Distribution and Grain Morphology of Wild Rice Collected in Madagascar and Tanzania, 1988

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Introduction

During the period from May to August in 1988, prior to the studies in England, the writer was sent to 2 countries of Africa, *i.e.*, Madagascar and Tanzania, 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 the Ministry of Education, Science and Culture of the Japanese Government, executed as the third survey in Africa, following 1984 and 1985. Making use of this opportunity, wild rices distributed in the two countries of Africa were studied.

On the distribution of wild rice in Africa, some reports have already been published [1~9,19~22]. Although Africa has been considered to be one of the most important distribution regions of 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 ecotypic differentiation of wild rice in Africa.

In the previous papers [10~16], the preliminary and advanced data have been reported as the results of the first and the second survey trips made in 1984 and 1985 around the eight African countries. In the present paper, the habitat and the record of the morphological characters of the unhusked grains of wild rice collected in 1988 were described. Their plant- and grain-characters and physiological specificities are now being analyzed at Kagoshima University as well as in the respective countries. Then, the analyses concerning the morphological, physiological, ecological and genetical characteristics treated in these series might further be ascertained in more details.

The author is most grateful to the Government Officials in REPOBLIKA DEMOKRATIKA MALAGASY and UNITED REPUBLIC OF TANZANIA. Thanks are also due to the scientists in the respective countries.

Abstract of distribution and habitat of wild *Oryza* species

The localities concerned in the trips in African countries made in 1988 were mentioned in the respective papers in detail [17,18]. In these two papers, habitats, not only those where samples were collected but those where only observations were made, were reported, and the specificities of locality were mentioned in detail. But the habitats where collections were made and brief records were only reported in the present paper. Geographical situations where wild rice was found were briefly illustrated in Fig. 1. In this figure, countries concerned, species names, 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 the scientific organizations in the respective countries, and another one was carried back to Japan. These plant- and grain-characters are being analyzed at the following institutes, Madagascar and Tanzania, and Kagoshima University, Japan.

The number of strains collected was 109 in the total. They were constituted by 47 and 36 of *Oryza longistaminata* in Madagascar and Tanzania, respectively; and 26 of *Oryza punctata* in Tanzania.

I. *Oryza longistaminata* CHEV. et ROEHR.

Populations of the species were found in a lot of localities of both of the countries, and many other populations were observed, but not collected, in this trip. They had a creeping growth in the pond, swamp, embankment, irrigation canal, waste land, and small stream. They were sometimes adjacent to the rice field, being separated by an embankment, or not separated. It may be noticed that the population of W37 collected in Anororo, Madagascar, are growing sympatrically with the cultivated rice.

II. *Oryza punctata* KOTSCHY

Populations of the species were found in several districts of Tanzania, and many other populations were observed but not collected in this trip. In brief, they had a creeping growth, sometimes forming a erect type, and growing sporadically or thickly, in road-side ditch, edge of swamp or pond, waste land, and low bush. They were sometimes adjacent to the rice field or upland crop field, large trees, being separated by an embankment or not. In some fields, it is said that they are looked upon as serious weed for the cultivated rice species.

Distributions of wild rices collected were listed up in Table 1. Populations observed but not collected were omitted in the present table, which were ascertained in the respective papers[17,18]. In this table, collection number, species name, date of collections, abstract of locality and brief informations of habitat were described. These detailed data are also found in the respective papers.

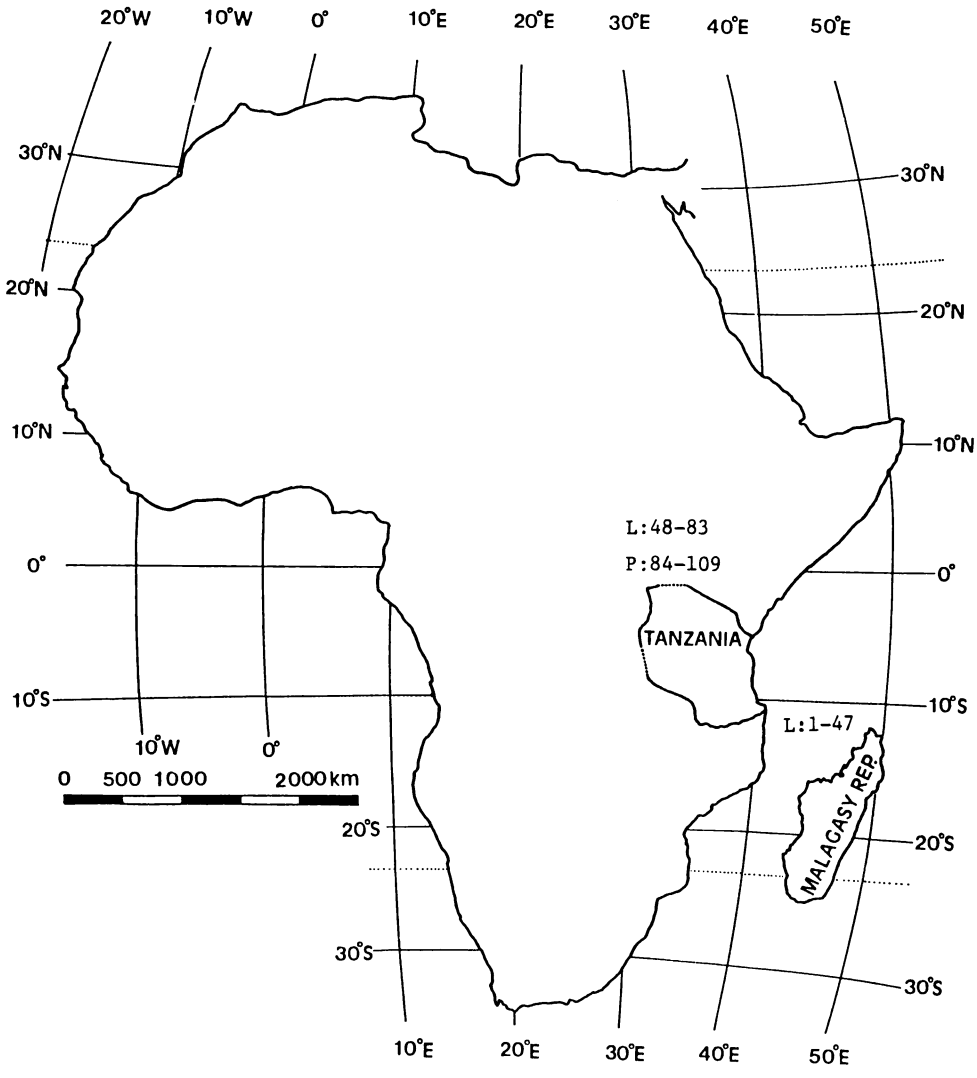

Fig. 1. Map showing the countries where collection and observation of the wild rice were made in Africa. Code numbers used in the figure are corresponding to the strain numbers used in the tables. L: *O. longistaminata* CHEV. et ROEHR., P: *O. punctata* KOTSCHY.

Table 1. Abstract on distribution and habitat of wild rice collected in Madagascar and Tanzania, 1988. Abbreviations: **L**; *Oryza longistaminata* CHEV. et ROEHR. (Collection Nos.**W1**～**W47** in Madagascar, and Nos.**W48**～**W83** in Tanzania), **P**; *Oryza punctata* KOTSCHY (Collection Nos.**W84**～**W109** in Tanzania), m; meter or meters, km; kilometer or kilometers

Collection No.	Species	Date	Place	Detailed locality, habitat and remarks
W1	**L**	June 4	Mahajanga	8 km northeast from Mahajanga. Paddy field, 100 m x 200 m.
W2	**L**	June 4	Mahajanga	10 km northeast from Mahajanga. Paddy field, 300 m x 400 m. Small pond in the middle position.
W3	**L**	June 4	Mahajanga	Near the place and similar habitat of **W2**.
W4	**L**	June 4	Mahajanga	20 km northeast from Mahajanga. Waste land, 200 m x 300 m.
W5	**L**	June 4	Mahajanga	21 km northeast from Mahajanga. Along the river.
W6	**L**	June 4	Mahajanga	9 km southeast from Mahajanga. Paddy field, 100 m x 200 m. Pre-matured grains.
W7	**L**	June 4	Marovoay	10 km from Marovoay. Experiment Farm of FOFIFA. Swamp, 50 m x 100 m.
W8	**L**	June 5	Marovoay	21 km north from Marovoay. Paddy field, dia. ca. 200 m. Located between road and waste land.
W9	**L**	June 5	Marovoay	51 km east from Marovoay. Terraced paddy fields, 100 m x 200 m in east, and 200 m x 300 m in west sides.
W10	**L**	June 5	Ambondma	16 km northeast from Ambondma. Pond, 20 m x 50 m, separated 50 m from main road. Small pool, 5 m x 10 m.
W11	**L**	June 5	Mampikony	33 km southeast from Mampikony. Pond, 100 m x 200 m. Paddy field in east side.
W12	**L**	June 5	Mampikony	27 km southeast from Mampikony. Paddy field, 300 m x 500 m.
W13	**L**	June 5	Mampikony	20 km southeast from Mampikony. Pond, 50 m～100 m x 400 m. Highly seed sterile.
W14	**L**	June 5	Mampikony	Near Mampikony town. Paddy field, 100 m x 200 m. Too much dry.
W15	**L**	June 6	Mampikony	9 km north from Mampikony. Paddy field, 200 m x 1 km.
W16	**L**	June 6	Port Berge	19 km northeast from Port Berge Vaovao. Waste land, 400 m x 400 m, and pond, dia. 100 m.
W17	**L**	June 6	Port Berge	32 km northeast from Port Berge Vaovao. Paddy field.
W18	**L**	June 6	Antsohihy	47 km southwest from Antsohihy. Paddy field and small canal.
W19	**L**	June 7	Antsohihy	8 km east from Antsohihy. Paddy field, 300 m x 200 m, and small pond. Presumed intra-population-diversity in view of flowering period, temporal isolation, pollen- and seed-fertilities.
W20	**L**	June 7	Antsohihy	34 km east from Antsohihy and 5 km east from junc-

				tion to Befandrianana. Paddy field, 100 m x 200 m, and small pond, 20 m x 50 m.
W21	**L**	June 8	Befandrianana	25 km west from Befandrianana. Paddy field, 50 m to 100 m x 300 m.
W22	**L**	June 8	Befandrianana	9 km west from Befandrianana. Paddy field, 200 m x 1 km.
W23	**L**	June 8	Befandrianana	4 km west from Befandrianana. Dried-up paddy field, 500 m x 800 m.
W24	**L**	June 8	Befandrianana	4.5 km west from Befandrianana. Dried-up paddy field, 300 m x 1 km. Nearly the same habitat of **W23**.
W25	**L**	June 8	Antsohihy	25 km southwest from Antsohihy. Waste lands, 1 km x 300 m. Small paddy fields.
W26	**L**	June 9	Mampikony	11 km southwest from Mampikony. Paddy fields, 100 m x 150 m, and also 100 m x 150 m.
W27	**L**	June 9	Ambondra-mamy	3 km south from Ambondramamy. Paddy field, 300 m x 200 m, having small stream in the middle part.
W28	**L**	June 9	Ambondra-mamy	21 km south from Ambondramamy. Paddy field, 100 m x 150 m.
W29	**L**	June 9	Ambondra-mamy	22 km south from Ambondramamy. Slightly sloped paddy field, 100 m x 200 m, having small pool.
W30	**L**	June 9	Ambondra-mamy	27 km south from Ambondramamy. Small stream across the main road.
W31	**L**	June 9	Ambondra-mamy	28 km south from Ambondramamy. Irregularly shaped paddy field, 100 m x 300 m.
W32	**L**	June 11	Antananarivo	In the City. Paddy field, waste land, and originated water pool.
W33	**L**	June 14	Tsinjoarivo	29 km west from Ambatondrazaka. Paddy field. Only along the embankment.
W34	**L**	June 14	Morarano	40 km north from Tsinjoarivo. Small stream, sub-road and pond, 200 m x 100 m.
W35	**L**	June 14	Ambahitarivo	1 km south from Ambahitarivo. Paddy field and pond.
W36	**L**	June 14	Anororo	2 km east from Antsapanimahazo and 6 km west from Anororo. Paddy field. Presumed temporal isolation.
W37	**L**	June 14	Anororo	7 km east from Antsapanimahazo and 2 km west from Anororo. Paddy field. Sympatrically with cultivated rice (Collection No.**C36**).
W38	**L**	June 14	Anororo	7 km west from Antsapanimahazo and 1 km west from Anororo. Paddy field, 200 m width. Sympatrically with cultivated rice (Collection No.**C37**).
W39	**L**	June 14	Vohitraivo	33 km northeast from Antsapanimahazo and 1 km southwest from Vohitraivo. Paddy field and small stream.
W40	**L**	June 15	Alaotra	In CALA, Complexe Agronomique du lac Alaotra. Experimental Rice Field.
W41	**L**	June 15	Imerimandroso	3 km south from Imerimandroso and 4 km north from Madiorano. Paddy field.

W42	**L**	June 15	Madiorano	Near Rice Mill. Bevondrona Village. Paddy field.
W43	**L**	June 17	Tamatave	5 km north from Tamatave. Swamp, 50 m x 200 m.
W44	**L**	June 17	Tamatave	10 km north from Tamatave. Large river, paddy field and waste land.
W45	**L**	June 19	Tamatave	57 km south from Fenerive and 35 km north from Tamatave. River side and swamp.
W46	**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.
W47	**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.
W48	**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.
W49	**L**	July 5	Ifakara	1 km south from the gate of TARO, Tanzania Agricultural Research Organization, Lumeno. Paddy field, 200 m x 50 m.
W50	**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.
W51	**L**	July 5	Ifakara	4 km from TAC, Mahutansa. Small stream.
W52	**L**	July 5	Ifakara	5 km northeast from Mahutansa. Shallow water paddy field, 300 m x 200 m.
W53	**L**	July 8	Kyela	117 km south from Mbeya, and 2 km south from Kyela. Paddy field and a lotus pond, 200 m x 50 m.
W54	**L**	July 8	Kyela	12 km south from Kyela. Swamp, 300 m x 1 km.
W55	**L**	July 8	Kyela	5 km south from Kyela. Paddy field and large pond.
W56	**L**	July 9	Ihahi	14 km north from Chimala. Meandering road through large areas of *Miscanthus* sp. field.
W57	**L**	July 9	Mbarari	NAFCO, National Agriculture and Food Corporation, in Mbarari. 20 km north from Igawa. Stocked-seeds in the office.
W84	**P**	July 9	Mbarari	NAFCO in Mbarari. 20 km north from Igawa. Stocked-seeds in the office.
W85	**P**	July 13	Dodoma	56 km west from Dodoma and 14 km east from Bahi Swamp. Paddy field.
W86	**P**	July 13	Manyoni	102 km west from Dodoma and 14 km east from Manyoni. Small river.
W87	**P**	July 13	Issuna	5 km north from Issuna and 50 km north from Manyoni. Man-created pond, 20 m x 50 m.
W88	**P**	July 14	Singida	68 km northwest from Singida and 23 km southeast from Shelui. Half-dried up irrigation canal.
W58	**L**	July 14	Shelui	15 km west from Shelui. Paddy field.
W59	**L**	July 15	Nzega	17 km northwest from Nzega. Large pond, 500 m x 200 m.
W60	**L**	July 15	Kahama	36 km west from Kahama. Road-side swamps, 10 m x 500 m, 10 m x 10 m and 10 m x 100 m.

W61	**L**	July 16	Kigoma	6 km east from Kigoma. Small pond, 3 m x 10 m and the flowing small stream.
W62	**L**	July 16	Kigoma	6 km east from Kigoma. Small pond, 10 m x 50 m. Connected with **W61** site by small stream-pipe under main road.
W63	**L**	July 17	Ujiji	1 km south from Ujiji City. Waste land. *Cyperus* sp. dominant.
W64	**L**	July 17	Ujiji	1 km south from Ujiji City. 200 m far from shore of the Tanganyika Lake. Waste land, 200 m x 200 m.
W65	**L**	July 17	Ujiji	1 km south from Ujiji City. Waste land, 200 m x 300 m.
W66	**L**	July 19	Uvinza	95 km east from Kigoma and 39 km north from Uvinza. Waste land, 50 m x 300 m.
W89	**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 **W66** and **W89**, but growing allopatrically.
W67	**L**	July 19	Uvinza	In Uvinza City. Waste land, 50 m width. Riverbed of Malagarasi River.
W68	**L**	July 20	Kasulu	8 km north from Kasulu. Waste land and small stream.
W69	**L**	July 21	Ibada	22 km east from Geita. Ibada Village. Swamps, 500 m x 1 km in north and south sides each.
W70	**L**	July 22	Kakurgusi	10 km northwest from Sengerema. Kakurgusi Village. Shallow water paddy fields.
W71	**L**	July 22	Mhalu	30 km northwest from Sengerema, 20 km northwest from Kakurgusi, and 5 km southeast from Nyakalilo. Waste land.
W72	**L**	July 23	Mwanza	13 km east from Mwanza. Paddy field.
W73	**L**	July 23	Mwanza	43 km east from Mwanza and 10 km east from Nyanguge Village. Swampy area, 10 m x 300 m.
W74	**L**	July 23	Mwanza	43 km east from Mwanza and 10 km east from Nyanguge Village. The same habitat as **W73**, but differentiated.
W90	**P**	July 23	Mwanza	43 km east from Mwanza and 10 km east from Nyanguge Village. Nearly the same habitats of **W73** and **W74**.
W75	**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.
W91	**P**	July 23	Mwanza	Nearly the same habitat of **W75**. Mainly along water canal, and a few plants in paddy field.
W76	**L**	July 23	Mwanza	54 km east from Mwanza. Entrance position for the habitats of **W75** and **W91**. Waste grass land and small pond, dia. 10 m, *Cyperus* sp. dominant. Paddy field.
W92	**P**	July 23	Mwanza	54 km east from Mwanza. Entrance position for the habitats of **W75** and **W91**. Nearly the same habitat of **W76**. Small pond of *Cyperus* sp. dominant.

W93	**P**	July 23	Mwanza	54 km east from Mwanza. Entrance position for the habitats of **W75** and **W91**. Paddy field.
W94	**P**	July 23	Mwanza	54 km east from Mwanza. Entrance position for the habitats of **W75** and **W91**. Waste land, 500 m x 200 m. 100 m far from main road.
W77	**L**	Aug. 1	Mtwango	Mtwango Village. Swamp, 100 m x 300 m in one side and paddy field in another side.
W95	**P**	Aug. 1	Mtwango	Mtwango Village. Swamp, 100 m x 2 km. Paddy field.
W96	**P**	Aug. 1	Kilombero	Just south village of Kilombero. Waste land and cultivated rice species, *O. glaberrima* (Collection No. **C206**). Field of Experimental Station. Waste land. Sympatrically with *O. glaberrima* to some extent.
W78	**L**	Aug. 1	Kilombero	Kilombero Village. Picked up from cultivated rice grains, spread on mat for drying.
W97	**P**	Aug. 1	Upenja	Just south of Upenja Village. Paddy field, 4 km north from habitat of **W78**.
W98	**P**	Aug. 1	Upenja	Upenja Village. Paddy field and waste land.
W99	**P**	Aug. 1	Upenja	Upenja Village. Waste land and road. Just west side of site of **W98**.
W79	**L**	Aug. 1	Bumbwi	Bumbwi Village. Waste land.
W100	**P**	Aug. 1	Bumbwi	Bumbwi Village. Waste land. Growing allopatrically with **W79**.
W80	**L**	Aug. 1	Bumbwi	Bumbwi Village. Road-side irrigation canal, 2 m width, 1 m depth, 50 cm water depth.
W101	**P**	Aug. 2	Mwanakombo	Mwanakombo Village. 10 km south from Mkokotoni Village. Waste land, and already harvested upland rice field.
W102	**P**	Aug. 2	Kasole	Kasole Village and 3 km south from Mwanakombo Village. Waste land.
W81	**L**	Aug. 2	Kibombani	Kibombani Village in Kasole region, 3 km south from Kasole Village. Upland agricultural fields. Upland rice field.
W103	**P**	Aug. 4	Kibirinzi	Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy field.
W82	**L**	Aug. 4	Kibirinzi	Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy field. 300 m north from site of **W103**, but continuous paddy field from there.
W104	**P**	Aug. 4	Kibirinzi	Kibirinzi Village, 5 km from Kilimo Regional Office. Paddy field. Partially growing sympatrically with *O. longistaminata* (**W82**).
W83	**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, **W82**, **W103** and **W104**.
W105	**P**	Aug. 4	Ole	Ole City. Ole Agricultural Experiment Station. Waste land and upland rice field.
W106	**P**	Aug. 4	Ole	Just northwest from Ole Agricultural Experiment Station. Paddy field of the station.

W107	**P**	Aug. 5	Ruvu	Ruvu Village. Paddy field of NAFCO, National Agriculture and Food Corporation.
W108	**P**	Aug. 5	Ruvu	Ruvu Village. Paddy field of NAFCO. 50 m far from the site of **W107**.
W109	**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 x 200 m and 50 m x 200 m.

Natural habitats of the collected materials, including both of the species concerned in the text were exhibited in Figs. 2~6 on the whole strains [17,18]. In this paper, other small informations on the habitats were illustrated in Fig. 2 from the several viewpoints; outlines of habitats, of environmental distribution and of geo-topographical conditions, have been described.

1. --- W31 -- Ambondramamy, Madagascar. A "dumpling stuffed with minced pork" shaped paddy field, 100 m x 300 m, surrounded by waste land, waste land, living houses and home gardens, and small stream in north, west, south and east sides, respectively. Main road is separated from small stream, slowly flowing, by low bush, which is slightly going down, growing thickly in small streams and sporadically in paddy field. Low bush discharges itself as defence for animals to paddy field. A spider weaves its web on the bush, which keeps shedding rice grains.
2. --- Tamatave, Madagascar. Small river running across the main road, making a right angle. Inserted large swamps. Growing thickly only along the boundary river and swamp. Showing high seed sterility. No seed was collected.
3. --- Tamatave, Madagascar. River side. Growing sporadically and thickly in west and east sides of the main road, respectively. Mainly flowering stage. Showing high seed sterility. Growing many Leguminous trees.
4. --- Ivuna, Tanzania. Lake Rukwa, Nkanga Village. Gradually enlarging its area year by year. Growing only in the boundary of lake. Changing in wet and dry seasons. It is said that growing area of the wild rice becomes gradually decreasing due to several natural causes.
5. --- Msembe, Iringa, Tanzania. Elliptical pond, 10 m x 30 m, 10 m far from main road. Growing large trees, a kind of Acacia surrounding the pond. Wild rice growing sporadically only near the trees, but not in the pond proper.
6. --- Chalinze, Tanzania. Slightly sloped down from main road. Under shade of large mango and other trees which are dominant.
7. --- Mkokotoni, Zanzibar, Tanzania. Living area and waste land, 600 m x 1 km. Growing sporadically and dis-connectedly in mid area and at north edge. Surrounded by main road, upland rice field, sweet potatoes and living houses, relatively wet waste land, lowland rice field in the east, south, west and south sides, respectively. Outskirt of these areas, adjacent to forest, coconut fields, mango fields in south, west and north sides, respectively.

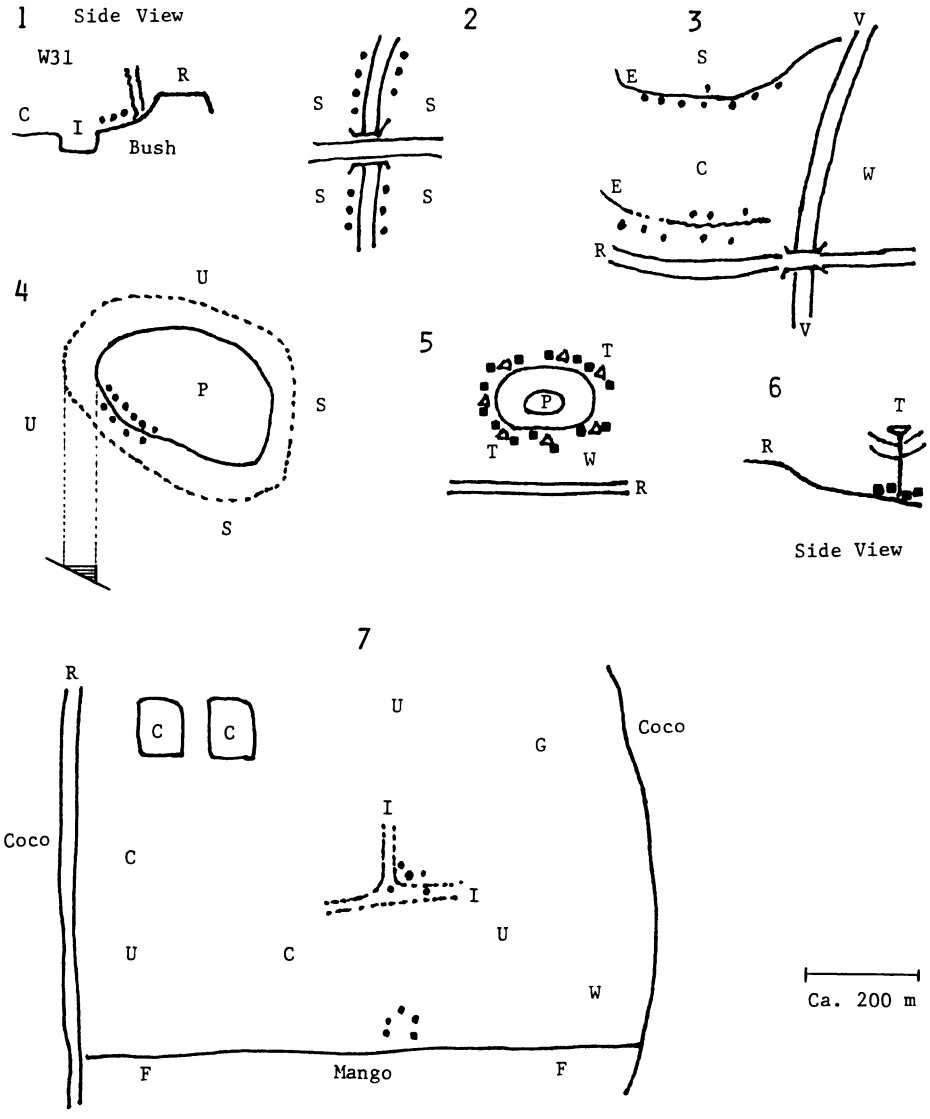

Fig. 2. Sketch maps of habitats of wild rice population. Circle dot [●] and square mark [■] show *Oryza longistaminata* CHEV. et ROEHR. and *Oryza punctata* KOTSCHY, respectively. C; cultivated rice field, P; pond or small water pool, R; road, V; river or small stream, I; irrigation canal, S; swamp, W; waste land, F; forest, G; grass land, T; tall tree, U; upland cultivated field.

Some morphological characters of unhusked grains

Eighty-three strains of *Oryza longistaminata* and 26 strains of *Oryza punctata* were collected on this trip, and they were used for morphological investigations of the unhusked grains.

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 the 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 values in the whole strains.

The results are given in Table 2. In this table, 6 morphological characters of the unhusked grains were illustrated by average values of the respective 3 groups; *i.e.*, *O. longistaminata* ---**A**: Madagascar [47 strains], **B**: Tanzania [36 strains], *O. punctata* --- **C**: Tanzania [26 strains]. The whole data were calculated, basing on the data mentioned in the respective papers.

I. *O. longistaminata*

Lengths for the individual grain level ranged from 11.00 mm (W57) to 5.80 mm (W27). In the strain level, the longest (9.53 mm) was obtained in W69, followed by W57 (9.48 mm) and W58 (9.34 mm). The shortest (6.72 mm) was noted in W9, followed by W11 (6.85 mm) and W10 (6.99 mm). In the group level, value of **B** was clearly larger than that of **A**. Average and its standard deviations through the whole strains (=83) belonging to groups **A** and **B** were found to be 8.26±0.61.

In the standard deviations of each strain, *i.e.*, those showing intra-population's variations, the largest (0.74) was obtained in W51, followed by W57 (0.72) and W76 (0.70). The smallest (0.26) was noted in W15, followed by W10, W28 and W42 (0.32). In the group level, value of **A** was larger than value of **B**. Average and its standard deviations through the whole strains belonging to groups **A** and **B** were found to be 0.49± 0.11

Widths for the individual grain level ranged from 4.10 mm (W51) to 1.70 mm (W1,

Table 2. Six morphological characters of unhusked grains illustrated by average values of the respective groups; *O. longistaminata* --- **A**: Madagascar (MD) [47 strains]: **B**: Tanzania (TA) [36 strains]; *O. punctata* --- **C**: Tanzania (TA) [26 strains]

Country	Group mark	Length (mm)	Width (mm)	Thickness (mm)	L/W	L/T	W/T
MD	**A**	7.93±0.52	2.26±0.19	1.52±0.10	3.54±0.26	5.26±0.30	1.50±0.09
TA	**B**	8.70±0.41	2.34±0.17	1.63±0.07	3.77±0.24	5.37±0.24	1.44±0.07
TA	**C**	5.96±0.25	2.29±0.11	1.51±0.05	2.62±0.15	3.96±0.20	1.52±0.07

W11, W27 and W56). In the strain level, the widest (2.80 mm) was obtained in W51, followed by W23 (2.69 mm) and W22 (2.67 mm). The narrowest (1.98 mm) was noted in W2, followed by W1 and W27 (2.00 mm). In the group level, value of **B** was clearly larger than value of **A**. Average and its standard deviations through the whole strains (=83) belonging to groups **A** and **B** were found to be 2.29 ± 0.19.

In the standard deviations of each strain, the largest (0.50) was obtained in W51, which was the same as in case of the length, followed by W56 (0.27) and W74 (0.26). It was noticed that the value was particularly large in W51. The smallest (0.10) was noted in W24 and W76, followed by W5 and W6 (0.11). In the group level, value of **A** was larger than that of **B**. Average and its standard deviations through the whole strains belonging to groups **A** and **B** were found to be 0.18 ± 0.05.

Thicknesses for the individual grain level ranged from 2.20 mm (W51), which was the same as in case of the width, to 1.00 mm (W62). In the strain level, the thickest (1.83 mm) was obtained in W45 and W51, in which the latter was the same as in case of the width, followed by W46 (1.82 mm). The thinnest (1.36 mm) was noted in W26, followed by W27 (1.37 mm) and W24 (1.40 mm). In the group level, value of **B** was clearly larger than that of **A**. Average and its standard deviations through the whole strains (=83) belonging to groups **A** and **B** were found to be 1.57 ± 0.11.

In the standard deviations of each strain, the largest (0.18) was obtained in W43 and W51, in which the latter was the same as in cases of the length and width, followed by W7, W61 and W62 (0.17). The smallest (0.07) was noted in W18, W26, W35, W55, W64 and W77. In the group level, value of **A** was larger than that of **B**. Average and its standard deviations through the whole strains belonging to the groups of **A** and **B** were found to be 0.11 ± 0.03.

Ratios of length to width (abbreviated as L/W in the table) for the individual grain level ranged from 5.08 (W59) to 2.41 (W51). In the strain level, the largest (4.13) was obtained in W67, followed by W48 (4.12) and W54 (4.10). The smallest (3.09) was obtained in W46, followed by W19 (3.16) and W18 (3.22). In the group level, value of **B** was clearly larger than that of **A**. Average and its standard deviations through the whole strains (=83) belonging to the groups of **A** and **B** were found to be 3.64 ± 0.26.

In the standard deviations of each strain, the largest (0.52) was obtained in W51, which was the same as in cases of the length, width and thickness, and W56, followed by W59 (0.51). The smallest (0.15) was noted in W44, followed by W24 (0.21) and W43 (0.22). In the group level, value of **A** was larger than that of **B**. Average and its standard deviations through the whole strains belonging to the groups of **A** and **B** were found to be 0.33 ± 0.08.

Ratios of length to thickness (abbreviated as L/T in the table) for the individual grain level ranged from 7.54 (W22) to 3.87 (W21). In the strain level, the largest 5.87 (W54), followed by W15 (5.77) and W58 (5.75). The smallest (4.69) was noted in W19, followed by W9 and W45 (4.70). In the group level, value of **B** was larger than that of

A. Average and its standard deviations through the whole strains (=83) belonging to the groups of **A** and **B** were found of be 5.31±0.28.

In the standard deviations of each strain, the largest (0.76) was obtained in W62, followed by W21 and W58 (0.71). The smallest (0.11) was noted in W28, which was noticeable as a very small value in the whole strains, followed by W13 (0.23) and W39 (0.28). In the group level, value of **A** was clearly larger than that of **B**. Average and its standard deviations through the whole strains belonging to the groups of **A** and **B** were found to be 0.47±0.10.

Ratios of width to thickness (abbreviated as W/T in the table) for the individual grain level ranged from 2.40 (W62) to 1.05 (W21), which was the same as in case of the ratio of length to thickness (L/T). In the strain level, the largest (1.74) was obtained in W23, which was the same as in case of the width, followed by W22 (1.72), which was also the same as in case of the width, and W21 (1.69). The smallest (1.33) was noted in W1 and W67, followed by W48 (1.34). In the group level, value of **A** was larger than that of **B**. Average and its standard deviations through the whole strains (=83) belonging to the groups of **A** and **B** were found to be 1.47±0.08.

In the standard deviations of each strain, the largest (0.52) was obtained in W34, followed by W62 (0.26), and W21 and W22 (0.22). It was noticeable that the value was particularly large in W34. The smallest (0.09) was noted in W67 and W76, in which the latter was the same as in case of the width, followed by W6, W38, W60 and W77 (0.10). In the group level, value of **A** was clearly larger than that of **B**. Average and its standard deviations through the whole strains belonging to the groups of **A** and **B** were found to be 0.14±0.03.

II. *O. punctata*

Lengths for the individual grain level ranged from 7.40 mm (W91) to 4.80 mm (W100 and W106). In the strain level, the longest (6.42 mm) was obtained in W91, followed by W93 (6.36 mm) and W92 and W102 (6.33 mm). The shortest (5.51 mm) was noted in W90, followed by W106 (5.52 mm) and W105 (5.67 mm). Average and its standard deviations in the whole strains were found to be 5.96±0.25.

In the standard deviations of each strain, the largest (0.56) was obtained in W91, followed by W94 (0.53) and W93 (0.48). The smallest (0.28) was noted in W84 and W98, followed by W85 (0.31). Average and its standard deviations in the whole strains were found to be 0.40±0.07.

Widths for the individual grain level ranged from 2.80 mm (W85 and W98) to 1.70 mm (W89). In the strain level, the widest (2.52 mm) was obtained in W98 and W102, followed by W85 (2.43 mm). The narrowest (2.04 mm) was noted in W89, followed by W90 (2.12 mm) and W105 (2.16 mm). Average and its standard deviations in the whole strains were found to be 2.29±0.11.

In the standard deviations of each strain, the largest (0.21) was obtained in W108, followed by W88 (0.20), and W87, W92, W94, W95 and W99 (0.19). The smallest

(0.11) was noted in W84, followed by W98, W101 and W109 (0.12). Average and its standard deviations in the whole strains were found to be 0.16 ±0.03.

Thicknesses for the individual grain level ranged from 1.80 mm (W93) to 1.30 mm (W86, W89, W90, W93, W94, W102, W103 and W105). In the strain level, the thickest (1.61 mm) was obtained in W85 and W98, followed by W88 (1.60 mm). The thinnest (1.43 mm) was noted in W90 and W105, followed by W102 (1.44 mm). Average and its standard deviations in the whole strains were found to be 1.51±0.05.

In the standard deviations of each strain, the largest (0.12) was obtained in W93, followed by W91, W92, W106, W108 and W109 (0.10). The smallest (0.06) was noted in W87, W95, W99 and W104. Average and its standard deviations in the whole strains were found to be 0.08±0.01.

Ratios of length to width (abbreviated as L/W in the table) for the individual grain level ranged from 3.70 (W91) to 1.93 (W87). In the strain level, the largest (2.96) was obtained in W91, followed by W89 (2.93) and W92 (2.90). The smallest (2.39) was noted in W106 and W109, followed by W98 (2.46). Average and its standard deviations in the whole strains were found to be 2.62±0.15.

In the standard deviations of each strain, the largest (0.41) was obtained in W108, followed by W89 and W95 (0.36). The smallest (0.12) was noted in W103, followed by W101 (0.13), and W98 and W106 (0.17). Average and its standard deviations in the whole strains were found to be 0.26±0.08.

Ratios of length to thickness (abbreviated as L/T in the table) for the individual grain level ranged from 5.46 (W93) to 3.00 (W99, W100 and W108). In the strain level, the largest (4.42) was obtained in W102, followed by W91 (4.29) and W93 (4.27). The smallest (3.65) was noted in W106, followed by W99 (3.71) and W107 (3.73). Average and its standard deviations in the whole strains were found to be 3.96±0.20.

In the standard deviations of each strain, the largest (0.47) was obtained in W93, followed by W91 (0.45) and W92 (0.43). The smallest (0.22) was noted in W85, followed by W98 (0.25) and W96 (0.27). Average and its standard deviations in the whole strains were found to be 0.33±0.06.

Ratios of width to thickness (abbreviated as W/T in the table) for the individual grain level ranged from 2.12 (W102) to 1.15 (W95 and W100). In the strain level, the largest (1.76) was obtained in W102, followed by W103 (1.64) and W109 (1.62). The smallest (1.39) was noted in W95, followed by W89 (1.41), and W91 and W107 (1.46). Average and its standard deviations in the whole strains were found to be 1.52±0.07.

In the standard deviations of each strain, the largest (0.17) was obtained in W92, W94 and W100. The smallest (0.10) was noted in W86, followed by W84, W88, W90, W103 and W106 (0.11). Average and its standard deviations in the whole strains were found to be 0.13±0.02.

Summary

During the period from May to August in 1988, the writer was sent to 2 countries of Africa, *i.e.*, Madagascar and Tanzania, for collection of the wild and cultivated rices. During the trip, 109 strains of wild rice, *i.e.*, 47 and 36 strains of *Oryza longistaminata* CHEV. et ROEHR. in Madagascar and Tanzania, respectively, and 26 strains of *Oryza punctata* KOTSCHY in Tanzania, were collected, and many populations of those 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 8.26 mm ± 0.61, 2.29 mm ± 0.19, 1.57 mm ± 0.11, 3.64 ± 0.26, 5.31 ± 0.28 and 1.47 ± 0.08 in length, width, thickness, ratios of length to width, of length to thickness, and of width to thickness, respectively, in case of the *Oryza longistaminata*. Strains W51, collected in Ifakara, and W69 in Ibada, Tanzania, showed larger values in the respective characters. It is noticeable that values of group averages in view of practical data in 5 characters were clearly smaller in strains collected in Madagascar than those in Tanzania, excepting for the ratio of width to thickness (W/T). On the contrary, values of group averages in view of standard deviations were clearly larger in strains collected in Madagascar than those in Tanzania through the whole of 6 characters.

In case of *Oryza punctata*, average values and the standard deviations in the whole strains were found to be 5.96 mm ± 0.25, 2.29 mm ± 0.11, 1.51 mm ± 0.05, 2.62 ± 0.15, 3.96 ± 0.20 and 1.52 ± 0.07, respectively, in the same order. It was noticed that the populations of W98 collected in Upenja and W102 in Kasole, Tanzania, showed very large values in length and width.

Basing on the analyses of the data obtained in field surveies, morphological, genetical and ecological characters, geographical, ecotypic and varietal differentiations could be discussed to give us some conclusions in the near future.

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