

Preliminary Consideration on Distribution and Some Morphological Characters of Wild Rice in African Countries

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Introduction

During the periods from October to November in 1984 and from August to November in 1985, the writer has been sent to 7 countries of Africa before and after studies in France, *i.e.*, Madagascar, Tanzania, Kenya, Nigeria, Ivory Coast, Liberia and Senegal, for collection of the wild and cultivated rices under the project, "Studies on the Distribution and Ecotypic Differentiation of Wild and Cultivated Rice Species in Africa", supported by a Grant from 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 reports have been already been published¹⁻¹³⁾. Though 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 aspect is far from being perfect. Taking these facts into account, the present study was made to accomplish the distribution and ecotypic differentiation of wild rice in Africa. In the present paper, the habitat and the record of the morphological characters of the unhusked grains of wild rice were described. Their plant and grain characters are now analysing at Kagoshima University and the respective countries. Then, after the further analyses of morphological, physiological, ecological and genetical studies in these series, the detailed and fundamental principles on the origin of cultivated rice and relationships between African and Asian wild rice species and strains might be ascertained in detail.

The author is most grateful to the Government Officials in REPOBLIKA DEMOKRATIKA MALAGASY, REPUBLIC OF KENYA, UNITED REPUBLIC OF TANZANIA, FEDERAL REPUBLIC OF NIGERIA, RÉPUBLIQUE DE CÔTE D'IVOIRE, RÉPUBLIC OF LIBERIA, RÉPUBLIQUE DE SENEGAL, RÉPUBLIQUE FRANCAISE. Thanks are 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 in detail. Geographical situation of wild rice found was briefly illustrated in Fig. 1. In this figure, countries concerned and strain numbers of the wild rice are given.

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

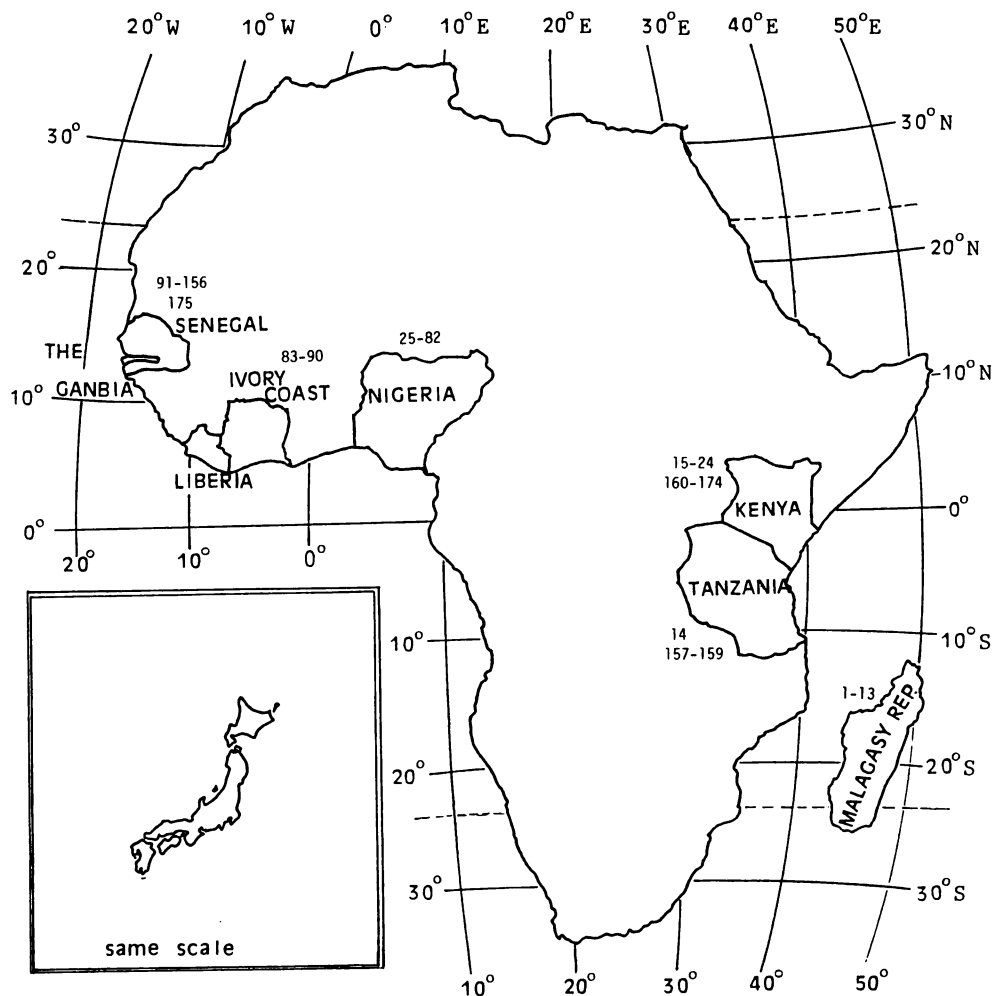


Fig. 1. Map showing countries collected and observed the wild rice in Africa. Code-numbers used in the figure are corresponding to the strain number which was used in the tables.

Number of strains collected was 175 in the total. They were constituted by 107 of *Oryza longistaminata*, 49 of *O. breviligulata*, 18 of *O. punctata* and 1 of *O. brachyantha*.

I. *Oryza longistaminata* CHEV. et ROEHR. (107 strains)

Populations of the species were found in abundant localities of 6 countries, *i.e.*, 13 strains in Madagascar, 1 strain in Tanzania, 10 strains in Kenya, 34 strains in Nigeria, 7 strains in Ivory Coast, 42 strains in Senegal, and many other populations were observed but not collected in these trips. They had a creeping growth in pond, swamp, irrigation canal, waste land. They were sometimes adjacent to a rice field separated by an embankment.

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.

III. *Oryza punctata* KOTSCHY (18 strains)

Populations of the species were found in several districts of 2 countries, *i.e.*, 3 strains in Tanzania and 15 strains in Kenya, and many other populations were observed but not collected in these trips. They were found in a road-side ditch, edge of swamp or pond, waste land, low bush.

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 area.

Distribution of wild rices collected were listed up in Table 1. Populations observed

Table 1. Distribution and habitat of wild rice collected in 7 countries of Africa; Madagascar in 1985, Tanzania in 1984, 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

Col- lected No.	Spe- cies	Date	Place	Locality, habitat and remarks
MADAGASCAR in 1985				
W1	L	Aug. 31	Marovoay	ca. 2 km south of trifurcated road, Antananarivo, Marovoay, Mahajanga. Swampy area near paddy field.
W2	L	Sep. 1	Marovoay	Ambodimadiro-Befanpisy Village. 6 km east from Marovoay and 500 m north from the Telephone Publik. Swampy area.
W3	L	Sep. 1	Marovoay	ca. 5 km north of a trifurcated road. Paddy field and waste land.
W4	L	Sep. 1	Mahajanga	ca. 7 km east from Airport of Mahajanga. Paddy field.

W5	L	Sep. 1	Mahajanga	Mangatsa Village. Pond, dia. 500 m.
W6	L	Sep. 2	Marovoay	Tananbon Village. Swampy area, dia. 500 m.
W7	L	Sep. 3	Antananarivo	Befotoana–Ampijoroa. Swamp, 100 m × 100 m and 100 m × 50 m.
W8	L	Sep. 5	Antsapanimahozo	100 m north from Antsapanimahozo. Along irrigation canal, 5 m width.
W9	L	Sep. 5	Antsapanimahozo	100 m north from Antsapanimahozo. Irrigation canal, 5 m width.
W10	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.
W11	L	Sep. 6	Ambatondrazaka	Experimental Field of CALA, FOFIFA, Complexe Agronomique du lac Alaotra. Irrigation canal and embankment.
W12	L	Sep. 6	Imerimandroso	Just south of Imerimandroso, north of Madiorano. Swamp, 100 m × 20 m.
W13	L	Sep. 6	Antanifutsy	Near Antanifutsy. Small river, jointed swamp, 100 m × 500 m.

TANZANIA in 1984

W157	P	Nov. 20	Dar es Salaam	Kimara Village. Large pond, 100 m × 200 m.
W14	L	Nov. 20	Kibara	Kibara Village. Half–dried up pond, 100 m × 200 m.
W158	P	Nov. 20	Chalinze	ca. 10 km east from Chalinze. Road–side pasture, slow down from the road.
W159	P	Nov. 23	Dakawa	In field of Dakawa Research Station. Swampy area, 5 m × 20 m.

KENYA in 1984

W160	P	Nov. 14	Mombasa	9 km south from Mombasa Ferry. Road–side swampy area, 50 m × 150 m.
W161	P	Nov. 14	Mombasa	2 km west from a joint to Kwale and Ukunda. Waste land, dia. 50 m. Small pool jointed.
W162	P	Nov. 16	Mariakani	5 km east from Mariakani. Near railway. Waste lands, 20 m × 200 m, 10 m × 50 m.
W163	P	Nov. 16	Mariakani	11 km west from Mariakani. Dried up waste lands, 10 m × 100 m, 3 m × 10 m.
W164	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

W15	L	Sep. 16	Bunyala	Bunyala Irrigation Schemes. Irrigation canal, 5 m width.
W165	P	Sep. 20	Samburi	Just west entrance 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.
W166	P	Sep. 20	Mariakani	11 km west from Mariakani. Dried up waste lands, 10 m × 100 m, 10 m × 10 m and 3 m × 10 m. Paddy field and pond, 50 m × 10 m.
W167	P	Sep. 20	Mariakani	5 km east from Mariakani. Near railway. Waste lands, 20 m × 200 m and dia. 5 m, 10 m × 50 m, having small stream.
W168	P	Sep. 20	Mombasa	9 km south from Mombasa Ferry. Road–side swampy area, 50 m × 150 m.
W169	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.
W16	L	Sep. 20	Mombasa	7 km west from a joint of Kwale and Ukunda. Paddy field.
W170	P	Sep. 20	Mombasa	7 km west from a joint of Kwale and Ukunda. Paddy field, small stream. Allopatrically with W16, <i>O. longistaminata</i> .

W171	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.
W17	L	Sep. 22	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.
W18	L	Sep. 22	Ngao	In Ngao Village. Embankment of paddy field and <i>Poa</i> growing area.
W19	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.
W20	L	Sep. 23	Saironi	In Saironi Village. Road-side ditch, temporary irrigation canal, 3 m × 20 m.
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W21	L	Sep. 23	Ngao	Just south side of Golbanti. Post harvested paddy field.
W22	L	Sep. 23	Ngao	Just south side of Golbanti. Post harvested paddy field.
				Further west side of W21 .
W23	L	Sep. 23	Ngao	ca. 2 km south of Golbanti. Waste land, relatively lower region, adjacent to paddy field.
W24	L	Sep. 23	Ngao	ca. 4 km south of Golbanti. Gradual slopping upland field. Adjacent paddy field.
W172	P	Sep. 25	Mariakani	2 km north of Mbongo. Waste land, Adjacent seasonal river, connected with W173 by bridge.
W173	P	Sep. 25	Mariakani	2 km north of Mbongo. Waste land. Adjacent seasonal river, connected with W172 by bridge.
W174	P	Sep. 25	Mariakani	2 km north of Mbongo. Waste land. Adjacent seasonal river, connected with W172 by bridge, and separated from W173 by tall trees.
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NIGERIA in 1984				
W25	L	Nov. 7	Zaria	7 km south from Zaria. Road cross small river, 5 m width. <i>Leersia</i> sp. growing together.
W26	L	Nov. 7	Zaria	1 km south from Zaria. Pond, 50 m × 150 m.
W27	L	Nov. 7	Zaria	10 km north from Zaria. Pond, 20 m × 200 m. Together with a few plants of <i>O. glaberrima</i> .
W28	B	Nov. 7	Zaria	63 km northeast from Zaria. Together with <i>O. glaberrima</i> .
W29	B	Nov. 7	Zaria	63 km northeast from Zaria. Together with <i>O. glaberrima</i> .
W30	B	Nov. 7	Zaria	72 km northeast from Zaria. Paddy field of <i>O. glaberrima</i> .
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W31	B	Nov. 7	Zaria	72 km northeast from Zaria. Paddy field of <i>O. sativa</i> .
W32	B	Nov. 7	Chiramawa	4 km northeast from Chiramawa. Small pond, 2 m × 5 m, 5 m × 10 m, surrounded by waste lands.
W33	B	Nov. 8	Maiduguri	27 km northeast from Maiduguri. Paddy field of <i>O. glaberrima</i> .
W34	B	Nov. 8	Maiduguri	49 km northeast from Maiduguri. Pond, 100 m × 200 m.
W35	L	Nov. 8	Dikwa	7 km northeast from Dikwa. Pond, 100 m × 200 m, neighbouring upland rice field of <i>O. sativa</i> .
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W36	L	Nov. 9	Dikwa	4 km north from Dikwa. Pond, connected two parts, 100 m × 200 m and 50 m × 100 m.
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NIGERIA in 1985				
W37	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.
W38	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.
W39	L	Oct. 1	Bida	15 km east from crossroad of Bida. Large pond, 100 m × 500 m. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , Foundation Seed Multiplication,

FARO. Irrigation canal.

- W40** 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.
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- W41** 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.
- W42** L Oct. 1 Wushishi 31 km north from Wushishi. Swamp, 200 m × 300 m.
- W43** L Oct. 2 Bin Yauri 12 km north from Bin Yauri. Paddy field, *O. glaberrima*. Allopatrically with **W44**, *O. breviligulata*.
- W44** B Oct. 2 Bin Yauri 12 km north from Bin Yauri. Paddy field, *O. glaberrima*. Allopatrically with **W43**, *O. longistaminata*.
- W45** 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*.
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- W46** L Oct. 2 Koko 29 km north from Koko. Small pool, dia. 20 m. Swampy area, dia. 200 m. Both areas located 2 m lower from the main road.
- W47** B Oct. 2 Koko 29 km north from Koko. Swampy area, dia. 200 m. Allopatrically with **W46**, *O. longistaminata*.
- W48** L Oct. 3 Bunza 5 km northeast of Bunza. Swamp, very large. Along the river, sailing boat of pearl millet.
- W49** L Oct. 3 Yarma 13 km south from Yarma. Pond, 100 m × 100 m, neighbouring sorghum field, and **W50**, *O. breviligulata*.
- W50** B Oct. 3 Yarma 13 km south from Yarma. Pond, 100 m × 100 m, neighbouring **W49**, *O. longistaminata*.
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- W51** B Oct. 3 Zaga 2 km northwest from Zaga. Paddy field, 100 m × 200 m, *O. sativa* and *O. glaberrima*.
- W52** L Oct. 3 Kende In Kende Town. Very large swamp, and along the river.
- W53** B Oct. 3 Kende In Kende Town. Very large swamp. Same habitat of **W52**, *O. longistaminata*, but only along the river.
- W54** L Oct. 4 Birnin Kebbi 30 km northeast Birnin Kebbi. L-shaped swamp, 1.5 km × 400 m, surrounded by upland field.
- W55** L Oct. 4 Argungu 40 km northeast from Argungu, and 1 km southwest from Sainyiana. Pond, 100 m × 300 m, growing lotus in the central region. Paddy field of *O. sativa*. Pond, 100 m × 500 m, having small island in the central region, cultivating *O. sativa* and pearl millet.
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- W56** 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, cultivating *O. sativa* and pearl millet.
- W57** 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.
- W58** L Oct. 4 Sokoto 24 km north from Sokoto. Swampy area and small pool, and swampy area surrounded by sorghum field. Paddy field of *O. sativa* and *O. glaberrima*, and swamp, 1 km × 200 m.
- W59** B Oct. 4 Sokoto 24 km north from Sokoto. Swampy area, 10 m × 50 m, and swampy area surrounded by sorghum field and paddy field of *O. sativa* and *O. glaberrima*. Allopatrically with **W58**, *O. longistaminata*.
- W60** L Oct. 5 Rabah 8 km northwest from Rabah. Upland field of *O. sativa* and *O. glaberrima*, 20 m × 30 m, and 20 m × 50 m, surrounded by sorghum field.
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- W61** 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 **W60**, *O. longistaminata*.
- W62** L Oct. 5 Rabah Just west of Rabah. Joint of old and new roads. Swampy area, 500 m × 2 km, constituted by pond, paddy field of *O. sativa* and *O. glaberrima* and waste land. Pond, 200 m × 500 m, growing lotus, paddy field of *O. sativa* and *O. glaberrima*, neighbouring sorghum and beans fields and deep swamp.

W63	B	Oct. 5	Rabah	Just west of Rabah. Pond, 200 m × 500 m, growing lotus, paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , neighbouring sorghum and beans fields, deep swamp.
W64	L	Oct. 5	Wurno	100 m west from Wurno Port of the basin. Just facing road of the basin. Waste land, 100 m × 1 km, neighbouring sorghum field.
W65	L	Oct. 5	Wurno	6 km north from Wurno Town. Paddy fields, <i>O. glaberrima</i> and <i>O. sativa</i> , and irrigation canal.
W66	B	Oct. 5	Wurno	6 km north from Wurno Town. Paddy fields of <i>O. glaberrima</i> and <i>O. sativa</i> .
W67	B	Oct. 5	Goronyo	16 km southwest from Goronyo. Dried up waste land, 100 m × 20 m.
W68	B	Oct. 5	Goronyo	16 km southwest from Goronyo. Dried up waste land, 10 m × 30 m.
W69	L	Oct. 5	Goronyo	8 km southwest from Goronyo. Pond, 10 m × 50 m, 1 m × 2 m.
W70	B	Oct. 5	Goronyo	8 km southwest from Goronyo. Paddy field of <i>O. glaberrima</i> . Neighbouring small pool of W69 , <i>O. longistaminata</i> .
W71	L	Oct. 6	Tureta	23 km northwest from a joint of Tureta. Large pond, 100 m × 300 m. Damaged by fungi severely.
W72	B	Oct. 6	Tureta	23 km northwest from a joint of Tureta. Large pond, 100 m × 200 m, 100 m × 300 m.
W73	L	Oct. 6	Talata Mafara	8 km northwest from Talata Mafara. Pond, 200 m × 500 m, cultivating <i>O. glaberrima</i> in edge. Surrounded by sorghum and beans field, shallow water type of <i>O. sativa</i> .
W74	B	Oct. 6	Talata Mafara	8 km northwest from Talata Mafara. Pond, 200 m × 500 m, cultivating <i>O. glaberrima</i> in edge.
W75	L	Oct. 6	Talata Mafara	4 km southeast from Talata Mafara. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , 100 m × 200 m, surrounded by sorghum and beans fields. Partially sympatrically with W76 , <i>O. breviligulata</i> .
W76	B	Oct. 6	Talata Mafara	4 km southeast from Talata Mafara. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , 100 m × 200 m, surrounded by sorghum and beans fields. Partially sympatrically with W75 , <i>O. longistaminata</i> .
W77	L	Oct. 6	Funtua	72 km southeast from Funtua. Lotus pond, 30 m × 100 m, gourd-shaped. Surrounded by roads, sorghum fields.
W78	L	Oct. 7	Zaria	5 km southeast from Zaria. Road-side ditches, 10 m × 100 m. Neighbouring sorghum fields.
W79	L	Oct. 7	Pambeguwa	17 km northwest from a joint of Pambeguwa. Grass land near stream, connecting swamps. Swamp, irregular shaped, 400 m × 300 m, having lotus pond in central region.
W80	B	Oct. 7	Jengle	1 km southeast from Jengle. Swamp, 100 m × 200 m, cultivating <i>O. glaberrima</i> in edge.
W81	L	Oct. 8	Makurdi	1 km east from entrance of Makurdi. Swamp, 50 m × 100 m, neighbouring paddy field of <i>O. sativa</i> and grass land.
W82	L	Oct. 8	Makurdi	22 km east from entrance of Makurdi. Paddy fields of <i>O. sativa</i> , inserted by stream between them. Near Benue River.
IVORY COAST in 1984				
W83	B	Oct. 31	Sobara	2 km northwest from Sobara. Pond, dia. 100 m. Grass land in other side of road.
W84	L	Nov. 1	Lokpoho	3.2 km west from Lokpoho. Large ponds, 50 m × 100 m each. Together with <i>Leersia</i> sp.
W85	L	Nov. 1	Bandama	2 km west from Bandama. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> .
W86	L	Nov. 1	Bandama	2 km west from Bandama. Paddy field of <i>O. glaberrima</i> . No plant in good managed paddy field.

W87	L	Nov. 1	Korhogo	Near Korhogo Town. Paddy field of <i>O. glaberrima</i> , and near irrigation canal.
W88	L	Nov. 1	Korhogo	3 km east of Korhogo. Paddy field of <i>O. sativa</i> . Surrounded by waste land, road, embankment, irrigation canal and other paddy field.
W89	L	Nov. 1	Korhogo	3 km east of Korhogo. Semi-dried up paddy field of <i>O. sativa</i> . Surrounded by waste land, road, irrigation canal and other paddy field.
W90	L	Nov. 1	Korhogo	3 km east of Korhogo. Paddy field of <i>O. glaberrima</i> , separated by waste land, 10 m width, road, semi-dried up rice field.

SENEGAL in 1985

W91	L	Oct. 30	Ziguinchor	2 km east from Ziguinchor. Paddy field of <i>O. sativa</i> , neighbouring building. Road-side ditch.
W92	L	Oct. 30	Ziguinchor	11 km east from Ziguinchor. Paddy field, half-damaged by salt.
W93	L	Oct. 30	Ziguinchor	18 km east from Ziguinchor. Guidel Village. Grass land, inside of the road, neighbouring palm yard.
W94	L	Oct. 30	Ziguinchor	24 km east from Ziguinchor. Rainfed paddy field of <i>O. sativa</i> , inside of the road, neighbouring <i>O. glaberrima</i> cultivation.
W95	L	Oct. 30	Ziguinchor	29 km east from Ziguinchor. Boutaupa Village. Paddy field.

W96	L	Oct. 30	Ziguinchor	37 km east from Ziguinchor. Swampy area, inside of road.
W97	L	Oct. 30	Ziguinchor	33 km east from Ziguinchor. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , separated by grass land from road. Near <i>O. glaberrima</i> field. Allopatrically with W98.
W98	B	Oct. 30	Ziguinchor	33 km east from Ziguinchor. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , separated by grass land from road. Allopatrically with W97, <i>O. longistaminata</i> .
W99	L	Oct. 31	Ziguinchor	12 km east from Ziguinchor. Small pool, 1 m × 10 m, inside of road about 200 m. Near mangrove trees.
W100	L	Oct. 31	Ziguinchor	16 km east from Ziguinchor. Large swamp, 200 m × 500 m, groud-shaped. Cultivating <i>O. sativa</i> in edge.

W101	L	Oct. 31	Ziguinchor	31 km east from Ziguinchor. Grass land, neighbouring paddy field and clear pond. Grass land, embankment of paddy field of <i>O. sativa</i> and baobab tree's land.
W102	L	Oct. 31	Ziguinchor	41 km east from Ziguinchor. Paddy field of <i>O. sativa</i> , and grass land.
W103	B	Oct. 31	Ziguinchor	41 km east from Ziguinchor. Paddy field of <i>O. sativa</i> .
W104	B	Oct. 31	Ziguinchor	54 km east from Ziguinchor. Swamp, having pond in central region. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> in around.
W105	B	Nov. 1	Goudomp	6 km east from Goudomp. Paddy field, partially maturing, after harvested. Separated by grass land from road about 200 m.

W106	L	Nov. 1	Simbandi	1 km west from Simbandi. Paddy field of <i>O. sativa</i> and <i>O. glaberrima</i> , 20 cm water depth. Neighbouring palm yard and waste land owing to salt damage.
W107	L	Nov. 1	Simbandi	19 km east from Simbandi. Paddy field and joint of old and new roads.
W108	L	Nov. 1	Tanaff	29 km west from Tanaff. Paddy field of <i>O. sativa</i> . Neighbouring forest and nursery bed of rice.
W109	L	Nov. 1	Tanaff	17 km west from Tanaff. Paddy field of <i>O. sativa</i> . Surrounded by paddy field and pond. Allopatrically with <i>O. breviligulata</i> .
W110	B	Nov. 1	Tanaff	3 km west from Tanaff. Swamp, space between palm fields. Allopatrically with <i>O. longistaminata</i> .

W111	L	Nov. 1	Tanaff	4 km east from Tanaff. Pond, dia. 100 m, touched by an arch bridge in north side.
W112	L	Nov. 1	Tanaff	7 km east from Tanaff. Paddy field of <i>O. sativa</i> and <i>O.</i>

- glaberrima*. Allopatrically with *O. breviligulata*, **W113**.
- W113** B Nov. 1 Tanaff 7 km east from Tanaff. Paddy field of *O. sativa* and *O. glaberrima*. Allopatrically with *O. longistaminata*, **W112**.
- W114** L Nov. 1 Kolda 8 km west from Kolda. Paddy field of *O. sativa* and *O. glaberrima*. Allopatrically with *O. breviligulata*, **W115**.
- W115** B Nov. 1 Kolda 8 km west from Kolda. Paddy field of *O. sativa* and *O. glaberrima*. Allopatrically with *O. longistaminata*, **W114**. Pond, 100 m × 200 m, neighbouring paddy field and upland field.
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- W116** 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*.
- W117** 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.
- W118** B Nov. 2 Tiapa 28 km east from Tiapa. Swamp, dia. 200 m.
- W119** L Nov. 2 Tiapa 54 km east from Tiapa. Forest, under shade. *Hygroryza* sp. growing. Neighbouring large pond.
- W120** L Nov. 3 Bassè, GAMBIA In Bassè Town. Pond, dia. 50 m, adjacent to Gambia River with 100 m width road.
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- W121** B Nov. 3 Biaobe 4 km north from crossroad to Anambe; 41 km south-west from Velingara. Paddy field of *O. sativa*, surrounded by palm field and grass land.
- W122** B Nov. 3 Biaobe 3 km northwest from the locality of **W121**. Paddy field, neighbouring road, irrigation canal, developed by the government.
- W123** L Nov. 3 Dabo 1 km north from Dabo. Stream, half-dried up, 3 m width.
- W175** R Nov. 3 Anambe 2 km south from Anambe. Shallow pond, dia. 50 m, surrounded by grass land, maybe seasonal pond in sometimes, heavy forest, bush road. *O. breviligulata* growing in opposite side.
- W124** L Nov. 3 Anambe 20 km north from Anambe. Paddy field of *O. sativa* and *O. glaberrima*, surrounded by upland fields.
- W125** B Nov. 3 Anambe 20 km north from Anambe. Paddy field of *O. sativa* and *O. glaberrima*, surrounded by upland field. Neighbouring *O. longistaminata*, **W124**.
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- W126** L Nov. 4 Kolda 29 km west from Kolda. Rainfed paddy field, separated by irrigated paddy field, 100 m width, from road. Surrounded by another rainfed paddy field, waste land and forest.
- W127** 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, space between road and bridge.
- W128** 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*, **W127**.
- W129** L Nov. 4 Kolda 50 km west from Kolda. Paddy field of *O. sativa*, having dried-up pond. Sympatrically with *O. breviligulata*, **W130**.
- W130** B Nov. 4 Kolda 50 km west from Kolda. Paddy field of *O. sativa*, having dried-up pond. Sympatrically with *O. longistaminata*, **W129**.
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- W131** L Nov. 4 Sefa 11 km east from Sefa. Paddy field of *O. sativa*, connected with waste land.
- W132** B Nov. 4 Sefa 11 km east from Sefa. Boundary paddy field, growing *O. longistaminata*, **W131**, and waste land. Connected with pond and salt damaged waste land.
- W133** L Nov. 4 Bounkiling 24 km west from Bounkiling. Paddy field of *O. sativa*, 10 cm water depth.
- W134** L Nov. 4 Tangouri 20 km east from Tangouri. Paddy field of *O. sativa*.
- W135** L Nov. 5 Bignona 22 km northwest from Bignona. Paddy field of *O. sativa*. Conspicuous high ridge cultivation owing to salt damage.
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- W136** L Nov. 6 Faraba Banta, GAMBIA 1 km north from Faraba Banta. Paddy field of *O. sativa*.
- W137** L Nov. 6 Kafuta, GAMBIA 2 km north from Kafuta. Near Gambia River in

			north side. Paddy field of <i>O. sativa</i> .
W138	B	Nov. 6	Kafuta, GAMBIA 2 km north from Kafuta. Near Gambia River in north side. Paddy field of <i>O. sativa</i> . Allopatrically with <i>O. longistaminata</i> , W137 .
W139	L	Nov. 6	Brikama, GAMBIA 17 km north from Brikama. Swamp, space between new and old roads, just south of office of conservation of nature.
W140	L	Nov. 7	Kafoutine Near Kafoutine Village. Paddy field, having pond, lotus swamp, work room. Swamp, 10 m × 5 m. Waste land and small road.
W141	L	Nov. 7	Diouloulou 9 km east from Diouloulou. Paddy field of <i>O. sativa</i> . Waste land and road-side ditch.
W142	B	Nov. 7	Diouloulou 9 km east from Diouloulou. Pond, 30 m × 40 m, separated about 50 m from road by waste land, growing <i>O. longistaminata</i> , a part of W141 .
W143	B	Nov. 8	St. Louis 21 km northeast from St. Louis. Paddy field, established 10 years ago. Road-side pool.
W144	L	Nov. 10	Richard Toll 22 km south of ISRA office in Richard Toll. Colonat Village, 300 m inside from main irrigation canal. Paddy fields, sub-irrigation canal, waste land.
W145	B	Nov. 10	Richard Toll 22 km south of ISRA office in Richard Toll. Colonat Village and suburbs. Paddy fields. Along the road.
W146	B	Nov. 10	Richard Toll 19 km south of ISRA office in Richard Toll. Paddy field and swamp. Along irrigation canal.
W147	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, embankment of upland fields.
W148	B	Nov. 11	Matam 3 km southeast from Matam. Over a branch of Senegal River. MAURITANIA on the other side of the river. Dried-up upland fields, after harvested of sorghum.
W149	L	Nov. 11	Matam 19 km southeast from crossroad of Ourosogui. Inside of Juc Village. Upland rice field. Sympatrically with <i>O. breviligulata</i> , W150 .
W150	B	Nov. 11	Matam 19 km southeast from crossroad of Ourosogui. Inside of Juc Village. Upland rice field. Partially sympatrically with <i>O. longistaminata</i> , W149 .
W151	L	Nov. 11	N'Dioum 2 km inside of main road, 12 km west from N'Dioum. Irrigation canal between paddy field of <i>O. sativa</i> and road.
W152	L	Nov. 12	Nianga In Project Field of Nianga. Paddy fields of <i>O. sativa</i> and <i>O. glaberrima</i> , irrigation canal.
W153	B	Nov. 12	Nianga In Project Field of Nianga. Paddy fields of <i>O. sativa</i> , and <i>O. glaberrima</i> and secondary irrigation canal.
W154	L	Nov. 12	Nianga In Project Field of Nianga. Lotus pond, waste land, dike and third irrigation canal.
W155	L	Nov. 12	Nianga In Project Field of Nianga. Lotus pond, paddy field.
W156	B	Nov. 12	Nianga In Project Field of Nianga. Paddy field. Inside of site of <i>O. longistaminata</i> , W155 .

but not collected were omitted in the table, which were ascertained in the respective papers. In this table, collection number, species name, year and date of collection, abstract of locality and brief information of habitat were described. These detailed data are also found in the respective papers.

Some morphological characters of the unhusked grains

107 strains of *Oryza longistaminata*, 49 strains of *Oryza breviligulata*, 18 strains of

Oryza punctata and 1 strain of *Oryza brachyantha* were collected on these trips, and they were used for morphological investigation of the unhusked grains. However, grains of 10 strains were wholly immature and inadequate to be used for measurements, *i.e.*, 7 of *O. longistaminata* (2 strains in Madagascar, strain Nos.2 and 12; 3 strains in Kenya, Nos.15, 16 and 17; 1 strain in Nigeria, No.25; 1 strain in Senegal, No. 101) and 3 of *O. breviligulata* in Nigeria, strain Nos.32, 33 and 34. Moreover, 8 strains (7 strains of *O. longistaminata* and 1 of *O. breviligulata*) collected in Ivory Coast were counted only a few seeds and also put out in this report, and will be informed in the near future.

Ten to 30 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 the ratios of length to width, 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 are given in Table 2. In this table, 6 morphological characters of the un-

Table 2. Six morphological characters of unhusked grains illustrated by average values of the respective groups; *O. longistaminata* ... A: Madagascar (MD) (11 strains); B: Tanzania (TA) (1 strain); C: Kenya (KE) (7 strains); D: Nigeria (NI) collected in 1984 (4 strains) ; E: the same collected in 1985 (29 strains); F: the same collected in both years (33 strains); G: Senegal (SE) collected in Casamance region (34 strains); H: the same in northern (7 strains); I: the same of both regions (41 strains); *O. breviligulata* ... J: Nigeria collected in 1984 (4 strains); K: the same in 1985 (17 strains); L: the same of both years (21 strains) ; M: Senegal collected in Casamance region (17 strains); N: the same in northern region (7 strains); O: the same of both regions (24 strains); *O. punctata* ... P: Tanzania (3 strains); Q: Kenya collected in 1984 (5 strains); R: the same in 1985 (10 strains); S: the same of both years (15 strains); *O. brachyantha* ... T: Senegal (1 strain)

Country	Group mark	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
MD	A	8.80±0.39	2.42±0.12	1.61±0.05	3.65±0.20	5.46±0.24	1.50±0.06
TA	B	9.05±0.46	2.58±0.07	1.79±0.09	3.50±0.14	5.07±0.32	1.45±0.07
KE	C	8.59±0.17	2.63±0.09	1.65±0.10	3.27±0.11	5.23±0.34	1.61±0.12
NI	D	9.30±0.81	2.81±0.27	1.82±0.09	3.33±0.08	5.12±0.23	1.54±0.08
	E	8.69±0.58	2.45±0.14	1.67±0.08	3.57±0.31	5.22±0.46	1.47±0.11
	F	8.77±0.64	2.49±0.20	1.69±0.10	3.54±0.30	5.21±0.44	1.48±0.11
SE	G	8.68±0.34	2.40±0.15	1.60±0.10	3.64±0.28	5.45±0.35	1.51±0.12
	H	9.16±0.61	2.57±0.18	1.69±0.11	3.58±0.16	5.42±0.29	1.52±0.04
	I	8.76±0.44	2.43±0.17	1.62±0.11	3.63±0.26	5.44±0.34	1.51±0.11
NI	J	9.25±0.23	3.14±0.10	2.12±0.09	2.96±0.14	4.38±0.22	1.48±0.02
	K	9.44±0.57	3.14±0.32	1.92±0.15	3.05±0.42	4.95±0.50	1.62±0.13
	L	9.40±0.53	3.14±0.29	1.96±0.16	3.03±0.39	4.84±0.51	1.59±0.13
SE	M	8.99±0.58	2.91±0.25	1.78±0.16	3.12±0.38	5.12±0.67	1.65±0.15
	N	8.87±0.69	3.16±0.12	1.95±0.05	2.82±0.27	4.57±0.44	1.58±0.09
	O	8.96±0.61	2.98±0.25	1.83±0.16	3.04±0.38	4.96±0.66	1.64±0.13
TA	P	6.40±0.22	2.50±0.03	1.56±0.01	2.57±0.11	4.12±0.16	1.61±0.01
KE	Q	6.38±0.40	2.46±0.06	1.52±0.03	2.60±0.16	4.23±0.17	1.63±0.07
	R	6.21±0.61	2.40±0.08	1.53±0.05	2.60±0.26	4.11±0.37	1.59±0.06
	S	6.27±0.57	2.42±0.08	1.53±0.05	2.60±0.23	4.15±0.32	1.60±0.07
SE	T	9.01±0.33	1.82±0.08	1.40±0.12	4.96±0.29	6.50±0.66	1.31±0.13

husked grains were illustrated by average values of the respective 20 groups; *i.e.*, *O. longistaminata* ... the first column of Table 2, **A**: Madagascar (13 strains were collected and 11 strains were measured), **B**: Tanzania (1 and 1 in the same order), **C**: Kenya (10 and 7), **D**: Nigeria collected in 1984 (5 and 4), **E**: Nigeria collected in 1985 (29 and 29), **F**: Nigeria collected in both years (**D** and **E**, 34 and 33), **G**: Senegal collected in Casamance region (35 and 34), **H**: Senegal collected in northern region (7 and 7), **I**: Senegal collected in both regions (**G** and **H**, 42 and 41); *O. breviligulata* ... the second column of Table 2, **J**: Nigeria collected in 1984 (7 and 4), **K**: Nigeria collected in 1985 (17 and 17), **L**: Nigeria collected in both years (**J** and **K**, 24 and 21), **M**: Senegal collected in Casamance region (17 and 17), **N**: Senegal collected in northern region (7 and 7), **O**: Senegal collected in both regions (**M** and **N**, 24 and 24); *O. punctata* ... the third column of Table 2, **P**: Tanzania (3 and 3), **Q**: Kenya collected in 1984 (5 and 5), **R**: Kenya collected in 1985 (10 and 10), **S**: Kenya collected in both years (**Q** and **R**, 15 and 15); *O. brachyantha* ... the fourth column of Table 2, **T**: Senegal (1 and 1). The whole data were calculated basing on the data mentioned in the respective papers.

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 aims of future analyses; *i.e.*, Kenya ... *O. punctata*, **Q**, **R** and **S**; Nigeria ... *O. longistaminata*, **D**, **E** and **F**, *O. breviligulata*, **J**, **K**, and **L**; Senegal ... *O. longistaminata*, **G**, **H**, and **I**, *O. breviligulata*, **M**, **N** and **O**; summed-up processes ... *O. longistaminata* ... group **U**: East Africa (**A**, **B** and **C**), **V**: West Africa (**D**, **E**, **G** and **H**), **W**: both of them; *O. breviligulata* ... **X**: **J**, **K**, **M** and **N**; *O. punctata* ... **Y**: **P**, **Q** and **R**.

I. *O. longistaminata*

1. Lengths

Lengths for the individual grain level ranged from 11.75 mm (strain No.36) to 6.90 mm (strain No.126). It was noticed that the value of No.126 was very small. In the strain level, the longest (10.52 mm) was obtained in No.149, followed by No.36 (10.19 mm) and No.35 (10.02 mm). The shortest (7.93 mm) was noted in No.94, followed by No.126 (7.97 mm) and Nos.43 and 46 (7.99 mm). In the group level, the longest (9.30 mm) was obtained in the strains collected in Nigeria in 1984 (abbreviated as **D** in Table 2), followed by group **H** (9.16 mm) and group **B** (9.05 mm). The shortest (8.59 mm) was noted in group **C**, followed by group **G** (8.68 mm) and group **E** (8.69 mm).

Averages and those standard deviations through the whole strains belonging to group **U** (summed-up of **A**, **B** and **C**, *i.e.*, east Africa), group **V** (summed-up from **D** to **I**, *i.e.*, west Africa) and group **W** (summed-up from **A** to **I**, *i.e.*, whole Africa) were found to be 8.74 ± 0.34 , 8.76 ± 0.54 and 8.76 ± 0.50 , respectively.

In the standard deviations of each strain, *i.e.*, showing intra-population's variations, the largest (0.76) was obtained in strain Nos.46 and 126, followed by No.35 (0.70). The smallest (0.04) was noted in No.57, followed by Nos.13 and 102 (0.06). In the group

level, the largest (0.81) was obtained in group **D**, followed by group **F** (0.64) and group **H** (0.61). The smallest (0.17) was noted in group **C**, followed by group **G** (0.34) and group **A** (0.39). It was noticeable that group **C** showed very small value. Averages and those standard deviations in the whole strains belonging to groups **U**, **V** and **W** were found to be 0.25 ± 0.12 , 0.27 ± 0.16 and 0.27 ± 0.15 , respectively.

2. Widths

Widths for the individual grain level ranged from 3.60 mm (No.36), which was the same as in case of the length, to 1.90 mm (No.135). In the strain level, the widest (3.15 mm) was obtained in No.36, followed by No.149 (2.83 mm) and No.21 (2.79 mm). It was noticeable that No.36 showed very large value. The narrowest (2.02 mm) was noted in No.140, followed by No.112 (2.14 mm) and No.77 (2.18 mm). In the group level, the widest (2.81 mm) was obtained in group **D**, which was the same as in case of the length, followed by group **C** (2.63 mm) and group **B** (2.58 mm). The narrowest (2.40 mm) was noted in group **G**, followed by group **A** (2.42 mm) and group **I** (2.43 mm).

Averages and those standard deviations through the whole strains belonging to groups **U**, **V** and **W** were found to be 2.51 ± 0.15 , 2.46 ± 0.19 and 2.47 ± 0.18 , respectively.

In the standard deviations of each strain, the largest (0.23) was obtained in No.7, followed by No.135 (0.19) and No.36 (0.18). The smallest (0.02) was noted in Nos.1, 13, 24, 40, 79 and 100. In the group level, the largest (0.27) was obtained in group **D**, which was the same as in case of the length, followed by group **F** (0.20) and group **H** (0.18). These orders of groups ($D > F > H$) were found to be the same as in case of the length. The smallest (0.07) was noted in group **B**, followed by group **C** (0.09) and group **A** (0.12). Averages and those standard deviations in the whole strains belonging to groups **U**, **V** and **W** were found to be 0.08 ± 0.05 , 0.09 ± 0.04 and 0.09 ± 0.04 , respectively.

3. Thicknesses

Thicknesses for the individual grain level ranged from 2.55 mm (No.36), which was the same as in cases of the length and width, to 1.15 mm (No.116). It was noticeable that No.36 showed very large value, which was 0.60 mm thicker than value (1.90 mm) of the following strains (Nos.7 and 14). In the strain level, the thickest (1.94 mm) was obtained in No.36, which was the same as in case of the width, followed by Nos.129 and 152 (1.81 mm). The thinnest (1.26 mm) was noted in No.116, followed by No.126 (1.40 mm) and No.19 (1.43 mm). In the group level, the thickest (1.82 mm) was obtained in group **D**, which was the same as in cases of the length and width, followed by group **B** (1.79 mm) and group **H** (1.69 mm). The thinnest (1.60 mm) was noted in group **G**, which was the same as in case of the width, followed by group **A** (1.61 mm) and group **I** (1.62 mm).

Averages and those standard deviations through the whole strains belonging to groups **U**, **V** and **W** were found to be 1.62 ± 0.07 , 1.65 ± 0.11 and 1.65 ± 0.11 , respectively.

In the standard deviations of each strain, the largest (0.17) was obtained in No.36, followed by No.7 (0.16) and No.116 (0.15). The smallest (0.00) was noted in No.127,

followed by Nos.1, 11, 19, 24, 65, 79, 94, 96, 99, 112, 129, 147 and 152 (0.02). In the group level, the largest (0.11) was obtained in groups H and I. The smallest (0.05) was noted in group A, followed by group E (0.08) and groups B and D (0.09). Averages and those standard deviations in the whole strains belonging to groups U, V and W were found to be 0.05 ± 0.03 , 0.06 ± 0.03 and 0.06 ± 0.03 , respectively.

4. Ratios of length to width

Ratios of length to width (abbreviated as L/W) for the individual grain level ranged from 4.69 (No.140) to 2.83 (No.30). In the strain level, the largest (4.56) was obtained in No.140, followed by No.77 (4.40) and No.78 (4.04). The smallest (3.06) was noted in Nos.21, 79 and 99. In the group level, the largest (3.65) was obtained in group A, followed by group G (3.64) and group I (3.63). The smallest (3.27) was noted in group C, which was the same as in case of the length, followed by group D (3.33) and group B (3.50).

Averages and those standard deviations through the whole strains belonging to groups U, V and W were found to be 3.50 ± 0.24 , 3.59 ± 0.28 and 3.57 ± 0.28 , respectively.

In the standard deviations of each strain, the largest (0.47) was obtained in No.147, followed by No.27 (0.46) and No.135 (0.39). The smallest (0.04) was noted in No.152, followed by Nos.96, 124, 129 and 149 (0.05). In the group level, the largest (0.31) was obtained in group E, followed by group F (0.30) and group G (0.28). The smallest (0.08) was noted in group D, followed by group C (0.11) and group B (0.14). Averages and those standard deviations in the whole strains belonging to groups U, V and W were found to be 0.14 ± 0.06 , 0.17 ± 0.09 and 0.16 ± 0.08 , respectively.

5. Ratios of length to thickness

Ratios of length to thickness (L/T) for the individual grain level ranged from 7.48 (No.116) to 4.22 (No.43). In the strain level, the largest (6.77) was obtained in No.116, followed by No.54 (6.42) and No.19 (6.04). It was noticeable that Nos.54 and 116 showed very large values. The smallest (4.64) was noted in No.43, followed by Nos.42, 45 and 58 (4.69). In the group level, the largest (5.46) was obtained in group A, which was the same as in case of the L/W, followed by group G (5.45) and group I (5.44). These orders of strains (A>G>I) were found to be the same as in case of the L/W. The smallest (5.07) was noted in group B, followed by group D (5.12) and group F (5.21). It was noticed that the value was very small in group B.

Averages and those standard deviations through the whole strains belonging to groups U, V and W were found to be 5.36 ± 0.31 , 5.34 ± 0.41 and 5.34 ± 0.39 , respectively.

In the standard deviations of each strain, the largest (0.96) was obtained in No.126, which was the same as in case of the length, followed by No.46 (0.70) and No.116 (0.65). It was noticed that No.126 showed very large value. The smallest (0.04) was noted in Nos.3 and 55, followed by No.152 (0.07). In the group level, the largest (0.46) was obtained in group E, which was the same as in case of the L/W, followed by group F (0.44) and groups C and I (0.34). The smallest (0.24) was noted in group A, which

was the same as case of the thickness, followed by group H (0.29) and group B (0.32). Averages and those standard deviations in the whole strains belonging to groups U, V and W were found to be 0.23 ± 0.11 , 0.26 ± 0.15 and 0.25 ± 0.15 , respectively.

6. Ratios of width to thickness

Ratios of width to thickness (W/T) for the individual grain level ranged from 2.35 (No.116), which was the same as in case of the L/T, to 1.18 (No.140). In the strain level, the largest (2.04) was obtained in No.116, which was the same as in case of the L/T, followed by No.19 (1.86) and No.52 (1.79). These combinations of strains (Nos.19, 52 and 116) were found to be the same as in case of the L/T. The smallest (1.25) was noted in No.140, which was the same as in case of the width, followed by No.40 (1.30) and Nos.49, 58 and 93 (1.33). In the group level, the largest (1.61) was obtained in group C, followed by group D (1.54) and group H (1.52). The smallest (1.45) was noted in group B, followed by group E (1.47) and group F (1.48).

Averages and those standard deviations through the whole strains belonging to groups U, V and W were found to be 1.54 ± 0.10 , 1.50 ± 0.11 and 1.50 ± 0.11 , respectively.

In the standard deviations of each strain, the largest (0.17) was obtained in Nos.46 and 126, which (Nos.46 and 126) were the same as in case of the length, followed by Nos.71 and 133 (0.15). The smallest (0.01) was noted in Nos.24 and 152, followed by Nos.1, 77 and 79 (0.02). In the group level, the largest (0.12) was obtained in groups C and G, followed by groups E, F and I (0.11). The smallest (0.04) was noted in Group H, followed by group A (0.06) and group B (0.07). These combinations of groups (A, B and H) were found to be the same as in case of the L/T. Averages and those standard deviations in the whole strains belonging to groups U, V and W were found to be 0.06 ± 0.03 , 0.08 ± 0.05 and 0.08 ± 0.04 , respectively.

II. *O. breviligulata*

1. Lengths

Lengths for the individual grain level ranged from 11.30 mm (strain No.50) to 7.80 mm (No.29). It was noticed that the value of No.50 was very large. In the strain level, the longest (10.69 mm) was obtained in No.50, followed by No.150 (10.47 mm) and Nos.63 and 122 (10.34 mm). The shortest (8.15 mm) was noted in Nos.103 and 117, followed by No.153 (8.29 mm). In the group level, the longest (9.44 mm) was obtained in the strains collected in Nigeria in 1985 (abbreviated as K in Table 2), followed by group L (9.40 mm) and group J (9.25 mm). The shortest (8.87 mm) was noted in group N, followed by group O (8.96 mm).

Average and those standard deviations through the whole strains belonging to group X (summed-up from J to O) were found to be 9.16 ± 0.62 .

In the standard deviations of each strain, *i.e.*, showing intra-population's variations, the largest (0.62) was obtained in strain No.29, followed by No.28 (0.46) and No.31 (0.40). The smallest (0.08) was noted in Nos.103 and 130, followed by No.115 (0.09). In the group level, the largest (0.69) was obtained in group N, followed by group O (0.61)

and group M (0.58). The smallest (0.23) was obtained in group J, followed by group L (0.53) and group K (0.57). It was noticeable that group J showed very small value. Average and those standard deviations in the whole strains were found to be 0.23 ± 0.11 .

2. Widths

Widths for the individual grain level ranged from 3.70 mm (Nos.28 and 56) to 2.00 mm (No.128). In the strain level, the widest (3.47 mm) was obtained in No.56, followed by No.61 (3.45 mm) and No.44 (3.44 mm). The narrowest (2.27 mm) was noted in No. 128, followed by No.67 (2.49 mm) and No.122 (2.54 mm). In the group level, the widest (3.16 mm) was obtained in group N. The narrowest (2.91 mm) was noted in group M, followed by group O (2.98 mm).

Average and those standard deviations through the whole strains belonging to group X were found to be 3.05 ± 0.28 .

In the standard deviations of each strain, the largest (0.20) was obtained in No.28, followed by No.128 (0.17) and No.150 (0.16). The smallest (0.02) was noted in No.138, followed by Nos.50, 51, 70, 98, 104 and 121 (0.04). In the group level, the largest (0.32) was obtained in group K, followed by group L (0.29). The smallest (0.10) was noted in group J, which was the same as in case of the length, followed by group N (0.12). Average and those standard deviations in the whole strains were found to be 0.09 ± 0.04 .

3. Thicknesses

Thicknesses for the individual grain level ranged from 2.50 mm (No.28), which was the same as in case of the width, to 1.15 mm (No.128), which was also the same as in case of the width. In the strain level, the thickest (2.26 mm) was obtained in No.28, followed by No.80 (2.23 mm) and No.30 (2.13 mm). The thinnest (1.66 mm) was noted in No.67, which was the same as in case of the width, followed by No.142 (1.68 mm) and No.138 (1.70 mm). In the group level, the thickest (2.12 mm) was obtained in group J, followed by group L (1.96 mm). The thinnest (1.78 mm) was noted in group M, which was the same as in case of the width, followed by group O (1.83 mm). These orders of groups ($M > O$) were found to be the same as in case of the width.

Average and those standard deviations through the whole strains belonging to group X were found to be 1.89 ± 0.17 .

In the standard deviations of each strain, the largest (0.12) was obtained in No.28, which was the same as in case of the width, followed by No.128 (0.11) and Nos.67 and 153 (0.09). The smallest (0.02) was noted in Nos.63, 74, 122 and 142. In the group level, the largest (0.16) was obtained in groups L, M and O. The smallest (0.05) was noted in group N, followed by group J (0.09). These combinations of groups (J and N) were found to be the same as in case of the width. Average and those standard deviations in the whole strains were found to be 0.06 ± 0.02 .

4. Ratios of length to width

Ratios of length to width (L/W) for the grain level ranged from 4.40 (No.128) to 2.46 (No.153). In the strain level, the largest (4.07) was obtained in No.122, followed by No.50 (3.97) and No.128 (3.83). The smallest (2.56) was noted in Nos.47 and 153, followed by No.148 (2.58). In the group level, the largest (3.12) was obtained in group M,

followed by group K (3.05). The smallest (2.82) was noted in group N, which was the same as in case of the length, followed by group J (2.96).

Average and those standard deviations through the whole strains belonging to group X were found to be 3.03 ± 0.38 .

In the standard deviations of each strain, the largest (0.31) was obtained in No.128, followed by No.150 (0.20) and No.156 (0.18). It was noticeable that No.128 showed very large value. The smallest (0.04) was noted in Nos.68, 70 and 130. In the group level, the largest (0.42) was obtained in group K, which was the same as in case of the width, followed by group L (0.39). These orders of groups ($K > L$) were found to be the same as in case of the width. The smallest (0.14) was noted in group J, which was the same as in cases of the length and width, followed by group N (0.27). It was noticed that the group J showed very small value. These orders of groups ($J < N$) were found to be the same as in case of the width. Moreover, these combinations of groups (J and N) were found to be the same as in cases of the width and thickness. Average and those standard deviations in the whole strains were found to be 0.10 ± 0.05 .

5. Ratios of length to thickness

Ratios of length to thickness (L/T) for the individual grain level ranged from 7.70 (No.128), which was the same as in case of the L/W, to 3.77 (No.28). In the strain level, the largest (6.70) was obtained in No.128, followed by No.122 (5.98) and No.115 (5.92). The smallest (4.01) was noted in No.121, followed by No.80 (4.08) and No.28 (4.13). In the group level, the largest (5.12) was obtained in group M, which was the same as in case of the L/W, followed group O (4.96). The smallest (4.38) was noted in group J, followed by group N (4.57). These combinations of groups (J and N) were found to be the same as in case of the L/W.

Average and those standard deviations through the whole strains belonging to group X were found to be 4.90 ± 0.60 .

In the standard deviations of each strain, the largest (0.58) was obtained in No.128, which was the same as in case of the L/W, followed by No.29 (0.33) and No.115 (0.32). It was noticed that No.128 showed very large value. The smallest (0.07) was noted in No.74, followed by Nos.117 and 122 (0.08). In the group level, the largest (0.67) was obtained in group M, followed by group O (0.66). The smallest (0.22) was noted in group J, which was the same as in cases of length, width and L/W, followed by group N (0.44). These orders of groups ($J > N$) were found to be the same as in cases of the width and L/W. Moreover, these combinations of groups (J and N) were found to be the same as in cases of the width, thickness and L/W. Average and those standard deviations in the whole strains were found to be 0.18 ± 0.09 .

6. Ratios of width to thickness

Ratios of width to thickness (W/T) for the individual grain level ranged from 2.31 (No.115) to 1.22 (No.28), which was the same as in case of the L/T. In the strain level, the largest (2.08) was obtained in No.115, followed by No.51 (1.93) and No.110 (1.81). The smallest (1.45) was noted in No.28, followed by No.122 (1.47) and No.31 (1.48). In the group level, the largest (1.65) was obtained in group M, which was the same as in

cases of the L/W and L/T, followed by group O (1.64). These orders of groups ($M > O$) were found to be the same as in case of the L/T. The smallest (1.48) was obtained in group J, which was the same as in case of the L/T, followed by group N (1.58). These orders of groups ($J < N$) were found to be the same as in case of the L/T. Moreover, these combinations of groups (J and N) were found to be the same as in cases of L/W and L/T.

Average and those standard deviations through the whole strains belonging to group X were found to be 1.62 ± 0.12 .

In the standard deviations of each strain, the largest (0.26) was obtained in No.128, which was the same as in cases of the L/W and L/T, followed by Nos.67 and 115 (0.13). The smallest (0.01) was noted in No.118, followed by Nos.68 and 121 (0.02). In the group level, the largest (0.15) was obtained in group M, which was the same as in case of the L/T. The smallest (0.02) was noted in group J, which was the same as in cases of the length, width, L/W and L/T, followed by group N (0.09). These orders of groups ($J < N$) were found to be the same as in cases of the width, L/W and L/T. Moreover, these combinations of groups (J and N) were found to be the same as in cases of the width, thickness, L/W and L/T. Average and those standard deviations in the whole strains were found to be 0.07 ± 0.04 .

III. *O. punctata*

1. Lengths

Lengths for the individual grain level ranged from 7.90 mm (strain Nos.157, 163 and 174) to 5.10 mm (Nos.168, 171 and 172). It was noticed that the values of Nos.168, 171 and 172 were very small. In the strain level, the longest (7.31 mm) was obtained in No.173, followed by No.174 (7.15 mm) and No.163 (7.01 mm). The shortest (5.51 mm) was noted in No.168, followed by No.170 (5.57 mm) and No.171 (5.67 mm). In the group level, the longest (6.40 mm) was obtained in the strains collected in Tanzania (abbreviated as P in Table 2), followed by group Q (6.38 mm). The shortest (6.21 mm) was noted in group R, followed by group S (6.27 mm).

Average and those standard deviations through the whole strains belonging to group Y (summed-up from P to S) were found to be 6.30 ± 0.53 .

In the standard deviations of each strain, *i.e.*, showing intra-population's variations, the largest (0.66) was obtained in No.174, followed by No.163 (0.60) and No.167 (0.57). The smallest (0.22) was noted in No.158, followed by Nos.161 and 169 (0.23). In the group level, the largest (0.61) was obtained in group R, followed by group S (0.57). The smallest (0.22) was noted in group P, followed by group Q (0.40). Average and those standard deviations in the whole strains were found to be 0.42 ± 0.13 .

2. Widths

Widths for the individual grain level ranged from 2.80 mm (Nos.159, 160, 162, 165 and 170) to 2.10 mm (Nos.160, 164, 165, 168 and 169). In the strain level, the widest (2.53 mm) was obtained in Nos.158, 164 and 170. The narrowest (2.24 mm) was noted in No.168, which was the same as in case of the length, followed by No.172 (2.32 mm) and

Nos.160 and 167 (2.35 mm). In the group level, the widest (2.50 mm) was obtained in group P, which was the same as in case of the length, followed by group Q (2.46 mm). These orders of groups ($P > Q$) were found to be the same as in case of the length. The narrowest (2.40 mm) was noted in group R, which was the same as in case of the length, followed by group S (2.42 mm). These orders of groups ($R < S$) were also found to be the same as in case of the length.

Average and those standard deviations through the whole strains belonging to group Y were found to be 2.43 ± 0.08 .

In the standard deviations of each strain, the largest (0.18) was obtained in No.165, followed by Nos.160, 164 and 169 (0.17). The smallest (0.07) was noted in Nos.167, 173 and 174. In the group level, the largest (0.08) was obtained in groups R and S. The smallest (0.03) was noted in group P, which was the same as in case of the length, followed by group Q (0.06). These orders of groups ($P < Q$) were found to be the same as in case of the length. Average and those standard deviations in the whole strains were found to be 0.12 ± 0.04 .

3. Thicknesses

Thicknesses for the individual grain level ranged from 1.85 mm (Nos.158, 162, 165 and 173) to 1.15 mm (Nos.161, 167, 168 and 169). In the strain level, the thickest (1.59 mm) was obtained in No.166, followed by Nos.158 and 173 (1.58 mm). The thinnest (1.41 mm) was noted in No.169, followed by Nos.161 and 168 (1.48 mm) and No.164 (1.49 mm). In the group level, the thickest (1.56 mm) was obtained in group P, which was the same as in cases of the length and width. The thinnest (1.52 mm) was noted in group Q.

Average and those standard deviations through the whole strains belonging to group Y were found to be 1.53 ± 0.05 .

In the standard deviations of each strain, the largest (0.22) was obtained in No.161, followed by No.169 (0.18) and No.168 (0.17). The smallest (0.06) was noted in No.164, followed by Nos.163 and 170 (0.08). In the group level, the largest (0.05) was obtained in groups R and S, which were the same as in case of width. The smallest (0.01) was noted in group P, which was the same as in cases of the length and width, followed by group Q (0.03). These orders of groups ($P < Q$) were found to be the same as in cases of the length and width. Average and those standard deviations in the whole strains were found to be 0.13 ± 0.04 .

4. Ratios of length to width

Ratios of length to width (abbreviated as L/W) for the individual grain level ranged from 3.57 (No.165) to 2.05 (No.169). In the strain level, the largest (2.98) was obtained in No.173, which was the same as in case of the length, followed by the No.174 (2.97) and No.165 (2.88). The smallest (2.20) was noted in No.170, followed by No.17 (2.32) and No.161 (2.35). In the group level, the largest (2.60) was obtained in groups Q, R and S. The smallest (2.57) was noted in group P.

Average and those standard deviations through the whole strains belonging to group Y were found to be 2.60 ± 0.22 .

In the standard deviations of each strain, the largest (0.30) was obtained in No.165, which the same as in case of the width, followed by Nos.163 and 164 (0.28). The smallest (0.08) was noted in No.170, followed by Nos.158 and 173 (0.13). In the group level, the largest (0.26) was obtained in group R, which was the same as in case of the length, followed by group S (0.23). These orders of groups ($R > S$) were found to be the same as in case of the length. The smallest (0.11) was obtained in group P, which was the same as in cases of the length, width and thickness, followed by group Q (0.16). These orders of groups ($P < Q$) were found to be the same as in cases of the length, width and thickness. Average and those standard deviations in the whole strains were found to be 0.21 ± 0.07 .

5. Ratios of length to thickness

Ratios of length to thickness (L/T) for the individual grain level ranged from 5.67 (No.173) to 2.97 (No.168). In the strain level, the largest (4.67) was obtained in No.173, which was the same as in cases of the length and L/W , followed by No.174 (4.65) and No.163 (4.47). These orders of strains ($173 > 174 > 163$) were found to be the same as in case of the length. The smallest (3.58) was noted in No.170, which was the same as in case of the L/W , followed by No.171 (3.67) and No.168 (3.79). These combinations of strains (Nos.168, 170 and 171) were found to be same as in case of the length. In the group level, the largest (4.23) was obtained in group Q, followed by group S (4.15). The smallest (4.11) was noted in group R, which was the same as in cases of the length and width, followed by group P (4.12).

Average and those standard deviations through the whole strains belonging to group Y were found to be 4.14 ± 0.30 .

In the standard deviations of each strain, the largest (0.67) was obtained in No.174, which was the same as in case of the length, followed by No.173 (0.59) and No.168 (0.57). The smallest (0.10) was noted in No.170, followed by No.164 (0.27) and No.160 (0.28). It was noticed that the value of No.170 was very small. In the group level, the largest (0.37) was obtained in group R, followed by group S (0.32). These orders of groups ($R > S$) were found to be the same as in cases of the length and L/W . Moreover, these combinations of groups (R and S) were found to be the same as in cases of the length, width, thickness and L/W . The smallest (0.16) was noted in group P, which was the same as in cases of the length, width, thickness and L/W , followed by group Q (0.17). These orders of groups ($P < Q$) were found to be the same as in cases of the length, width, thickness and L/W . Average and those standard deviations in the whole strains were found to be 0.43 ± 0.13 .

6. Ratios of width to thickness

Ratios of width to thickness (W/T) for the individual grain level ranged from 2.25 (No.169) to 1.25 (No.165). In the strain level, the largest (1.74) was obtained in No.169, followed by No.161 (1.71) and No.164 (1.70). The smallest (1.53) was noted in Nos.165 and 168, followed by No.160 (1.54). In the group level, the largest (1.63) was obtained in group Q, which was the same as in case of the L/T , followed by group P (1.61). These combinations of groups (P and Q) were found to be the same as in cases of the length

and width. The smallest (0.59) was noted in group R, which was the same as in cases of the length, width and L/T, followed by group S (0.60). These orders of groups ($R < S$) were found to be the same as in cases of the length and width.

Average and those standard deviations through the whole strains belonging to group Y were found to be 1.60 ± 0.06 .

In the standard deviations of each strain, the largest (0.24) was obtained in No.161, which was the same as in case of the thickness, followed by No.169 (0.22) and No.167 (0.21). The smallest (0.06) was noted in No.163, followed by No.170 (0.07) and No.159 (0.08). In the group level, the largest (0.07) was obtained in groups Q and S. The smallest (0.01) was noted in group P, which was the same as in cases of the length, width, thickness, L/W and L/T, followed by group R (0.06). Average and those standard deviations in the whole strains were found to be 0.14 ± 0.05 .

IV. *O. brachyantha*

The results are given also in Table 2. 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 to width (abbreviated as 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 5.55. 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 and from August to November in 1985, the writer was sent to 7 countries of Africa, *i.e.*, Madagascar, Tanzania, Kenya, Nigeria, Ivory Coast, Liberia and Senegal, for collection of the wild and cultivated rices. During the trips, 175 strains of wild rice, *i.e.*, 107 of *Oryza longistaminata*, 49 of *O. breviligulata*, 18 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 those standard deviations in the whole strains were found to be $8.76 \text{ mm} \pm 0.50$, $2.47 \text{ mm} \pm 0.18$, $1.65 \text{ mm} \pm 0.11$, 3.57 ± 0.28 , 5.34 ± 0.39 and 1.50 ± 0.11 in length, width, thickness, ratios of length to width, of length to thickness, and of width to thickness, respec-

tively, in case of the *O. longistaminata*. The largest and the smallest values in the respective characters were ascertained in Nigeria of 1984 (D mark in Table 2) and Kenya (C); Nigeria of 1984 and Casamance of Senegal; Nigeria of 1984 and Casamance of Senegal; Madagascar and Kenya; Madagascar and Nigeria of 1984; Kenya and Tanzania; respectively, in the same order.

In case of *O. breviligulata*, average values and those standard deviations in the whole strains were found to be $9.16 \text{ mm} \pm 0.62$, $3.05 \text{ mm} \pm 0.28$, $1.89 \text{ mm} \pm 0.17$, 3.03 ± 0.38 , 4.90 ± 0.60 and 1.62 ± 0.12 , respectively, in the same order. The largest and the smallest values in the respective characters were ascertained in Nigeria of 1985 (K) and north of Senegal (N); north of Senegal and Casamance of Senegal; Nigeria of 1984 and Casamance of Senegal; Casamance of Senegal and north of Senegal; Casamance of Senegal and Nigeria of 1984; Casamance of Senegal and Nigeria of 1984, respectively, in the same order.

In case of *O. punctata*, average values and those standard deviations in the whole strains were found to be $6.30 \text{ mm} \pm 0.53$, $2.43 \text{ mm} \pm 0.08$, $1.53 \text{ mm} \pm 0.05$, 2.60 ± 0.22 , 4.14 ± 0.30 and 1.60 ± 0.06 , respectively, in the same order. The largest and the smallest values in the respective characters were ascertained in Tanzania (P) and Kenya of 1985 (R); Tanzania and Kenya of 1985; Tanzania and Kenya of 1984; Kenya and Tanzania; Kenya of 1984 and Kenya of 1985; Kenya of 1984 and Kenya of 1985, respectively, in the same order.

In case of *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.

Basing on the analyses of the data obtained in the field survey, morphological, genetical and ecological characters, geographical, ecotypic and varietal differentiations could be discussed and concluded in the future.

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