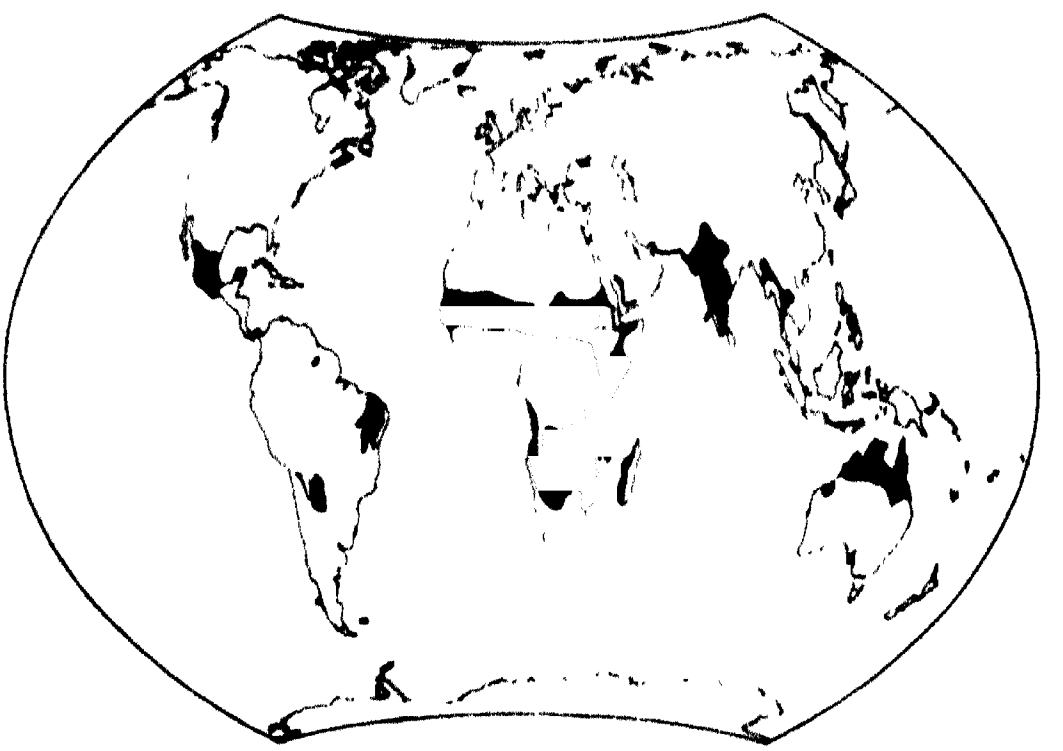
INTERNATIONAL PEARL MILLET DISEASE RESISTANCE TESTING PROGRAM (IPMDRTP)

PROGRESS REPORT: PM Path.-64



REPORT OF THE 1980 INTERNATIONAL PEARL MILLET RUST NURSERY (IPMRN)

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ABSTRACT

The 1980 International Pearl Millet Rust Nursery (IPMRN), containing 30 entries, was sent to cooperators at 7 Indian locations. The results were obtained from 6 locations. Screening of test entries was effective at Pune, Kudumiamalai, Kovilpatti and Bhavanisagar. Two entries 700481-21-8 and IP-2084-1 developed ≤ 10 percent rust at all locations and 6 others including P-15, 700481-35-7, IP-537-B, F_1R-2045 x 2789, Souna Mali and D-212-P_1 also performed well. Of these, 700481-21-8, Souna Mali, 700481-35-7 and IP 537-B showed high levels of rust resistance at all the test locations in 1979.

RESUME

En 1980, la Pépinière internationale de la rouille du mil à chandelle (International Pearl Millet Rust Nursery, IPMRN) comprenait 30 entrées. Elles ont été envoyées aux coopérateurs et évaluées sur sept emplacements situés en Inde. On a obtenu les résultats provenant de six emplacements. Le criblage des entrées d'essai a été efficace à Pune, Kudumianalai, Kovilpatti et Bhavanisagar. Deux entrées 700481-21-8 et IP-2084-1 ont montré ≤ 10% de rouille sur tous les emplacements et six autres, incluant P-15, 700481-35-7, IP-537-B, F_1R-2045 x 2789, Souna Mali et D-212-P_1, se sont bien comportées aussi. 700481-21-8, Souna Mali, 700481-35-7 et IP 537-B avaient de haute niveaux de résistance à la rouille sur tous les emplacements en 1979.

INTRODUCTION

One of the major objectives of the ICRISAT Pearl Millet Pathology Program is to identify broad-spectrum stable resistance to the important pearl millet diseases. The approach adopted to meet this objective is to expose promising lines to many populations of the pathogens under a wide range of environmental conditions. In 1977 a Preliminary Pearl Millet Rust Nursery (PPMRN) with 74 test entries selected in two seasons screening at Hyderabad and Bhavanisagar was tested at six locations in India with the help of cooperators. Considerable interest was shown in this nursery and requests were received from additional scientists to participate in the nursery. In view of this, the International Pearl Millet Rust Nursery (IPMRN) was initiated in 1978. In 1980 the trial was sent to seven locations in India. At the time of preparation of this report results were received from six locations.

A brief report on results is given here so that breeders and pathologists can make use of the data in planning their future activities.

TEST LOCATIONS AND COOPERATORS

Details of the test locations and cooperators from whom results were received by March 30, are given in Table 1. The locations represent an excellent coverage of Indian locations where severe rust pressure occurs annually.

ENTRIES

The trial contained 30 entries, including 19 germplasm lines selected at ICRISAT and Bhavanisagar, and the 11 best entries from the 1979 IPMRN. The cooperators were invited to include a local susceptible check as an indicator of local rust pressure.

SCREENING AND SCORING METHODS

All screening was conducted under natural rust occurrence. The incidence/severity assessment was made using Cobb's modified scale. A visual score of 20 plants per entry randomly selected in each replication was taken and an average was calculated. The rust scores of lower and upper leaves (top four leaves) were taken separately,

RESULTS

Detailed data are presented in Table 2-5. The results from the top 4 leaves only are being explained here since they are of most importance in contribution to yield. A summary of rust infection of the top 4 leaves is presented in Table 5.

Rust Pressure at Test Locations

Rust pressure was low at Ludhiana. No entry averaged more than 10 percent rust. Thirteen entries developed ≤ 5 percent rust in both the replications. The rust on the susceptible check ranged from 10 to 14 percent.

At Hissar rust was low to moderate. Though no entry was rust free, 25 of the test entries had ≤ 15 percent rust in both the replications. Rust on the local susceptible check was also low (5-25%).

At Bhavanisagar light to moderate rust developed. No entry was rust free. Seven entries had ≤ 5 percent rust and seven others had ≤ 10 percent rust in both the replications. In the remaining entries, rust ranged from 11-46 percent. Rust on the susceptible check ranged from 25-50 percent.

At Kudumiamalai rust pressure was moderate. No entry was rust free. Five entries had ≤ 5 percent and 3 others had ≤ 10 percent rust in both the replications. On the remaining entries, rust ranged from 11 to 61 percent. Entry MLC-SN-6-1-2 was the most susceptible with 61 percent rust in both the replications. Mean rust on the local susceptible check ranged from 30 to 38 percent.

At Kovilpatti also, moderate rust developed on the majority of the test entries. No entry had less than 5 percent rust and 700481-21-8 and IP-2084-1 were the only entries with less than 10 percent rust in both the replications. However, the majority of the entries had between 11 and 25 percent rust. The susceptible check developed 21 to 40 percent rust.

The highest rust pressure of all the locations occurred at Pune. No entry was rust free. D-212-P1 and P-15 had less than 5 percent rust.

In other entries, rust ranged from 11 to 66 percent. Local susceptible check developed 35 to 72 percent.

Performance of Entries Across Locations

In Table 5 the entries are ranked on the maximum rust on the upper leaves at any location. Where the rust incidence values are same for more than one entry, these entries are ranked on across locations mean severity values. The mean of rust values recorded on local susceptible checks was low at Hissar and Ludhiana, moderate at Bhavanisagar, Kudumlamalai and Kovilpatti, and high at Pune.

No entry was rust free at all locations. Eight entries averaged $\leq$ 10 percent overall mean rust. Of these, the 700481-21-8 and IP-2084-1 developed $\leq$ 10 percent rust at all locations and P-15 had $\leq$ 10 percent rust at all locations except at Kovilpatti. Other promising entries include Souna Mali, D-212-P1, 700481-7-5 and IP-537-B.

Distinct differential reactions among locations were observed for several entries, Table 6.

OTHER DISEASES

Observations on natural infection of downy mildew, ergot, and smut on the 1980 IPMRN entries was taken at Hissar, Pune and Kovilpatti.

Hissar

Downy mildew (DM): No entry was DM free. Ten entries including 700481-22-8, 700481-35-5, 700481-21-8, 700481-23-2, MLC-SN-92-1-1, Collection-95,

D-75-C-1, P-24, P-39 and P-25 had ≤ 10 percent mean DM. 700481-34-8 showed the highest DM incidence (32%).

Ergot: 700557-2-5 was ergot free. 700481-21-8, IP-1662-L, D-72, 700481-23-2, MLC-SN-6-1-2, P-212-P1, P-29, P-15 and P-17 showed ≤ 5 percent mean ergot incidence. The highest mean ergot incidence was 23 percent.

Smut: Smut infection was less severe. D-212-P1, P-2084-1, P-1451, P-24 and P-29 were smut free. All the other entries with the exception of P-39, P-1449, D-130, Collection-95, and D-72, had ≤ 10 percent smut.

Pune

Downy mildew: DM pressure was extremely low. Souna Mall, P-1662 and P-1438 were the only entries that developed less than 5 percent DM.

Ergot: 700481-22-8 and P-24 were ergot free. On the remaining entries, ergot incidence ranged from 10-22 percent.

Smut: Low smut developed. All the entries except IP-1662-L, P-29 and P-25 were either free or had ≤ 5 percent smut.

Kovilpatti

P-1438 showed little DM incidence. IP 1662-L, MLC-SN-6-1-2 had 5-10 percent ergot, and P-1438 alone showed 5 percent smut. Other entries were free from the diseases.

DISCUSSION

Natural rust pressure was adequate at Pune, Kudumiamalai, Kovilpatti and Bhavanisagar, and thus, the screening of test entries was effective at these locations. Several of the best entries from the previous years' trials including 700481-21-8, 700481-7-5 and 700481-35-7 have shown rust resistance again this year confirming the stability of their resistance.

The origin of the best 10 entries for rust is in West Africa, suggesting that, like downy mildew, West African millets are a rich source for rust resistance also. The distinct differential reactions of several entries among locations are interesting. However, prior to drawing any conclusions, these entries will be retested in the following years to test the validity of the results obtained.

THE 1981 IPMRN

The IPMRN will be continued in 1981. Several new sources of resistance that performed well at Bhavanisagar during 1980 will be included. Entries for this trial are welcome from scientists in national programs provided they have been shown to be rust resistant at the home locations.

SEED SUPPLY

Scientist who want seed of any entry listed in this report should

send a request to the Principal Pathologist (millets) at ICRISAT (address given on the back cover of this report) indicating that the seed requested is from the 1980 IPMRN.

Table 1. Test locations and cooperators in the 1980 IPMRN

Locations	Cooperators
Ludhiana	D.P. Thakur
Hissar	S.S. Chahal
Pune	B.D. Patil & P.A. Shinde
Bhavanisagar	S.D. Singh
Kudumiamalai	S. Muthusamy
Kovilpatti	R. Jagannathan

Table 2. Percent rust incidence of 30 entries and local susceptible in the 1980 IPMRN at Hissar and Ludhiana.

Entry	HISSAR				LUDHIANA			
	Rep. I		Rep. II		Rep. I		Rep. II	
	L.L.	U.L.	L.L.	U.L.	L.L.	U.L.	L.L.	U.L.
700481-22-8	1	4	3	4	30	7	5	1
700481-7-5	1	3	2	14	28	4	30	6
700557-2-8	4	22	4	21	6	4	33	7
IP-537-B	2	9	4	15	23	2	30	2
700481-34-8	3	14	3	11	1	1	18	1
700481-35-5	2	4	3	9	45	9	40	2
Souna Mali	3	15	2	7	18	2	23	3
700481-21-8	1	4	2	14	2	1	6	1
700481-33-1	2	9	2	11	33	2	18	2
IP-1662-L	3	8	2	9	40	4	35	3
D-72	2	6	3	13	38	10	43	7
700481-35-7	2	6	3	15	35	7	15	2
700481-23-2	1	5	3	15	3	1	4	1
MLC-SN-92-1-1	4	21	2	8	58	14	48	6
MLC-SN-6-1-2	3	11	2	19	28	6	28	4
Collection-95	2	8	2	12	25	4	43	6
F_1R-2045x2789	2	13	4	13	25	2	35	6
D-75-C-1	2	11	2	15	23	3	38	4
D-130	2	3	2	7	38	4	33	4
D-212-P_1	1	7	4	23	3	1	8	1
IP-2084-1	3	3	2	11	33	11	30	5
P-1449	3	10	3	23	28	4	35	5
P-1451	1	9	4	20	48	14	30	2
P-24	1	3	3	19	48	6	30	4
P-29	2	5	2	8	33	4	45	6
P-39	2	12	3	11	33	3	40	6
P-1438	2	7	3	12	43	4	38	3
P-17	2	9	3	13	43	11	23	4
P-25	4	12	3	14	23	5	30	3
P-15	0	0	2	12	13	4	40	7
Local susceptibles[a/]	3	16	2	17	61	12	54	11
Location mean for entries		1		2		5		4

a/ Mean of 3 plots in each replication
L.L. - Lower leaves
U.L. - Upper leaves

Table 3. Percent rust incidence of 30 entries and local susceptible in the 1980 IPMRN at Bhavanisagar and Kudumiamalai.

Entry	BHAVANISAGAR				KUDUMIAMALAI			
	Rep. I		Rep. II		Rep. I		Rep. II	
	L.L.	U.L.	L.L.	U.L.	L.L.	U.L.	L.L.	U.L.
700481-22-8	25	5	25	6	5	2	5	2
700481-7-5	-	-	65	18	5	6	5	6
700557-2-8	25	2	40	11	18	12	0	3
IP-537-B	25	2	25	6	0	1	5	1
700481-34-8	40	9	25	3	18	13	8	9
700481-35-5	40	22	25	5	10	7	3	8
Souna Mali	25	4	10	4	23	10	18	11
700481-21-8	25	2	25	6	5	1	0	1
700481-33-1	33	7	10	3	8	10	5	11
IP-1662-L	40	26	40	18	33	18	0	1
D-72	65	10	65	34	25	24	3	8
700481-35-7	40	4	25	4	0	1	0	1
700481-23-2	40	3	10	5	18	15	3	7
MLC-SN-92-1-1	100	35	65	31	65	61	65	61
MLC-SN-6-1-2	100	46	40	25	40	35	18	21
Collection-95	40	5	65	10	33	22	25	25
F_1R-2045x2789	25	4	10	2	3	1	5	8
D-75-C-1	65	31	33	8	53	43	10	17
D-130	40	3	25	2	25	21	8	12
D-212-P_1	25	5	25	6	5	11	10	14
IP-2084-1	10	5	-	-	3	5	3	5
P-1449	40	18	40	13	65	33	33	19
P-1451	65	46	65	39	10	24	10	24
P-24	65	10	25	14	25	29	10	36
P-29	40	5	40	11	53	49	10	27
P-39	25	6	25	8	40	37	53	41
P-1438	25	5	10	1	25	21	-	1
P-17	65	16	65	18	10	17	18	18
P-25	65	38	65	45	5	9	8	13
P-15	40	5	10	2	8	6	-	1
Local susceptibles[a/]	65	33	77	32	40	34	40	35
Location mean for entries		13		12		18		14

a/ Mean of 3 plots in each replication
L.L. - Lower leaves
U.L. - Upper leaves

Table 4. Percent rust incidence of 30 entries and local susceptible in the 1980 IPMRN at Kovilpatti and Pune.

Entry	KOVILPATTI				PUNE			
	Rep. I		Rep. II		Rep. I		Rep. II	
	L.L.	U.L.	L.L.	U.L.	L.L.	U.L.	L.L.	U.L.
700481-22-8	33	15	33	14	50	36	60	55
700481-7-5	45	11	53	25	20	12	15	7
700557-2-8	33	14	18	7	35	9	60	45
IP-537-B	25	10	33	12	55	40	20	10
700481-34-8	53	31	53	22	-	-	55	35
700481-35-5	25	9	33	11	50	37	25	11
Souna Mali	33	14	33	18	35	19	25	13
700481-21-8	18	6	33	7	-	-	8	8
700481-33-1	33	15	33	21	55	42	45	26
IP-1662-L	83	32	53	22	80	65	35	16
D-72	25	18	33	11	35	22	60	44
700481-35-7	53	26	33	11	30	16	0	0
700481-23-2	53	33	45	14	20	12	55	39
MLC-SN-92-1-1	53	27	40	23	25	11	55	38
MLC-SN-6-1-2	40	20	53	21	70	66	40	51
Collection-95	33	10	33	14	15	8	45	30
F_1R-2045x2789	38	12	18	11	55	40	20	8
D-75-C-1	33	15	33	19	-	-	55	34
D-130	83	27	33	14	25	23	60	35
D-212-P_1	33	21	33	21	5	2	5	4
IP-2084-1	18	6	18	6	25	19	5	1
P-1449	53	19	33	25	45	32	25	12
P-1451	65	47	65	27	40	48	40	26
P-24	53	39	65	32	30	19	10	2
P-29	18	12	45	26	30	17	25	11
P-39	25	13	33	16	25	11	30	11
P-1438	45	13	33	16	50	45	45	31
P-17	33	19	53	32	60	45	30	7
P-25	18	11	33	17	35	27	35	20
P-15	40	24	33	17	5	2	8	2
Local susceptibles[a/]	53	32	46	27	77	64	67	50
Location mean for entries		19		18		24		21

a/ Mean of 3 plots in each replication
L.L. - Lower leaves
U.P. - Upper leaves

Table 5. Percent mean rust incidence, location mean and range of 30 IPMRN entries and means of local susceptibles at five locations during 1980 rainy season.

Entry	Ludhiana	Hissar	Bhavanisagar	Kudumalai	Kovilpatti	Pune	Mean[a/]	Range[b/]
700481-21-8	1	9	4	1	7	4	4	1-14
IP-2084-1	8	7	5	5	6	10	7	1-19
Souna Mali	3	11	4	11	16	16	10	2-19
D-212-P_1	1	15	6	13	21	3	10	1-23
P-15	6	6	4	4	21	2	7	1-24
700481-7-5	5	9	18	6	18	10	11	2-25
700481-35-7	5	11	4	1	19	8	8	1-26
Collection-95	5	10	8	24	12	19	13	4-30
P-1449	5	17	16	26	22	22	18	4-33
700481-34-8	1	13	6	11	27	18	13	1-35
D-130	4	5	3	17	21	29	13	2-35
700481-35-5	6	7	14	8	10	24	12	2-37
700481-23-2	1	10	4	11	24	26	12	1-39
P-24	5	11	12	33	36	11	16	2-39
IP-537-B	2	12	4	1	11	25	9	1-40
F_1R-2045x2789	4	13	3	5	12	24	10	1-40
P-39	5	12	7	39	15	11	15	3-41
700481-33-1	2	10	5	11	18	34	14	2-42
D-75-C-1	4	13	20	30	17	17	17	3-43
D-72	9	10	22	16	15	33	18	6-44
P-1438	4	10	3	11	15	38	12	1-45
700557-2-8	6	22	7	8	11	27	14	2-45
P-25	4	13	42	11	14	24	18	3-45
P-17	8	11	17	18	26	26	18	4-45
P-1451	8	15	43	24	37	37	27	2-48
P-29	5	7	8	38	19	14	15	5-49
700481-22-8	4	4	6	2	15	46	13	1-55
MLC-SN-92-1-1	10	15	33	61	25	25	28	6-61
IP-1662-L	4	9	22	10	27	41	19	1-65
MLC-SN-6-1-2	5	15	36	28	21	59	27	4-66
Local susceptible mean[c/]	12	17	33	35	30	57		11-64
Location mean for entries	4	11	12	16	18	23		1-24

a/ Means calculated before values were rounded off
b/ Based on individual replication
c/ Means of five replications

Table 6. Differential rust reactions of selected entries in the 1980 IPMRN

Entry	Rust incidence (%)					
	Hissar	Ludhi-ana	Bhavani-sagar	Kudumia-malai	Kovil-patti	Pune
700481-22-8	4	4	6	2	15	46
700481-33-1	10	2	5	11	18	34
IP-1662-L	9	4	22	10	27	41
D-72	10	9	22	16	15	33
MLC-SN-92-1-1	14	10	33	61	25	25
MLC-SN-61-2	15	5	36	28	21	59
P-1451	14	8	43	24	37	37
P-29	7	5	8	38	19	14
P-39	12	5	7	39	15	11

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