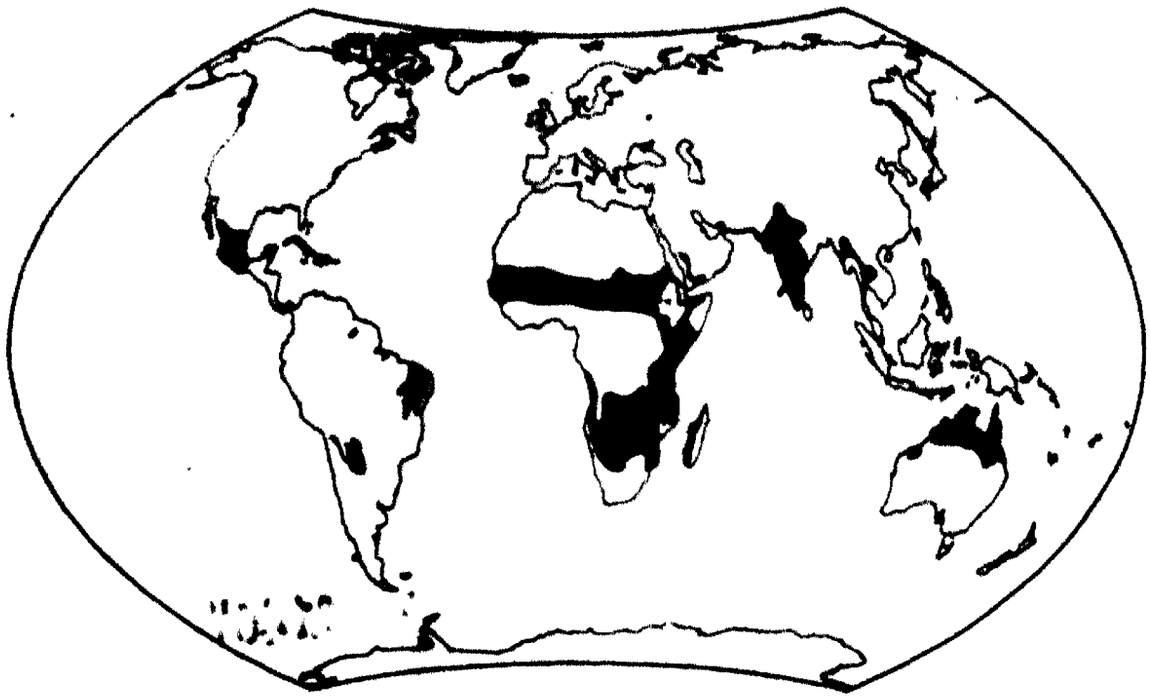
INTERNATIONAL PEARL MILLET DISEASE RESISTANCE TESTING PROGRAM

(IPMDRTP)

Progress Report: P.M. Path. 51



REPORT OF

THE 1980 INTERNATIONAL PEARL MILLET DOWNY MILDEW NURSERY

(IPMDMN)

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics

ICRISAT Patancheru P.O.

Andhra Pradesh 502 324, India

1981

ABSTRACT

In the 1980 International Pearl Millet Downy Mildew Nursery (IPMDMN), 45 pearl millet entries were sent for evaluation of reactions to downy mildew to cooperators at 20 locations in four countries. Aurangabad in India provided the most severe downy mildew pressure, followed by Kano and Samaru in Nigeria. One entry SDN-503 showed high level of downy mildew resistance at 8 of the test locations. 700651, 700516, 700251 and P-7 also performed well at all locations except at Aurangabad, Kano and Samaru. All these entries performed well in the preceding year's trials. Among the newly included entries, 700512 EB-298-2-1-8, MPP-7147-2-1, SSC-7218 and WC-8220 appeared to be promising.

RESUME

Dans le cadre de la Pépinière internationale pour le mildiou de mil à chandelle de 1980 (IPMDMN), 45 entrées de mil à chandelle ont été expédiées aux coopérateurs dans 20 emplacements de quatre pays, en vue de l'évaluation de leur réaction au mildiou. L'incidence de mildiou a été la plus sévère à Aurangabad, en Inde, suivi de Kano et de Samaru au Nigéria. Une entrée, SDN-503, a fait preuve d'une forte résistance sur neuf des emplacements expérimentaux. Les entrées 700651, 700516, 700251 et P-7 se sont également bien comportées sur tous les emplacements, excepté à Aurangabad, à Kano et à Samaru. Toutes ces entrées s'étaient bien comportées au cours des essais de l'année dernière. Parmi les nouvelles entrées, 700512-EB-298-2-1-8, MPP-7147-2-1, SSC-7218 et WC-8220 se sont révélées prometteuses.

INTRODUCTION

The International Pearl Millet Disease Resistance Testing Program (IPMDRTP) was initiated in 1976 with the establishment of the International Pearl Millet Downy Mildew Nursery (IPMDMN). The IPMDMN program is an international cooperative activity through which pearl millet cultivars are tested for degree and stability of resistance to downy mildew. The results of the 1976, 1977 and 1978 IPMDMN, which were tested by cooperators at more than 20 locations in six countries in Africa and Asia, indicated major differences between test entries in level and stability of downy mildew resistance, and between locations in the severity and virulence of the downy mildew pathogen (*Sclerospora graminicola*). As the trial provided valuable information there was considerable support for it to continue. In 1980 the fifth IPMDMN was distributed to cooperators at 20 locations in six countries in Africa and Asia. At the time of preparation of this report results have been received from twelve locations. The report is being prepared at this time, though all results have not been received, in order that the data and entries may be used in the 1981 main growing season.

TEST LOCATIONS AND COOPERATORS

Details of the test locations and the cooperators from whom data was received by January 20, 1981 are given in Table 1. The locations represent an excellent coverage of Indian and West African millet growing regions.

ENTRIES

The trial contained 45 test entries and cooperators were invited to include a local susceptible after every ten test entries to act as an "indicator" of local DM pressure. The majority of the 1980 IPMDMN entries were those that had performed well at all locations in the 1979 PRE-IPMDMN. The 11 best lines from the 1979 IPMDMN were also included.

RESULTS

Three infection parameters were calculated:

i) Percent infection 30 days after planting (% INF 30)

ii) Percent infection at final scoring (incidence)

iii) A combination of incidence and severity termed infection index (severity)

Detailed results from each location are presented in Tables 2 to 6, and a summary of the results is presented in Table 7. The results from Kovilpatti and Kudumiamalai were not included for there was no DM even in the susceptible checks.

Plant population was good at all the locations except at Pune, Hissar and Aurangabad where some entries had less than adequate plant number.

DM Pressure at Locations:

In Table 7 entries are ranked on maximum severity values, where severity values are the same for more than one entry these entries are ranked on across location mean severity values.

Hissar: All the test entries performed well. Fifteen test entries were DM free and with the exception of 700335 and BJ-104 which had 8 and 6% mean DM severity respectively, all the remaining entries had less than 3 percent DM. 7042, the standard susceptible check, had 48 percent DM and local susceptible check averaged 87 percent DM severity.

Jamnagar: Seventeen entries were DM free and the DM severity on the remaining entries was less than 10 percent. 7042 had 70 percent DM and local susceptible check averaged 74 percent DM severity.

Ludhiana: Fourteen entries were DM free. The remaining entries showed low susceptibility. 7042 had 60 percent DM and local susceptible check averaged 50 percent DM severity.

Pune: Nine entries were DM free. 700251 with a high stable resistance for several years developed 15% DM. The majority of remaining entries had less than 10 percent DM. 7042 developed low level of infection probably due to the death of early infected seedlings which disappeared unnoticed. DM severity on local susceptible check was also low (34%).

ICRISAT Center: Twelve test entries were DM free. BJ-104 and 7042 developed 43 and 58 percent DM severity respectively. All the remaining entries except ICH-241 had less than 7 percent DM. Local susceptible check averaged more than 90 percent DM showing thereby a high disease pressure in the trial.

Kamboinse: Five entries were DM free and thirty five entries developed less than 8 percent DM. Highest DM severity on test entries was 17

percent. 7042 developed high DM severity. However, DM severity was considerably low on the local susceptible check (32%).

Mysore: No entry was DM free. Twenty five entries recorded less than 10 percent DM. The DM severity on the remaining test entries ranged from 11-27 percent 7042 had 60 percent DM and local susceptible check averaged 59 percent DM. Thus the DM pressure at this location was acceptably high.

Samaru: No entry was DM free and only six entries including E-298-2-1-8, FcF4 1474-2-2-2, SSC-7218, MPP-7147-2-1, 700633, and 75-series-1 had less than 10 percent DM. As high as 61 percent DM severity was recorded on test entries (700335). 7042 had 98 percent DM. On local susceptible check DM severity was only 24 percent.

Kano: E-298-2-1-8, SDN-503, WC-8220, MPP-7147-2-1, NC-7158 and SDN-714 had less than 10 percent DM. ICH-241 an ICRISAT hybrid developed 73% DM. In other entries also DM severity was generally high. 7042 had 98% DM. Local susceptible check showed only 22 percent DM.

Aurangabad: No entry was DM free or even low susceptible. DM severity on test entries ranged from 23-45 percent. 7042 had 50 percent DM. The DM severity on local susceptible was 47 percent.

Performance of Entries Across Location

No entry was DM free at all the locations. Only one entry E-298-2-1-8 had across location mean severity of 5 percent. An additional 27 entries averaged less than 10 percent across location severity values and

include SDN 503, 700516, 700651, 700251 & P-7 all of which have performed well in the preceding year's trial. The mean and maximum severity values for all these five entries increased considerably in 1980, Table 8.

The performance of the 5 entries tested in 3-5 years of IPMDMN trial at ICRISAT Center, Kamboinse, Samaru and Kano is presented in Table 9. SDN 503 showed high level of DM resistance in all the years of test and at all the locations. Relatively high DM severity on this entry at Samaru and Kamboinse in 1979 appeared to be an error because the severity declined in the following year at both the locations. The ining 4 entries - 700516, 700251, 700651 and P-7 behaved differently at different locations. At the ICRISAT Center and Kamboinse, all these showed high DM resistance in all the 5 years. The resistance in the 5 entries at Samaru and P-7 and 700251 at Kano appears to be gradually eroding for the level of DM in these entries increased from 2-4 times more in 1980 when compared with the first testing year. 700516 and 700651 are susceptible at Kano.

Other Diseases

Ergot. Ergot was observed at 7 locations and was most severe at Samaru where 32 test entries developed $\geq$ 50 percent ergot. The incidence of ergot was also high at Kano, Kamboinse and Aurangabad. At Jamnagar, Pune and Mysore ergot incidence was light and the majority of the test entries had $\leq$ 10 percent ergot at the 3 locations, except J-1486 x

700787-2-10 and IP-2058 at Pune. No entry however, had less than 10 percent ergot at all locations. BJ-104 was the most susceptible entry at Aurangabad, Kano and Samaru with 45, 80 and 99 percent ergot respectively.

Smut. Smut was most severe at Hissar and Samaru with a range of 0-70 percent and 3-58 percent respectively at the two locations. At other locations the majority of the entries had less than 10 percent smut. 700792, 700590, J-76, IP-1930, SSC-7218, Fc F_4-1474-2-2-2, 700512 and 700251 were smut free at Hissar. 700251 is one of the best DM resistant entry also. No entry was smut free at other locations except 700792 and NC 7174 at Kamboinse. Four entries including 700792, 700590, J-76, and IP-1930 had $\leq$ 10 percent smut at all locations. 7042, a high DM susceptible entry, developed highest smut infection of all the test entries at Hissar, Kamboinse and Jamnagar with 70, 33 and 20% smut respectively. The entry was however free at Kano.

Rust. Rust was recorded at Jamnagar, Aurangabad, Mysore, Kano, Pune, Samaru and ICRISAT Center. At the latter two locations rust incidence was in traces only on a few entries. Rust incidence was also light at Aurangabad and Kano though all the entries had rust except 7042, NC-8220, EB-79-2-2 x EB at Kano. The most severe rust occurred at Mysore where 42 of the test entries showed susceptible reactions. Three entries including SDN 714, EB-83-2 and MPP-7147-2-1, however, remained rust free. No entry was rust free at Pune and Jamnagar and the range was from moderate to light at both the locations.

Blast. Blast was recorded at Aurangabad and Kano. No entry was free at either locations. However, the incidence was light at the two locations.

DISCUSSION

The operation of IPMDMN trial in the last five years had enabled us to identify reliable sources of DM resistance. In 1980 considerable increase in the mean and maximum severity values of the entries included in the several years of IPMDMN trial has been due to unusually high DM pressure obtained at Aurangabad this year (location mean for entries 31 percent in 1980 as compared with 2 percent in 1979 at Aurangabad). Such a vast difference in the DM pressure at a location is unusual and the reasons need to be investigated.

Several entries listed in Table 9 showed gradual erosion in resistance at Samaru and Kano. As discussed in earlier report this might probably be due to the gradual erosion of genes responsible for resistance, during the seed multiplication process which is being done here at ICRISAT. To avoid this type of gene loss it is suggested that the West African program pathologists should operate a disease resistance testing program similar to IPMDMN so that the seed production is done right at these locations.

THE 1981 IPMDMN

The IPMDMN will be continued in 1981 with a selection of the best 1980 IPMDMN entries and those lines that performed well in the 1980 PRE-IPMDMN.

SEED SUPPLY

Any scientist who would like to receive seed of any entry listed in this report should send a request to the Millet Pathologist at ICRISAT (address given on the cover of this report) indicating that the seed request is from the 1980 IPMDMN entries.

Table 1. Cooperators and locations in the 1980 IPMDMN from whom results were received by January 20, 1981

Cooperators	Locations	Country
K.M. Safeeulla	Mysore	India
S.D. Singh	ICRISAT	India
S.S. Chahal	Ludhiana	India
N.A. Thakar	Jamnagar	India
N.B. Pawar	Aurangabad	India
B.D. Patil	Pune	India
D.P. Thakur	Hissar	India
A.S. Mathar	Kovilpatti	India
S. Muthusamy	Kudumiamalai	India
N.V. Sundaram	Kano	Nigeria
N.V. Sundaram	Samaru	Nigeria
J.A. Frowd	Kamboinse	Upper Volta

Table 2. Plant population, downy mildew incidence (% incid.) and severity (%) of 45 entries and local susceptible in the 1980 IPMDON at Hissar and Jamnagar

Entry	Hissar						Jamnagar					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
P-7	76	42	0	0	0	0	87	88	1	2	1	2
700251	94	34	4	0	2	0	98	90	0	3	0	3
700335	68	51	10	14	5	11	103	87	5	5	4	3
700512	76	47	0	0	0	0	72	67	3	0	2	0
700516	66	40	0	5	0	2	102	84	1	1	1	1
700546	56	32	2	0	1	0	77	78	0	0	0	0
700590	72	43	3	2	1	1	81	103	0	0	0	0
700619	91	34	3	0	1	0	85	86	4	0	3	0
700633	67	43	0	0	0	0	95	81	0	0	0	0
700651	81	43	0	2	0	1	83	90	0	0	0	0
700706	102	44	4	2	2	1	105	113	2	0	2	0
700780	82	33	4	3	1	1	90	96	0	1	0	1
700792	56	29	7	0	4	0	67	76	0	0	0	0
7042	24	14	83	79	66	30	67	109	70	79	64	76
SDN-503	72	39	1	5	<1	3	73	99	1	3	1	3
SDN-714	109	44	0	0	0	0	84	105	0	0	0	0
J-76	72	39	1	3	<1	1	88	104	0	1	0	1
J-92-1	102	27	0	0	0	0	86	76	0	0	0	0
J-215-1	78	26	1	0	1	0	116	97	1	6	1	6
J-1593	65	41	0	0	0	0	79	65	0	2	0	1
J-1486 x 700787-2-10	59	31	0	0	0	0	119	82	0	0	0	0
IP-1930	36	25	0	4	0	1	80	68	0	0	0	0
IP-2037	52	36	4	0	1	0	75	84	0	1	0	1
IP-2058	65	25	0	0	0	0	86	117	0	1	0	1
NC-7158	68	35	0	0	0	0	92	72	0	0	0	0
NC-7174	86	37	0	0	0	0	92	77	0	1	0	1
NELC-8010	85	45	2	7	1	3	87	105	1	0	1	0
NC-8220	87	36	0	0	0	0	90	126	1	0	1	0
IVS-8038	89	41	2	7	1	4	114	102	1	2	1	2
IVS-8172	72	31	0	0	0	0	90	93	9	5	8	5
E-298-2-1-8	75	23	0	4	0	1	87	83	0	0	0	0
EB-18-3-1	81	36	1	3	<1	1	82	102	0	2	0	2
EB-83-2	48	36	0	0	0	0	101	93	0	0	0	0
EB-79-2-2 x EB-59-3-1	62	34	0	6	0	2	85	108	0	0	0	0
SSC-7218	90	42	1	5	1	2	89	90	0	0	0	0

Table 2 (Contd.)

Entry	Hissar						Jamnagar					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
R-238-1-2-1	76	33	0	0	0	0	81	94	0	1	0	1
IPP-7147-2-1	72	39	0	5	0	1	808	106	3	5	3	4
2989-109-1	58	38	0	3	0	1	65	79	0	0	0	0
75-Series-1	63	23	0	0	0	0	92	87	0	2	0	2
F_4PC-1474-2-8-2	58	44	0	2	0	1	817	104	2	3	1	8
T-128-3 x 700404-1-5-5	69	35	3	0	1	0	106	91	0	0	0	0
ICH-165	87	28	1	4	<1	1	78	93	0	0	0	0
ICH-226	81	38	1	5	<1	2	85	74	0	1	0	1
ICH-241	68	42	0	2	0	1	82	75	2	1	2	1
BJ-104	52	23	8	17	3	9	126	84	8	10	7	8
Local susceptible[a]	91	28	100	100	84	90	70	75	78	77	73	74

a/ Mean of five plots in each replication

Table 3. Plant population, downy mildew incidence (% incid.) and Severity (%) of 45 entries and local susceptible in the 1980 IPMDBN at Ludhiana and Pune

Entry	Ludhiana						Pune					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
P-7	52	40	0	0	0	0	36	27	14	0	6	0
70[illegible]	55	48	4	0	2	0	31	44	0	48	0	31
700335	68	54	3	7	2	4	36	40	8	10	2	3
700512	50	53	0	0	0	0	36	39	0	0	0	0
700516	61	45	0	0	0	0	29	28	0	0	0	0
700546	48	54	0	0	0	0	34	34	0	0	0	0
700590	55	52	6	4	3	2	37	37	5	0	1	0
700619	61	58	2	3	1	3	31	35	0	3	0	2
700633	58	61	3	2	2	2	29	37	0	6	0	4
700651	55	48	0	0	0	0	24	35	4	3	4	3
700706	54	56	6	4	3	3	28	34	0	35	0	18
700780	51	46	6	9	3	5	37	34	3	12	3	7
700792	52	48	4	4	2	2	28	30	0	7	0	5
7042	50	46	84	83	57	63	39	27	21	41	11	19
SDN-503	57	54	4	2	2	1	24	33	0	0	0	0
SDN-714	54	53	4	0	2	0	36	37	0	0	0	0
J-76	68	57	6	4	4	3	35	38	3	5	1	4
J-92-1	56	47	0	0	0	0	29	38	0	3	0	1
J-215-1	60	50	0	2	0	1	33	39	12	5	10	4
J-1593	60	51	0	2	0	1	33	40	15	13	9	5
J-1486 x 700787-2-10	60	58	2	0	1	0	23	38	0	3	0	1
IP-1930	58	39	0	8	0	6	37	35	0	3	0	1
IP-2037	55	45	0	2	0	2	28	37	39	0	21	0
IP-2058	52	48	0	0	0	0	34	33	0	6	0	2
NC-7158	50	47	0	0	0	0	38	39	0	0	0	0
NC-7174	56	54	0	0	0	0	35	29	6	3	6	1
NELC-8010	61	51	7	6	4	4	39	36	3	0	1	0
NC-8220	50	57	0	0	0	0	34	36	3	6	3	1
IVS-8038	52	55	8	7	4	4	34	39	6	8	5	6
IVS-8172	61	59	2	2	<1	1	37	30	8	7	5	6

Table 3 (Contd)

Entry	Ludhiana						Pune					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
F-298-2-1-8	37	53	0	0	0	0	33	31	0	0	0	0
EB-18-3-1	52	50	8	10	3	6	34	38	6	0	4	0
EB-83-2	45	87	0	0	0	0	32	36	9	0	2	0
EB-79-2-2 x EB-59-3-1	60	38	0	0	0	0	25	40	4	3	4	2
SSC-7218	54	54	0	2	0	2	35	33	0	0	0	0
R-238-1-2-1	60	49	0	6	0	5	30	32	3	0	1	0
MPP-7147-2-1	54	54	0	7	0	5	27	29	7	3	5	3
2989-109-1	60	44	0	0	0	0	32	39	6	13	4	7
75-Series-1	52	40	10	15	5	10	26	37	0	0	0	0
F_4 FC-1474-2-2-2	62	54	7	6	3	4	38	33	3	9	1	8
T-128-3 x 700404-1-5-5	57	54	7	4	4	1	39	37	0	3	0	3
ICH-165	48	52	4	2	2	1	25	27	0	4	0	4
ICH-226	54	57	6	7	3	5	32	37	6	38	2	15
ICH-241	55	50	2	0	1	0	33	37	9	38	4	16
BJ-104	57	52	11	10	7	8	21	25	19	28	5	19
Local susceptible[a/]	51	50	65	87	40	61	32	35	42	57	28	41

a/ Mean of five plots in each replication

Table 4. Plant population, downy mildew incidence (% incid.) and severity (%) of 45 entries and local susceptible in the 1980 IPMDMN at ICRISAT and Kamboinse

Entry	ICRISAT						Kamboinse					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
P-7	130	132	1	0	1	0	89	46	0	0	0	0
700251	160	122	0	1	0	1	81	47	1	2	1	2
700335	141	127	6	7	6	6	67	66	16	17	13	15
700512	104	86	0	1	0	1	69	78	0	6	0	6
700516	157	122	1	0	1	0	85	72	0	1	0	1
700546	141	147	0	0	0	0	76	73	0	1	0	<1
700590	153	141	0	0	0	0	83	79	1	0	<1	0
700619	151	121	5	8	5	8	82	85	9	2	6	2
700633	142	158	0	1	0	1	93	57	4	4	3	3
700651	144	130	0	0	0	0	76	65	1	2	1	1
700706	145	88	0	0	0	0	92	72	1	1	<1	1
700780	170	95	0	0	0	0	64	91	0	3	0	3
700792	118	87	0	0	0	0	80	67	0	0	0	0
7042	109	106	45	78	44	72	50	79	68	87	64	82
SDN-503	120	134	3	1	3	1	54	66	9	11	5	7
SDN-714	152	140	0	0	0	0	89	87	0	1	0	1
J-76	118	120	2	3	2	2	69	84	6	1	2	1
J-92-1	170	43	0	0	0	0	78	62	0	0	0	0
J-215-1	175	118	1	1	1	1	78	61	12	2	3	<1
J-1593	118	91	1	3	<1	3	83	49	16	20	15	17
J-1486 x 700787-2-10	163	136	0	0	0	0	68	74	2	1	<1	1
IP-1930	109	94	0	1	0	1	73	71	3	0	1	0
IP-2037	132	130	0	1	0	1	72	62	0	0	0	0
IP-2058	213	137	0	2	0	1	65	78	9	5	3	3
NC-7158	119	138	2	1	2	1	72	88	4	1	3	1
NC-7174	146	166	0	0	0	0	76	78	3	4	1	3
NELC-8010	153	121	1	2	1	2	73	54	33	11	23	11
NC-8220	138	102	1	1	1	1	80	62	1	2	1	2
IVS-8038	134	154	1	1	1	1	65	75	3	8	3	6
IVS-8172	189	169	1	0	1	0	58	58	7	5	4	2

Table 4 (Contd

Entry	ICRISAT						Kamboinse					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
F-298-2-1-8	127	167	0	1	0	<1	75	57	3	4	3	2
EB-18-3-1	107	108	0	2	0	2	78	73	1	0	1	0
EB-83-2	134	138	0	1	0	1	87	62	1	11	1	8
EB-79-2-2 x EB-59-3-1	156	157	1	0	1	0	84	71	0	0	0	0
SSC-7218	163	119	0	0	0	0	81	73	1	3	1	3
R-238-1-2-1	107	150	1	3	1	3	76	64	9	5	8	3
MPP-7147-2-1	117	97	0	1	0	1	77	70	4	0	1	0
2989-109-1	123	104	2	3	2	3	57	81	4	1	3	1
7S-Series-1	217	162	3	5	2	5	72	74	0	8	0	4
F_4FC-1474-2-2-2	149	142	2	6	2	5	64	70	2	13	1	11
T-128-3 x 700404-1-5-5	129	102	0	0	0	0	51	64	0	2	0	1
ICH-165	142	98	2	1	2	1	63	68	3	0	2	0
ICH-226	142	105	1	4	1	3	80	49	1	10	1	8
ICH-241	131	136	24	4	22	3	77	63	10	8	8	7
BJ-104	118	97	54	43	51	35	62	51	32	14	15	8
Local susceptible[a/]	203	739	90	95	88	94	76	79	30	42	26	37

a/ Mean of five plots in each replication

Table 5 Plant population, downy mildew incidence (% incid.) and severity (%) of [illegible] entries and local susceptible in the 1980 IPMDMN at Mysore and Samaru

Entry	Mysore						Samaru					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
[illegible]	153	191	0	27	0	17	50	49	26	29	19	18
700251	111	147	1	6	<1	4	40	49	28	20	14	16
700335	114	117	13	27	9	22	48	45	75	71	62	61
700512	110	194	3	16	2	11	50	40	18	23	13	18
700516	103	148	2	6	1	5	48	43	21	26	17	22
700546	124	196	4	23	3	15	47	48	21	23	16	19
700590	172	145	8	30	5	19	49	47	37	36	28	30
700619	107	170	7	17	4	14	49	47	57	55	45	36
700633	139	128	16	20	11	14	48	49	4	14	2	12
700651	121	181	7	8	4	7	47	45	30	36	22	28
700706	126	183	14	20	7	12	26	49	27	27	21	23
700780	82	188	2	9	2	6	50	50	58	48	39	29
700792	168	147	4	6	3	5	45	44	40	43	26	38
7042	186	124	86	86	55	66	47	47	100	100	98	97
SDN-503	168	113	14	23	9	19	42	49	17	18	8	18
SDN-714	144	170	3	8	2	6	49	44	22	9	20	7
J-76	73	199	10	21	7	16	45	46	53	39	38	30
J-92-1	124	176	16	9	9	5	42	20	14	50	14	41
J-215-1	142	177	5	9	3	6	43	49	30	31	22	20
J-1593	102	148	21	20	10	15	43	36	61	47	52	45
J-1486 x 700787-2-10	69	144	19	6	15	5	47	50	26	22	18	14
IP-1930	55	113	18	34	14	26	45	49	24	22	20	19
IP-2037	179	140	0	20	0	15	50	48	22	27	17	22
IP-2058	131	120	5	11	4	9	47	50	40	46	27	34
NC-7158	136	122	4	10	4	7	50	48	12	19	9	15
NC-7174	126	133	2	2	1	2	50	48	24	23	15	18
NELC-8010	109	120	1	24	1	19	44	33	61	46	42	31
NC-8220	61	123	0	18	0	14	46	46	17	13	10	10
IVS-8038	127	175	75	13	64	9	42	46	45	35	34	27
IVS-8172	122	177	20	12	16	9	46	46	54	41	50	32
E-298-2-1-8	109	111	7	13	5	11	46	49	15	8	9	6
EB-18-3-1	93	136	3	13	3	11	48	50	17	20	13	18
EB-83-2	104	172	14	7	8	5	42	46	21	15	16	11
EB-79-2-2 x EB-59-3-1	145	173	21	23	14	14	47	49	28	27	20	26
SSC-7218	146	167	8	13	6	9	50	39	12	21	9	10

Table 5 (Contd.)

Entry	Mysore						Samaru					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
R-238-1-2-1	195	108	22	32	15	26	47	47	38	49	25	35
MPP-7147-2-1	124	136	4	13	3	11	46	50	7	8	4	8
2989-109-1	182	117	5	30	3	24	48	50	21	26	15	25
75-Series-1	119	198	8	16	6	9	46	47	7	6	5	4
F_4FC-1474-2-2-2	151	140	14	26	8	19	45	50	27	6	17	6
T-128-3 x 700404-1-5-5	131	135	1	14	1	11	50	40	38	23	29	18
ICH-165	126	104	16	26	10	20	50	50	16	18	14	14
ICH-226	84	175	5	25	3	21	50	50	26	16	19	13
ICH-241	134	146	25	17	18	12	49	50	63	54	51	48
BJ-104	59	93	20	48	17	37	50	49	42	39	29	25
Local susceptible[a]	158	157	84	89	57	61	49	48	29	33	20	27

a/ Mean of five plots in each replication

Table 6. Plant population, downy mildew incidence (% incid.) and severity (%) of [illegible] tries and local susceptible in the 1980 IPMDMN at Aurangabad and Kano

Entry	Aurangabad						Kano					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
	34	81	78	80	44	32	45	50	40	28	25	24
700251	45	70	61	51	24	21	47	49	55	27	39	20
700335	45	32	74	95	30	50	50	49	66	53	57	49
700512	70	61	53	86	17	31	45	50	22	16	13	9
700516	52	50	63	82	28	31	50	49	22	27	15	20
700546	68	61	66	69	25	25	50	50	32	34	19	24
700590	50	33	78	76	33	80	50	48	48	46	39	37
700619	57	76	84	85	36	26	50	50	32	28	25	21
700633	17	25	73	83	32	37	50	47	16	23	9	13
700651	58	21	82	69	[illegible]	28	49	50	[illegible]	50	[illegible]	37
700706	43	48	58	74	26	30	47	50	36	26	22	18
700780	56	57	60	69	23	29	50	50	76	74	68	58
700792	30	25	71	74	30	28	50	36	54	67	45	63
7042	22	58	100	97	46	54	46	50	98	98	97	98
SDN-503	31	68	68	83	30	28	50	44	16	11	8	10
SDN-714	32	37	85	74	43	27	50	50	12	10	8	10
J-76	48	79	58	85	24	29	45	50	33	40	18	29
J-92-1	41	65	74	75	32	27	46	36	15	14	11	14
J-215-1	57	24	62	33	32	17	48	50	44	50	28	31
J-1593	65	59	72	76	31	34	50	50	84	50	71	37
J-1486 x 700787-2-10	45	71	59	86	21	28	50	50	34	26	27	18
IP-1930	45	28	61	59	24	26	47	43	21	16	18	11
IP-2037	20	43	93	87	45	39	29	50	31	22	23	17
IP-2058	57	70	70	86	30	28	50	49	20	18	19	17
NC-7158	53	65	81	85	41	40	50	50	6	12	5	5
NC-7174	36	68	68	74	32	18	50	50	40	32	32	25
NELC-8010	46	33	58	78	22	34	50	50	72	68	54	52
NC-8220	47	71	59	86	26	38	50	50	12	10	7	10
IVS-8038	63	74	78	83	31	28	47	50	47	24	32	17
IVS-8172	48	70	62	81	21	35	42	47	36	38	26	31

Table 5 (Contd.)

Entry	Mysore						Samaru					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
R-238-1-2-1	195	108	22	32	15	26	47	47	38	49	25	35
MPP-7147-2-1	124	136	4	13	3	11	46	50	7	8	4	8
2989-109-1	182	117	5	30	3	24	48	50	21	26	15	25
75-Series-1	119	198	8	16	6	9	46	47	7	6	5	4
F_4FC-1474-2-2-2	151	140	14	26	8	19	45	50	27	6	17	6
T-128-3 x 700404-1-5-5	131	135	1	14	1	11	50	40	38	23	29	18
ICH-165	126	104	16	26	10	20	50	50	16	18	14	14
ICH-226	84	175	5	25	3	21	50	50	26	16	19	13
ICH-241	134	146	25	17	18	12	49	50	63	54	51	48
BJ-104	59	93	20	48	17	37	50	49	42	39	29	25
Local susceptible[a]	158	157	84	89	57	61	49	48	29	33	20	27

a/ Mean of five plots in each replication

Table 6. Plant population, downy mildew incidence (% incid.) and severity (%) of [illegible]ries and local susceptible in the 1980 IPMDMN at Aurang[illegible] and Kano

Entry	Aurangabad						Kano					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
	34	81	78	80	44	32	45	50	40	28	25	24
700251	45	70	61	51	24	21	47	49	55	27	39	20
700335	45	32	74	95	30	50	50	49	66	53	57	49
700512	70	61	53	86	17	31	45	50	22	16	13	9
700516	52	50	63	82	28	31	50	49	22	27	15	20
700546	68	61	66	69	25	25	50	50	32	34	19	24
700590	50	33	78	76	33	80	50	48	48	46	39	37
700619	57	76	84	85	36	26	50	50	32	28	25	21
700633	17	25	73	83	32	37	50	47	16	23	9	13
700651	58	[illegible]	82	69	[illegible]	28	49	50	[illegible]	50	[illegible]	37
700706	43	48	58	74	26	30	47	50	36	26	22	18
700780	56	57	60	69	23	29	50	50	76	74	68	58
700792	30	25	71	74	30	28	50	36	54	67	45	63
7042	22	58	100	97	46	54	46	50	98	98	97	98
SDN-503	31	68	68	83	30	28	50	44	16	11	8	10
SDN-714	32	37	85	74	43	27	50	50	12	10	8	10
J-76	48	79	58	85	24	29	45	50	33	40	18	29
J-92-1	41	65	74	75	32	27	46	36	15	14	11	14
J-215-1	57	24	62	33	32	17	48	50	44	50	28	31
J-1593	65	59	72	76	31	34	50	50	84	50	71	37
J-1486 x 700787-2-10	45	71	59	86	21	28	50	50	34	26	27	18
IP-1930	45	28	61	59	24	26	47	43	21	16	18	11
IP-2037	20	43	93	87	45	39	29	50	31	22	23	17
IP-2058	57	70	70	86	30	28	50	49	20	18	19	17
NC-7158	53	65	81	85	41	40	50	50	6	12	5	5
NC-7174	36	68	68	74	32	16	50	50	40	32	32	25
NELC-8010	46	33	58	78	22	34	50	50	72	68	54	52
NC-8220	47	71	59	86	26	38	50	50	12	10	7	10
IVS-8038	63	74	78	83	31	28	47	50	47	24	32	17
IVS-8172	48	70	62	81	21	35	42	47	36	38	26	31

Table 6 (Contd.)

Entry	Aurangabad						Kano					
	Total plants		Incidence		Severity		Total plants		Incidence		Severity	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
[illegible]-298-2-1-8	45	77	60	83	26	29	50	50	8	4	6	3
EB-18-3-1	75	61	61	79	25	27	49	50	14	18	14	16
EB-83-2	58	103	63	59	28	22	50	48	16	17	10	10
EB-79-2-2 x EB-59-3-1	46	76	74	74	33	23	49	50	35	34	26	22
SSC-7218	42	30	48	85	18	37	50	48	30	27	16	18
R-238-1-2-1	46	77	76	83	37	28	48	50	35	18	25	13
MPP-7147-2-1	42	35	82	71	37	30	50	50	8	14	7	12
2989-109-1	58	35	72	63	34	28	46	43	28	19	23	11
75-Series-1	46	32	83	91	50	39	49	34	12	24	9	19
F_4FC-1474-2-2-2	44	77	74	80	29	31	50	50	30	14	17	11
T-128-3 x 700404-1-5-5	37	73	72	79	32	30	33	50	12	12	9	11
ICH-165	29	32	67	78	28	33	50	50	20	22	18	16
ICH-226	63	50	78	89	35	41	44	49	32	27	23	20
ICH-241	63	68	76	80	26	36	50	50	96	92	81	66
BJ-104	37	51	74	90	32	32	50	50	46	48	33	38
Local susceptible[a]	45	57	91	86	51	43	49	48	30	31	21	22

a/ Mean of five plots in each replication

Table 7. Percent severity[a/] of 45 entries at 10 locations[b/] in the 1980 IPMIMN compared with severity of local susceptibles and location mean for all these entries

S. No.	Entry	LOCATIONS 1	2	3	4	5	6	7	8	9	10	Max. severity	Mean[c/]
1	700512	0	1	0	0	<1	3	7	16	11	24	24	6
2	LB-83-2	0	0	0	1	<1	4	7	14	10	25	25	6
3	700546	<1	0	0	0	0	<1	9	18	21	25	25	7
4	J-1486x700787-2-10	0	0	<1	<1	0	<1	10	16	22	25	25	7
5	IP-1930	<1	0	3	<1	<1	<1	20	20	14	25	25	8
6	EB-18-3-1	<1	1	5	2	1	<1	7	15	15	26	26	7
7	E-298-2-1-8	<1	0	0	0	<1	2	8	7	4	27	27	5
8	SSC-7218	1	0	1	0	0	2	8	9	17	27	27	7
9	700706	1	<1	3	9	0	<1	10	22	20	28	28	9
10	EB-79-2-2xEB-59-3-1	<1	0	0	3	<1	0	14	23	24	28	28	9
11	NC-7174	0	<1	0	3	0	2	2	16	29	25	29	8
12	SDN-5[illegible]3	2	2	2	0	2	6	14	13	9	29	29	8
13	700516	<1	1	0	0	<1	<1	3	20	17	30	30	7
14	J-92-1	0	0	0	<1	0	0	7	28	13	30	30	8
15	IP-2058	0	<1	0	1	<1	3	7	30	18	29	30	9
16	F_4Fc-1474-2-2-2	<1	2	3	5	4	6	14	11	14	30	30	9
17	J-215-1	<1	3	<1	7	<1	2	5	21	30	24	30	9
18	T-128-3x700404-1-5-5	<1	0	3	1	0	<1	6	24	10	31	31	8
19	ICH-165	<1	0	2	2	1	<1	15	14	17	31	31	8
20	700251	1	2	1	15	<1	1	2	15	30	23	31	9
21	2989-109-1	<1	0	0	6	3	2	14	20	17	31	31	9
22	NC-8220	0	<1	0	2	<1	1	7	10	8	32	32	6
23	R-238-1-2-1	0	<1	2	<1	2	5	21	30	19	33	33	11
24	MPP-7147-2-1	<1	3	2	4	<1	<1	7	6	9	34	34	7
25	700633	0	0	2	2	<1	3	12	7	11	34	34	7
26	700651	<1	0	0	4	0	1	5	25	30	35	35	10
27	J-76	<1	<1	4	3	2	1	11	34	24	27	34	11
28	SDN-714	0	0	1	0	0	<1	4	14	8	35	35	6
29	IVS-8038	2	2	4	6	<1	5	37	31	25	29	37	14
30	P-7	0	2	0	3	<1	0	9	19	24	38	38	9
31	ICH-226	1	<1	4	8	2	4	12	16	22	38	38	11
32	700590	<1	0	3	<1	0	<1	12	29	38	31	38	11
33	NC-7158	0	0	0	0	1	2	5	12	5	40	40	7
34	700619	<1	2	2	1	7	4	9	41	23	31	41	12
35	IVS-8172	0	7	<1	5	<1	3	13	41	29	28	41	13

Table 7 (cont)

S. No.	Entry	LOCATIONS 1	2	3	4	5	6	7	8	9	10	Max. severity	Mean[c/]
36	IP-2037	<1	<1	1	10	<1	0	8	19	20	42	42	10
37	BJ-104	6	8	7	12	43	11	27	27	35	32	43	21
38	75-Series-1	0	<1	7	0	4	2	7	5	14	45	45	8
39	[illegible]	2	<1	4	<1	1	17	10	36	53	28	52	15
	700792	2	0	2	3	0	0	4	32	54	29	54	13
41	J-1593	0	<1	<1	7	2	16	13	48	54	32	54	17
42	700335	8	4	3	2	6	14	15	61	53	40	61	21
43	700780	1	<1	4	5	0	1	4	34	63	26	63	14
44	ICH-241	<1	2	<1	10	13	8	15	49	73	31	73	20
45	7042	48	70	60	15	58	73	60	98	98	50	98	63
Location Mean for entries		2	3	3	3	3	5	11	24	26	31		
Local susceptible Mean		87	74	50	34	91	32	59	24	22	47		

a/ Percent infection index

b/ 1. Hissar 2. Jamnagar 3. Ludhiana 4. Pune 5. ICRISAT
6. Kamboinse 7. Mysore 8. Samaru 9. Kano 10. Aurangabad.

c/ Mean for entries across locations.

Table 8. Performance of entries included in the IPMDMN trial for five years

Entry	Mean Severity (%)					Max. Severity (%)				
	76	77	78	79	80	76	77	78	79	80
[illegible] 503	<1	1	3	3	8	2	8	10	14	29
700251	1	2	2	1	9	5	9	11	5	31
700516	1	3	2	1	7	15	35	12	6	30
P-7	3	2	3	3	9	11	11	12	8	38
P-10	4	3	4	1	-	-	24	12	7	-
700651	<1	3	4	1	10	3	28	29	3	34
SDN-347-1	3	3	4	3	-	13	16	24	14	-
J-1593 a/	31	28	14	8	17	78	78	38	27	54

a/ Susceptible check

Table 9. Downy mildew severity (%) in five entries included for 3-5 years in the IPMDAN trials at the ICRISAT Center, Kamboinse, Samaru and Kano

Entry	ICRISAT Center					Kamboinse					Samaru					Kano				
	76	77	78	79	80	76	77	78	79	80	76	77	78	79	80	76	77	78	79	80
SDN-503	0	2	6	2	2	0	2	4	14	6	-	-	6	17	13	-	8	1	4	9
P-7	<1	1	1	<1	<1	5	11	5	7	0	-	-	8	17	19	-	7	10	13	24
700251	2	5	1	<1	<1	5	8	3	5	1	-	-	7	15	15	-	9	5	23	30
700516	0	1	<1	0	<1	2	0	2	6	1	-	-	7	20	20	-	24	3	26	17
700651	0	<1	4	<1	0	2	6	2	3	1	-	-	6	39	25	-	28	29	16	30

Table 10. Percent ergot incidence in 45 IPMDMN entries at Aurangabad, Jamnagar, Kano, Samaru, Kamboinse, Pune and Mysore during 1980 rainy season.

No.	Entry	ERGOT (%)							
		Aurangabad	Jamnagar	Kano	Samaru	Kamboinse	Pune	Mysore	Mean[a]
1	700792	14	2	5	23	0	8	5	8
2	MPP-7147-2-1	15	0	20	35	20	5	0	14
3	700590	18	<1	35	23	8	10	8	15
4	F4FC-1474-2-2-2	15	<1	20	35	18	7	8	15
5	7042	49	4	0	18	19	8	8	15
6	IVS-8172	29	<1	28	30	13	5	5	16
7	J-92-1	26	0	30	23	20	8	5	16
8	NC-7158	12	2	35	50	11	5	5	17
9	75-Series-1	23	<1	30	40	13	8	8	17
10	IP-1930	17	3	40	45	15	5	5	18
11	EB-18-3-1	16	2	25	55	23	5	5	19
12	700651	40	1	15	55	11	5	5	19
13	WC-8220	30	<1	15	63	13	8	5	19
14	IP-2037	26	2	35	50	15	8	3	20
15	700633	35	5	40	45	8	5	8	21
16	700251	25	1	20	58	30	10	4	21
17	P-7	19	<1	45	50	20	5	8	21
18	700516	19	3	35	43	38	5	7	21
19	700706	19	2	50	50	15	10	5	22
20	SDN-714	26	0	35	50	35	5	2	22
21	NC-7174	26	1	35	60	20	8	5	22
22	J-1593	44	<1	40	35	28	5	4	22
23	700335	32	5	25	73	10	5	8	22
24	T-128-3x700404-1-5-5	32	3	50	45	20	5	5	23
25	SDN-503	26	3	35	58	28	5	8	23
26	700780	20	2	45	73	15	5	5	23
27	700512	15	6	50	50	30	8	8	24
28	EB-79-2-2xEB-59-3-1	29	<1	40	60	28	8	5	24
29	IVS-8038	40	2	45	55	19	5	5	24
30	700619	30	1	35	75	20	5	5	24

Table 10 (Cont.)

S. No.	Entry	ERGOT (%) Aurangabad	Jamnagar	Kano	Samaru	Kamboinse	Pune	Mysore	Mean a/
31	R-238-1-2-1	19	2	45	70	28	5	8	25
32	J-215-1	33	2	50	63	18	8	5	25
33	ICH-165	27	6	50	58	28	5	5	25
34	ICH-226	33	<1	55	60	20	5	4	25
35	700546	27	<1	60	63	18	8	5	26
36	SSC-7218	26	0	50	70	23	10	5	26
37	ICH-241	45	0	35	83	18	5	5	27
38	J-1486x700787-2-10	35	1	45	63	35	15	8	29
39	EB-83-2	31	<1	50	75	35	8	5	29
40	J-76	35	<1	65	75	20	5	5	29
41	E-298-2-1-8	23	1	65	88	20	5	5	29
42	2989-109-1	36	2	55	80	35	10	5	32
43	IP-2058	38	2	50	87	33	13	8	33
44	NELC-8010	39	1	60	78	43	8	5	33
45	BJ-104	45	2	80	99	33	8	4	39
Mean of local susceptible		33	2	40	70	-	10	7	23

a/ Mean for entries across locations.

Table 11. Percent smut incidence of 45 IPMDMN entries at Hissar, Kano, Samaru, Jammagar and Kamboinse during 1980 rainy season

S. No.	Entry	SMUT (%) Hissar	Kano	Samaru	Jammagar	Kamboinse	Mean a/
1	700792	0	1	3	4	0	1
2	00590	0	8	3	1	1	2
3	J-76	0	5	10	4	2	4
4	IP-1930	0	8	8	7	3	5
5	SSC-7218	0	5	18	3	4	6
6	F4FC-1474-2-2-2	0	20	8	<1	1	6
7	700512	0	5	20	4	3	6
8	NC-7174	5	13	15	1	0	7
9	700251	0	8	20	4	2	7
10	700780	5	5	23	2	1	7
11	J-1486x700787-2-10	10	4	15	5	4	7
12	700516	5	4	23	4	4	8
13	J-1593	25	5	8	1	1	8
14	75-Series-1	25	5	5	2	4	8
15	700335	20	5	10	3	3	8
16	IP-2037	10	6	8	5	15	9
17	IVS-8172	25	11	10	4	1	10
18	E-298-2-1-8	25	8	10	9	2	11
19	NC-7158	10	5	15	7	16	11
20	700706	35	8	10	1	2	11
21	700546	40	8	8	3	1	12
22	EB-79-2-2xEB-59-3-1	20	8	30	1	1	12
23	T-128-3x700404-1-5-5	40	8	10	2	2	12
24	J-92-1	40	8	5	4	5	12
25	2989-109-1	20	13	20	7	3	12
26	ICH-165	40	4	15	1	4	13
27	SDN-714	40	11	5	2	8	13
28	SDN-503	35	8	15	8	<1	13
29	EB-18-3-1	35	6	20	6	2	14
30	MPP-7147-2-1	55	5	5	3	1	14

Table 11 (Cont.)

No	Entry	SMUT (%)					Mean[a/]
		Hissar	Kano	Samaru	Jamnagar	Kamboinse	
31	R-238-1-2-1	35	8	23	3	2	14
32	700633	40	5	23	5	1	15
33	ICH-241	25	5	23	21	2	15
34	700651	35	5	35	4	2	16
35	IVS-8038	35	10	13	12	13	16
36	P-7	55	15	8	3	3	17
37	700619	55	5	10	11	6	17
38	WC-8220	70	4	10	2	3	18
39	IP-2058	40	6	35	4	6	18
40	NELC-8010	70	8	30	6	9	24
41	BJ-104	70	15	23	11	4	24
42	J-215-1	70	10	23	16	5	25
43	ICH-226	70	18	28	7	3	25
44	EB-83-2	55	8	58	2	4	25
45	7042	70	0	8	20	33	26
Mean of local susceptible		45	7	13	16	-	16

a/ Mean for entries across locations