mm±0.80, 3.04 mm±0.25, 1.86 mm±0.16, 3.06 ± 0.41, 5.00±0.66 and 1.64±0.09, respectively, in the same order. The strains collected in Ivory Coast and Nigeria were ascertained to be long, wide and thick types, respectively. Ratios of length to width, of length to thickness and of width to thickness were found to

be the largest in the strains collected in Ivory Coast.

In case of the *O. punctata*, average values and the standard deviations in the whole strains were found to be 6.10 mm ± 0.42, 2.35 mm ± 0.12, 1.52 mm ± 0.05, 2.61 ± 0.18, 4.04 ± 0.26 and 1.56 ± 0.08, respectively, in the same order. The longer, the wider and the thicker characters were found in the strains collected in Kenya.

In case of the *O. brachyantha*, average values were found to be 9.01 mm, 1.82 mm, 1.40 mm, 4.96, 6.50 and 1.31, respectively, in the same order.

Several character-specificities in habitat, morphological points and connection with one another were found. Basing on the analyses of the data obtained in the field survey, however, morphological, genetical and ecological characters, geographical, ecotypic and varietal differentiations could be discussed and concluded in the future.

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