Singh, S.D
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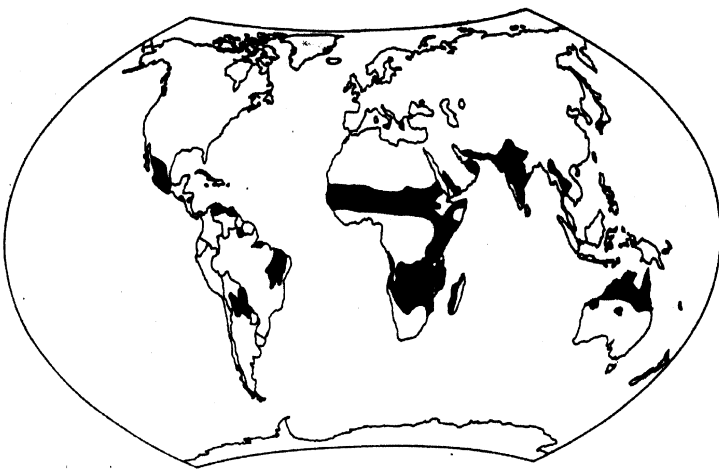
Progress Report:MP 113

INTERNATIONAL PEARL MILLET DISEASE RESISTANCE TESTING PROGRAM

(IPMDRTP)



REPORT OF

THE EIGHTH (1984) INTERNATIONAL PEARL MILLET RUST NURSERY

(IPMRN)

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics
ICRISAT, Patancheru, P.O., Andhra Pradesh, 502324, India

ABSTRACT

The 1984 International Pearl Millet Rust Nursery (IPMRN), containing 45 entries, was sent to cooperators at seven locations in India. The results were received from six locations. Rust pressure was most severe at ICRISAT Center followed by Pune and Bhavanisagar and moderate at other locations, except at Durgapura where it was low. No entry was rust free at all locations. Seven entries developed no more than 10% rust on the upper four leaves at any of the six locations. These included (P 1564, P 1581, P 1591, P 1592, P 140 and 700481-21-8) that showed high levels of rust resistance in tests in previous year. Among the entries that were included for the first time, 7042-1-4-4 and D 322/1/2-3 showed high levels of rust resistance. Two entries, P 1581 and P 140, were identified as having high levels of combined resistance to downy mildew and rust.

RESUME

La Pépinière internationale de la rouille de petit mil (IPMRN) pour 1984, comprenant 45 entrées a été envoyée aux coopérateurs à sept emplacements en Inde. Des résultats ont été obtenus de six emplacements. L'incidence de la rouille a été la plus forte au Centre ICRISAT, suivie de Pune et de Bhavanisagar. L'incidence a été moyenne sur d'autres emplacements, sauf à Durgapur où elle a été faible. Aucune entrée n'a été exempte de rouille à tous les emplacements. Sept entrées n'ont développé que 10% de rouille sur les quatre feuilles supérieures à l'un ou l'autre des six emplacements. Les entrées P 1564, P 1581, P 1591, P 1592, P 140 et 700481-21-8 qui ont figuré parmi elles, se sont montrées très résistantes dans les essais antérieurs. Parmi les entrées incluses pour la première fois, 7042-1-4-4 et D 322/1/2-3 ont eu de très bonne résistance à la rouille. On a identifié deux entrées, P 1581 et P 140, ayant une forte résistance à la fois au mildiou et à la rouille.

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THE 1984 INTERNATIONAL PEARL MILLET RUST NURSERY

(IPMRN)

INTRODUCTION

One of the major objectives of the ICRISAT Pearl Millet Pathology Program is to identify broad-spectrum stable ressistance to important pearl millet diseases. The approach adopted to meet this objective is to expose promising lines to populations of the pathogen at geographically diverse locations. 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. In the following years, requests were received from additional scientists to participate in this nursery. In view of this, the International Pearl Millet Rust Nursery (IPMRN) was initiated in 1978 and has continued in each succeeding year. In 1984 the trial was sent to cooperators at seven locations in India and the 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 are given in Table 1. The locations represent good coverage of Indian locations where severe rust often occurs annually.

ENTRIES

The trial contained 45 entries including 23 germplasm accessions selected after their rust evaluation at ICRISAT and Bhavanisagar, and 22 entries with good performance from the 1983 IPMRN. NHB 3 was used as the local susceptible check at all locations.

SCREENING AND SCORING METHODS

Screening was conducted under natural rust occurrence at all locations. The severity assessment was made using Cobb's modified scale. A visual score of each of 20 plants per 2-row plot randomly selected in each replication was taken and an average was calculated. The rust scores of lower and upper leaves (top four leaves) were separately taken at about the dough stage.

RESULTS

Detailed data for the lower and upper leaves for all locations by replication are presented in Tables 2-4. However, the results obtained from the top four leaves only are discussed here since they are of most importance in contributing to yield.

Performance of Entries at Different Locations

Durgapura: Entries were evaluated under low rust pressure. Highest rust recorded on test entries was 7% and local susceptible check averaged only 13% rust.

Ludhiana: Rust pressure was low. Local susceptible check averaged 25% rust. Though only two entries, 7042-1-4-4 and P 536-2, were rust free, none developed more than 10% rust.

Kovilpatti: Entries were evaluated under low to moderate rust pressure. Local susceptible check averaged only 28% rust. Eleven entries were rust free and all other except five entries (D 212-P1, IP 8877-3, IP 8695-4, P 462-4 and IP 8714-1) developed 10% rust or less.

Bhavanisagar: Severe rust developed at this location. NHB 3 (local susceptible check) averaged 72% rust. Three test entries, P 542, P 2950, and SAD 421, developed more than 25% rust. However, four entries, P 1564, 7042-1-4-4, P 1581 and P 548, were rust free and 14 other entries developed 5% rust or less.

Pune: Entries were evaluated under moderate rust pressure. Though no entry was rust free, 17 entries developed 5% or less rust. Four entries, P 24, 45-331, IP 8714-1 and J 1798) developed 25% rust and one entry, SAD 421, showed high susceptibility (67%).

ICRISAT Center: Most severe rust developed at ICRISAT Center. Though the local susceptible check averaged only 55% rust, all the entries except one, 7042-1-4-4, developed rust and 16 entries developed more than 25% rust.

Performance of Entries Across Locations

Across location performance of entries is presented in Table 5. No entry was rust free at all locations. However, three entries P 1584, 7042-1-4-4, and P 1581, developed 5% or less rust at all locations and four other entries, P 1591, P 1592, P 140, and 700481-21-8, had 10% or less rust at all locations. Fifteen entries (including seven above) developed ≤5% mean rust across locations and included 12 entries that showed good rust resistance in previous years' of the IPMRN. Amongst the other entries advanced from the 1983 IPMRN, SAD 421 performed worst with 42-67% rust at Bhavanisagar, ICRISAT, and Pune, while others had light to moderate rust at one or two of these locations.

Fourteen of the 1984 IPMDMN entries were evaluated for rust in the 1984 IPMRN. Two of these entries, P 1591 and P 140, developed <10% rust at all locations. Several other entries developed slightly more rust only at ICRISAT Center, Pune or at Bhavanisagar. One entry P 2950, appeared to be susceptible to rust and downy mildew (DM).

Performance of entries that have been screened for 2-8 years are presented in Table 6. Several of these entries have generally shown low levels of rust at all locations each year.

Other diseases

Records on natural occurrence of DM and ergot were taken only at Pune.

DM. Twenty seven entries were reported DM free. The remaining entries, except 7042-1-4-4 and J 1798, which developed 34 and 19% DM respectively, had less than 10% DM. The local susceptible check averaged 20% DM.

Ergot. No entry was ergot free. Nineteen entries developed less than 10% ergot and on the remainders ergot severity ranged from 11-33%. Ergot severity on local susceptible ranged from 3-8%.

DISCUSSION

Natural rust pressure was good at ICRISAT Center, Bhavanisagar, and Pune, moderate at Kovilpatti, and low at Ludhiana and Durgapura. Seven entries, P 1564, 7042-1-4-4, P 1581, P 1591, P 1592, P 140, and 700481-21-8, showed high levels of resistance and there were several others which showed good levels of locations non-specific resistance at the majority of the locations. Of the 23 entries that were advanced from the 1983 IPMRN, eight entries, P 2890, 45-373, 700481-22-8, P 542, P 1588, P 2880, 45-331, and SAD 421, developed more than 25% rust at one or two of the locations. The reasons for their increased susceptibility will be looked into during the 1985 testing season.

Two entries, P 1591 and P 140, with a high degree of combined resistance to DM and rust were identified. These two entries will again be tested to confirm their reactions before their utilization in breeding program. Several other entries with a high degree of DM resistance also showed good rust resistance at several locations. Further selection in these lines will be made to isolate lines with

combined resistance to DM and rust.

7042-1-4-4, a selection from original population of 7042, remained rust free, as expected, at Bhavanisagar, ICRISAT Center, Kovilpatti and at Ludhiana. It has, however, developed 1-2% rust at Kovilpatti and Durgapura. Whether this has been due to seed mixture from other sources or due to its susceptibility to the rust populations at these locations needs further investigation.

The 1985 IPMRN

The IPMRN will be continued in 1985. Several new sources of resistance from germplasm screened at Bhavanisagar during the 1984 rainy season will be included. Entries for this trial are welcome from scientists in the national program provided they have been shown to be rust resistant at the home locations.

SEED SUPPLY

Scientists who want seed of any entry listed in this report should send a request to Millet Pathologists at ICRISAT (address given on inside back cover of this report) indicating that the seed request is from the 1984 IPMRN.

Table 1. Test locations and cooperators in the 1984 IPMRN

Locations	Cooperators
Ludhiana	S.S. Chahal
Durgapura	Govind Singh
Pune	G.K. Patil, B.S. Patil and Y.S. Jadhav
Kovilpatti	R. Jagannadham
Bhavanisagar	S.D. Singh
ICRISAT Center	S.D. Singh and P. Malla Reddy

Table 2. Percent mean rust severities[a] of entries in the 1984 IPMRN et Durgapura and Ludhiana

Entry	Durgapura				Ludhiana			
	Lower leaves		Upper leaves		Lower leaves		Upper leaves	
	R1	R2	R1	R2	R1	R2	R1	R2
P 24	3	13	2	4	5	5	<1	<1
P 140	5	5	1	3	15	15	3	2
P 462-4	3	0	0	0	10	15	4	1
P 536-2	0	0	0	0	0	0	0	0
P 542	3	10	1	7	25	25	2	4
P 548	8	13	4	10	10	10	1	1
P 615	3	3	1	1	15	15	2	3
P 618	3	3	0	1	5	5	<1	0
P 1449-4	3	0	0	0	30	38	3	3
P 1564	0	0	0	0	5	0	1	0
P 1577	0	5	0	2	30	13	8	2
P 1581	5	0	4	0	5	5	<1	<1
P 1588	8	8	1	2	35	35	7	8
P 1591	5	0	1	0	15	15	1	2
P 1592	5	8	4	3	5	5	0	<1
P 1596	8	8	2	6	0	5	0	<1
P 2880	3	8	0	3	20	25	5	1
P 2890	5	3	2	1	20	20	2	3
P 2895-3	3	0	0	0	5	5	1	0
P 2933-1	3	3	0	1	25	20	2	4
P 2950	8	15	1	7	10	5	2	1
IP 6147-4	5	0	2	0	10	10	2	1
P 94/1/2-1	5	0	2	0	15	15	2	1
IP 2084-1	3	3	<1	1	10	10	2	1
IP 6138-3	5	3	1	1	20	20	3	2
IP 6140-1	0	0	0	0	5	5	0	<1
IP 6240-2	0	0	0	0	30	25	5	4
IP 8695-4	5	0	2	0	10	10	1	2
IP 8714-1	3	3	0	2	25	30	2	2
IP 8877-3	0	0	0	0	10	10	2	1
IP 8998-1	10	0	2	0	25	25	3	1
700481-21-8	8	8	4	4	7	10	<1	1
700481-22-8	28	8	11	3	33	38	4	1
700481-23-2	10	13	6	9	5	5	1	1
700516-2	0	0	0	0	30	25	3	2
700651-11	5	0	2	0	30	30	4	3
7042-1-4-4	5	3	2	1	0	0	0	0
45-329	5	13	3	7	50	40	13	7
45-331	13	15	3	8	5	5	<1	0
J 1798	8	8	1	4	40	50	7	13
45-373	10	10	7	8	20	20	4	2
D 212-P1	5	3	1	1	-	-	-	-
D 332/1/2-3	0	3	0	1	5	5	0	0
SAD 421	8	13	3	8	20	20	3	5
Souna Mali	5	5	2	2	20	20	5	2
Location mean for entries	5	5	2	2	16	16	3	2
Local susceptible (NHB 3)[b]	20	20	11	14	62	63	24	27

[a]Figures were "rounded-off" to the nearest whole number except <1.

[b]Mean of five plots in each replication.

Table 3. Percent mean rust severities[a] of entries in the 1984 IPMRN at Kovilpatti and Bhavanisagar

Entry	Kovilpatti				Bhavanisagar			
	Lower leaves		Upper leaves		Lower leaves		Upper leaves	
	R1	R2	R1	R2	R1	R2	R1	R2
P 24	10	10	2	0	40	65	11	12
P 140	25	25	4	0	25	10	2	1
P 462-4	65	45	33	10	40	10	13	2
P 536-2	40	10	6	0	10	5	1	0
P 542	5	10	0	2	100	25	55	4
P 548	5	10	0	0	5	5	0	0
P 615	25	10	9	2	53	65	5	19
P 618	5	5	0	0	25	40	8	5
P 1449-4	25	10	2	3	25	25	5	7
P 1564	10	0	2	0	0	0	0	0
P 1577	5	10	0	2	25	5	7	0
P 1581	25	10	0	0	5	5	0	0
P 1588	45	10	3	7	40	65	13	4
P 1591	25	5	0	0	10	25	1	1
P 1592	10	65	2	16	5	10	<1	<1
P 1596	25	10	14	7	40	25	7	8
P 2880	5	10	0	2	40	40	10	14
P 2890	10	5	0	0	40	10	2	0
P 2895-3	5	5	0	0	25	10	9	0
P 2933-1	25	10	4	2	65	65	17	19
P 2950	40	40	3	13	65	100	21	43
IP 6147-4	10	40	1	8	10	40	2	8
P 84/1/2-1	25	25	6	14	25	25	8	4
IP 2084-1	5	10	0	0	40	25	6	8
IP 6138-3	25	25	14	7	40	25	9	1
IP 6140-1	10	10	3	2	40	40	20	11
IP 6240-2	5	25	0	1	25	65	6	20
IP 8695-4	40	10	35	2	65	65	23	12
IP 8714-1	40	40	28	7	40	40	9	15
IP 8877-3	25	85	6	30	40	25	8	5
IP 8998-1	10	25	2	4	40	40	10	12
700481-21-8	5	10	0	8	10	65	2	18
700481-22-8	5	10	2	0	40	40	8	4
700481-23-2	5	25	0	0	10	25	1	3
700516-2	5	10	0	0	40	65	14	27
700651-11	40	25	4	8	40	40	14	16
7042-1-4-4	0	0	0	0	0	0	0	0
45-329	10	25	0	7	40	65	17	16
45-331	25	10	2	3	40	40	6	16
J 1798	25	25	2	2	40	65	10	6
45-373	5	10	0	0	10	40	2	9
D 212-P1	53	25	20	5	-	32	-	8
D 332/1/2-3	5	10	0	2	10	40	1	3
SAD 421	10	10	6	2	65	100	35	50
Souna Mali	10	10	2	0	25	10	3	2
Location mean for entries	19	18	5	4	32	36	9	9
Local susceptible (NHB 3)[b]	54	47	30	25	85	100	58	86

[a]Figures were "rounded-off" to the nearest whole number except <1.

[b]Mean of five plots in each replication.

Table 4. Percent mean rust severities[a] of entries in the 1984 IPMRN at Pune and ICRISAT Center

Entry	Pune				ICRISAT Center			
	Lower leaves R1	Lower leaves R2	Upper leaves R1	Upper leaves R2	Lower leaves R1	Lower leaves R2	Upper leaves R1	Upper leaves R2
P 24	40	54	18	35	25	40	4	17
P 140	15	5	3	2	40	25	9	10
P 462-4	24	15	7	3	65	65	44	38
P 536-4	26	20	4	1	25	40	15	15
P 542	22	16	8	3	25	40	17	26
P 548	2	7	0	0	25	25	13	14
P 615	27	28	8	12	40	40	12	14
P 618	4	8	0	1	40	40	22	24
P 1449-4	16	16	7	6	40	40	23	17
P 1564	0	0	0	0	5	5	1	<1
P 1577	8	5	0	0	33	40	18	21
P 1581	2	5	0	0	10	10	5	5
P 1588	12	27	7	13	65	65	55	20
P 1591	8	6	2	0	25	40	8	6
P 1592	0	0	0	0	10	5	5	<1
P 1586	35	18	18	12	40	40	22	27
P 2880	37	52	18	28	40	65	30	28
P 2890	20	23	6	12	40	65	31	36
P 2895-3	26	34	9	13	65	53	19	28
P 2933-1	31	53	17	29	65	53	60	30
P 2950	38	42	15	25	65	53	38	40
IP 6147-4	3	6	0	0	40	25	21	13
P 94/1/2-1	62	58	18	19	25	40	18	29
IP 2084-1	18	30	6	14	40	33	18	12
IP 6138-3	6	6	0	0	65	65	43	53
IP 6140-1	4	6	0	0	33	33	18	14
IP 6240-2	18	9	7	2	53	40	17	30
IP 8695-4	31	30	7	2	25	40	23	25
IP 8714-1	43	55	23	31	65	65	35	36
IP 8877-3	34	50	3	3	33	40	24	25
IP 8998-1	31	24	13	3	40	40	21	27
700481-21-8	8	21	4	8	8	10	3	6
700481-22-8	22	27	10	18	33	65	25	33
700481-23-2	22	10	8	3	25	25	12	15
700516-2	32	41	17	23	40	40	28	27
700651-11	46	42	17	13	65	40	58	30
7042-1-4-4	2	0	0	0	0	0	0	0
45-329	50	61	15	30	65	83	53	54
45-331	41	51	23	30	40	55	36	40
J 1798	58	60	37	31	100	65	55	46
45-373	22	31	10	16	53	53	24	29
D 212-P1	-	-	-	-	-	-	-	-
D 332/1/2-3	26	45	9	12	25	25	13	10
SAD 421	80	80	67	66	65	65	55	32
Souna Mali	26	32	12	16	25	25	10	10
Location mean for test entries	25	27	10	12	40	42	24	23
Local susceptible (NHB 3)[b]	76	70	58	56	79	83	56	54

[a]Figures were "rounded-off" to the nearest whole number except <1.

[b]Mean of five plots in each replication.

Table 5. Percent mean rust severities[a] location mean and ranges of 45 IPMRN entries and means of the local susceptible check at six locations during the 1984 rainy season

Entry	Locations						Mean[a]	Range[b]
	Durgapura	Ludhiana	Kovilpatti	Bhavanisagar	Pune	ICRISAT Center		
P 1584	0	1	1	0	1	1	<1	0-2
7042-1-4-4	2	0	0	0	1	0	1	0-2
P 1581	2	<1	0	0	1	5	1	0-5
P 1591	<1	2	0	1	1	7	2	0-8
D 212-P1	1	-	13	2	-	-	2	1-20
P 1592	3	<1	9	<1	1	3	3	0-16
P 140	2	2	2	2	3	9	3	0-10
P 536-2	0	0	3	<1	3	15	3	0-15
P 548	7	1	0	0	1	13	3	0-14
D 332/1/2-3	<1	<1	1	2	11	11	4	0-13
700481-21-8	4	1	4	10	6	5	5	0-18
IP 6147-4	1	1	5	5	1	17	5	0-21
700481-23-2	7	1	0	2	6	14	5	0-15
P 1577	1	5	1	3	1	20	5	0-21
P 618	1	<1	0	7	1	23	5	0-24
Souna Mali	2	3	1	2	15	10	6	0-16
IP 6140-1	0	<1	2	15	1	16	6	0-20
IP 2084-1	1	2	0	7	11	15	6	0-18
P 1448-4	0	3	2	6	7	20	6	0-23
P 2895-3	0	<1	0	5	11	24	7	0-28
P 615	1	3	5	12	11	13	7	1-19
IP 6240-2	0	5	1	13	5	24	8	0-30
P 2890	2	3	0	1	9	33	8	0-36
IP 8998-1	1	2	3	11	9	24	8	0-27
P 24	3	<1	1	12	27	10	9	0-35
IP 8877-3	0	2	18	6	4	25	9	0-30
45-373	7	3	0	5	13	27	9	0-29
700481-22-8	7	2	1	6	15	29	10	0-33
P 94/1/2-1	1	2	10	6	19	23	10	0-29
P 1596	4	<1	10	7	15	24	10	0-27
P 542	4	3	1	29	6	21	11	0-55
IP 6138-3	1	3	10	5	1	48	11	0-53
IP 8695-4	1	1	18	17	5	24	11	0-35
P 1588	1	7	5	9	10	37	11	1-55
P 2860	2	3	1	12	24	29	12	0-30
700516-2	0	3	0	20	20	27	12	0-28
P 482-4	0	3	21	7	5	41	13	0-44
700651-11	1	4	6	15	16	44	14	0-58
45-331	5	<1	2	11	27	41	14	0-46
P 2933-1	1	3	3	18	23	45	15	0-60
IP 8714-1	1	2	17	12	27	35	16	0-36
P 2950	4	1	8	32	20	39	17	1-43
J 1798	2	10	2	8	34	50	18	1-55
45-329	5	10	3	16	25	53	19	0-54
SAD 421	5	4	4	42	67	43	27	2-67
Location mean for test entries	2	2	4	9	12	24	9	
Local susecptible (NHB 3)[c]	13	25	28	72	58	55	41	

[a]Figures were "rounded-off" to the nearest whole number except <1.

[b]Based on individual replication.

[c]Mean of ten plots from two replications.

Table 6. Performance of 16 rust resistant entries and susceptible check across locations[a] in 2-8 years (1977-1984) of testing in India

Entry	Origin	Mean rust severity (%)							
		'77	'78	'79	'80	'81	'82	'83	'84
700481-21-8	Nigeria	7(0-25)[b]	11(0-30)	4(0-8)	4(1-9)	4(0-11)	2(0-5)	5(0-11)	5(1-10)
700481-22-8	Nigeria	8(0-25)	6(0-26)	2(0-5)	13(2-46)	5(0-15)	4(0-12)	5(1-14)	10(1-29)
700481-23-2	Nigeria	7(0-25)	5(0-20)	6(0-8)	12(<1-26)	6(0-20)	5(2-7)	9(0-31)	5(0-14)
IP 537 B	USA	0[c]	7(0-36)	3(0-8)	9(1-25)	6(0-17)	11(0-25)	-	-
Souna Mali	Mali	-	-	4(3-5)	10(3-16)	6(0-21)	8(<1-27)	11(3-30)	6(1-15)
IP 2084-1	India	-	-	-	7(5-10)	6(0-16)	6(1-11)	3(1-7)	6(0-15)
P 24	Cameroon	-	-	-	16(5-36)	6(0-15)	10(1-36)	8(5-18)	9(0-27)
D 212-P1	Niger	-	-	-	10(1-21)	6(0-25)	11(0-30)	-	2(0-13)
P 140	Cameroon	-	-	-	-	-	-	6(0-12)	3(2-9)
P 615	Mali	-	-	-	-	-	-	8(1-16)	7(1-13)
P 1564	Senegal	-	-	-	-	-	-	3(<1-8)	0(0-1)
P 1577	Senegal	-	-	-	-	-	-	3(<1-7)	5(1-20)
P 1581	Senegal	-	-	-	-	-	-	1(0-5)	1(0-5)
P 1591	Senegal	-	-	-	-	-	-	2(0-5)	2(0-7)
P 1592	Senegal	-	-	-	-	-	-	5(1-10)	3(0-9)
P 2890	Niger	-	-	-	-	-	-	4(1-9)	8(0-33)
Susceptible Check		51(10-100)	42(12-79)	34(2-59)	31(12-57)	26(13-53)	34(19-56)	40(20-95)	41(13-72)

[a] Locations: Ludhiana; Durgapura; Pune; Bhavanisagar; Kudumiamalai; Kovilpatti; ICRISAT Center.

[b] Figures in Parentheses are severity ranges.

[c] This entry was tested only at Hyderabad and Bhavanisagar during the year 1977.

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