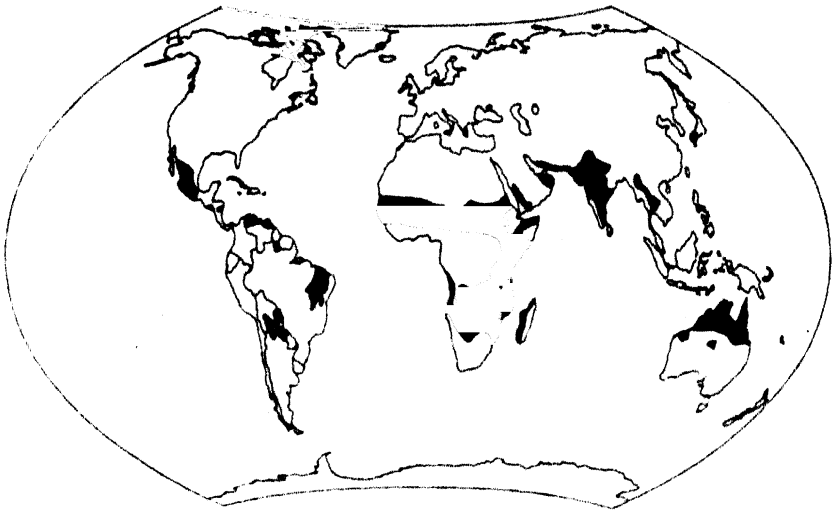
REPORT OF

THE THIRTEENTH (1988) INTERNATIONAL PEARL MILLET DOWNY MILDEW NURSERY

(IPMDMN)



INTERNATIONAL PEARL MILLET DISEASE RESISTANCE TESTING PROGRAM
(IPMDRTP)

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics
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ABSTRACT

The 1988 International Pearl Millet Downy Mildew Nursery (IPMDMN) containing 30 test entries (5 resistant germplasm accessions and 25 breeding lines and varieties) and 3 checks (1 resistant and 2 susceptible) was sent to 12 locations, 6 in India and 6 in West Africa. Data were received from all locations. Highest levels of downy mildew (DM) were registered at Bengou, Niger (47% mean DM severity for test entries), followed by other West African locations and then Indian locations. All test entries had higher mean DM severities (generally more than two fold) across West African locations than across Indian locations, except ICMR 87018 which had 51% in India and 37% in West Africa. Highest across location DM resistance was found in P 1449-3 (3% DM), P 310-17 (4%), and ICMP 423 (7%). The 1988 results suggest several possible virulence differences among pathogen populations at the various test locations. We hope to be able to retest for some of these differences in the 1989 IPMDMN.

RESUME

La pépinière internationale du mildiou du mil de l'année 1988 (IPMDMN) contenant 30 entrées d essais 5 accessions des ressources génétiques résistantes et 25 lignées de sélection et des variétés) et 3 témoins (1 résistante et 2 sensibles) a été envoyée à 12 locations - 6 en Inde et 6 en Afrique de l Ouest. Les données ont été obtenues de toutes ces locations. Les niveaux les plus élevés de mildiou ont été enregistrés à Bengou au Niger soit 47% de sévérité moyenne de mildiou chez les entrées d essais. Viennent après d autres locations de l'Afrique de l'Ouest et de l Inde. Toutes les entrées d essais ont témoigné une plus forte moyenne de sévérité de mildiou (le double très souvent en Afrique de l'Ouest qu'en Inde. La seule exception était ICMR 87018 dont la sévérité était de 51% en Inde et 37% en Afrique de l'Ouest. La plus forte résistance au mildiou à travers les locations a été remarquée chez le P 1449-3 (3% de mildiou), le P 310-17 (4%), et le ICMP 423 (7%). Les résultats obtenus en 1988 indiquent aux possibilités de différences de virulence chez les populations des agents pathogènes à des locations variées. Nous espérons répéter ces essais lors de l IPMDMN de 1989 pour pouvoir identifier quelques-unes de ces différences.

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THE 1988 INTERNATIONAL PEARL MILLET DOWNY MILDEW NURSERY (IPMDMN)

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 lines, populations, and hybrids are tested for degree and stability of resistance to downy mildew (DM). The results of the previous years' IPMDMNs, which were tested each year by cooperators at 7-16 locations in two to six countries in Africa and Asia, indicated major differences between test entries in the level and stability of DM resistance, and between locations in the aggressiveness and virulence of the DM pathogen (Sclerospora graminicola). In 1988, the thirteenth IPMDMN was distributed to cooperators at 12 locations, six in India and six in West Africa (distributed by J. Werder). Results were received from all locations.

MATERIALS AND METHODS

Entries

The nursery contained 30 test entries, one resistant check, P 7-4, and two susceptible checks, 7042 and NHB 3. Cooperators were requested to plant one of the checks, NHB 3, after every 10 plots to act as an "indicator" of DM pressure. Twenty-four of the 1988 IPMDMN entries were new and 25 entries were breeding products. All these entries had been selected based on their good performance in advanced DM screening at the ICRISAT Center, Patancheru. Twelve entries, representing 6 pairs of breeding lines (selected or not selected for DM resistance for one generation at the seedling stage in a greenhouse at ICRISAT Center) were also included.

Test Locations and Cooperators

Details of the test locations and the cooperators are given in Table 1. As much as possible, the locations include Indian and West African ones where DM can occur in a severe form.

Data Recording

The cooperators were requested to record DM data at two stages; 1) at approximately 30 days after planting, and ii) at the dough stage. The first record was based on incidence (frequency of DM infected plants) and the second was based on a combination of incidence and severity (proportion of plant parts with disease symptoms).

RESULTS

Reaction to Downy Mildew by Location

Gwalior (Table 2). DM pressure at this location was low as indicated by only 2% mean severity for test entries and 10% for 7042 and 16% for NHB 3. However, one test entry, Togo Yellow B-3, had 16% downy mildew severity, considerably more DM than any other test entry.

Aurangabad (Table 3). There were generally moderate levels of DM at this location with test entries having a mean severity of 7% and susceptible checks having 49 (7042) and 74% (NHB 3). Only six test entries registered > 5% DM severity. Among them were selected and unselected versions of ICMP 85109 (22 and 26%), and ICMP 451 (13 and 8%) and ICMR 87018 (90%).

Patancheru (Table 4). For India, there was a high level of DM at this location, with test entries having a mean severity of 14% and susceptible checks having 72 (7042) and 81% (NHB 3). Seven breeding lines had $\geq$ 30% severity. However, DM of $\leq$ 5% severity was recorded in three DM resistant

germplasm accessions and in eight breeding lines. Togo yellow B-3 was the only entry that remained free of DM at this location.

Mysore (Table 5). For India, there was a high level of DM at this location, with test entries having a mean severity of 15% and susceptible checks having 58 (7042) and 93% (NHB 3). Even the resistant check, P 7-4, had 20% DM severity. However, 4 out of 5 DM resistant accessions and 11 out of 25 breeding lines had $\leq$ 5% DM severity.

Bhavanisagar (Table 6). Although the 6% mean DM severity of test entries and the 56 (7042) and 52% (NHB 3) severity in the susceptible checks suggest moderate levels of DM at this location, it should be pointed out that all test entries, except three, ICMR 87018, ICMR 87030, and Togo yellow B-1, which had 28, 47, and 82% DM severity, respectively, had $\leq$ 6% DM.

Kovilpatti (Table 7). DM pressure was generally low at this location with susceptible checks having 40 (7042) and 13% (NHB 3) DM severity, and test entries having a mean DM severity of 4%. However, most of this 4% was contributed by two test entries, ICMR 87030 and ICMR 87018, which had 50 and 36% DM severity, as DM severity did not exceed 6% in any of the remaining 28 test entries.

Cinzana (Table 8). Mean DM severity for this location was very high, 41% for test entries, and 72 (7042) and 79% (NHB 3) for the susceptible checks. Only two test entries had < 10% DM severity (both 9%) and half of the entries had $\geq$ 28% DM severity. It is noteworthy that low DM levels (< 5%) did not occur in any of the test entries at this location, although they did occur at all other locations in West Africa and India, except at Manga-Bawku, Ghana, where data were recorded on the basis of affected hills

rather than plants, and therefore may not be a fair comparison.

Kamboinse (Table 9). For West Africa, this location had a relatively low DM severity of 17%. Over half the test entries had ≤ 6% DM severity, but DM severity ranged from 25 to 88% in eight entries. Susceptible checks had 97 (7042) and 56% (NHB 3) DM severity.

Manga-Bawku (Table 10). Data obtained for this location are based on percentage of hills 'infected' (generally two plants per hill) rather than on percentage of plants infected. All test entries had a high frequency of DM 'infected'hills, at the first scoring, 23-87%. However, many entries registered few if any DM 'infected' hills at the second scoring.

Sadore (Table 11). This location had a relatively high level of DM with 34% mean DM severity in test entries, 25% severity in the resistant check, and 100 (7042) and 65% (NHB 3) in the susceptible checks. The nursery was sown late in the growing season (September 15) and was maintained with supplemental irrigation after the rains ended. Three lines, P 1449-3, ICTP 8203, and ICMP 423, showed very low levels of DM, not exceeding 5% severity.

Bengou (Table 12). This location had 47% mean DM severity in test entries and a surprisingly high 49% in the resistant check (P 7-4), both representing the highest figures for these items at any location. Fourteen of the 30 test entries had > 50% DM severity. However, four entries, P 310-17, P 1449-3, ICMP 85109 (selected), and ICMP 423 (unselected), registered DM severities of ≤ 5%.

Samaru (Table 13). This location also had a high level of DM, with test entries having a mean DM severity of 38%, the resistant check having 28%, and the susceptible checks 99 (7042) and 51% (NHB 3). DM severity ranged from 0 to 100% in test entries, with only three entries, P 310-17, ICMP 83506 unselected, and ICMP 84122, having < 5% DM, and more than one-half of the entries having > 25% DM.

Reaction to Downy Mildew Across Locations

Average DM severities of test entries across 11 locations (Manga-Bawku not included because data based on frequency of hills infected rather than plants infected) ranged from 3% for P 1449-3 to 48% for ICMR 87030 (Table 14). P 310-17 had an across-location mean of 4% with < 10% DM severity at all locations. Among breeding materials, ICTP 8203 averaged 11% DM severity for the selected/unselected pair, with 97% DM severity in the unselected version recorded for the Samaru location (only 20% in the selected version). ICMP 423 (selected/unselected pair) had an across location mean DM severity of only 7%. DM severity in the two ICMP 423 lines exceeded 13% only at Samaru. Half of the test entries had across location DM severities of > 19%, the resistant check (P 7-4) had 14%, and the two susceptible checks had 67 (7042) and 57% (NHB 3).

The 30 test entries had a mean DM severity across 11 locations (Manga-Bawku excluded) of 20%, with 8% for the mean of the six Indian locations and 35% for the mean of the 5 West African locations. All entries had higher (generally more than two fold) mean DM severities across West African locations than across Indian locations, except ICMR 87018 which had mean DM severity of 51% in India and 37% in West Africa. Across location means for West Africa and India were about equal for the susceptible check, NHB 3.

Reaction to Other Diseases

The IPMDMN was also scored for reaction to natural inoculation by ergot (Claviceps fusiformis), smut (Tolyposporium penicillariae), rust (Puccinia penniseti), leaf blast (Pyricularia sp.), Dactuliophora leaf spot (Dactuliophora elongata), and rectangular leaf spot (Ramulispora sp.) at one or more locations.

Ergot was recorded at Mysore, Bengou, and Samaru (Table 15). At Mysore the level was moderate to high, considering the fact that artificial inoculation was not done. Although considerable differences for ergot severity were recorded among entries (range 10-75%), it is probable that these differences are more expressions of environmental differences (including inoculum and pollen availability) during the critical time of ergot vulnerability (protogyny), than genetic differences in ergot susceptibility per se. Ergot levels recorded at Bengou were very low and those at Samaru were generally low, but variable. There is no reason to believe that entries in the 1989 IPMDMN carry resistance to ergot.

Smut was recorded at four locations, Gwalior, Cinzana, Bengou, and Samaru (Table 16). Smut severity was low at all locations. As with ergot, it is doubtful that any of the entries possess significant levels of smut resistance.

Rust was recorded at all six Indian locations (Table 17), with moderate to high levels at all locations except Gwalior. The known resistance in P 24-1 held up, with rust severities of 0-10% across locations compared to the location means across test entries of 3 to 39%. Other entries showing relatively low levels of rust were P 1449-3, ICMP 851018, and ICMP 451.

Leaf blast was recorded at Gwalior (range in scores of 1-3 on a 1-5 scale), Dactuliophora leaf spot at Bengou (range of 1-4), and rectangular leaf spot at Bengou (range of 1-4) (Table 18). ICMP 84122 received a 1 score for all three diseases suggesting that this entry may possess some resistance to leaf diseases in general, although not to rust (Table 17). Togo yellow B-1 also showed little or no symptoms of these diseases. ICMB 87003 and ICMP 85410 showed sharply contrasting reactions (1 and 4 scores) to at least two of the three diseases.

DISCUSSION

The 1988 IPMDMN had good exposure to downy mildew, based on there being 12 locations, and especially the fact that six of these were in West Africa where relatively high levels of downy mildew were recorded. It is only through the good work of cooperators (Table 1) that the acquisition of these data was possible.

Two lines derived from accessions of germplasm, P 310-17 and P 1449-3, again showed high levels of resistance across locations. To a slightly lesser extent, P 2880 also confirmed results from previous years indicating stable resistance to DM. On the other hand, P 1591 had a mean across location DM severity of 17% in 1988, whereas in 1984-87 it averaged < 1 to 5% DM severity. This difference might be attributed to differences in locations between 1988 and previous years, especially the increased number of apparent hot-spot locations in West Africa. It is also possible that seed lots used during this period were not always the same and therefore may have differed in their reaction to DM.

Twenty-five of the 30 test entries in the 1988 IPMDMN were breeding materials. Only 3 of these, 863 B, ICMP 451, and ICMP 85410, were tested

earlier (1987 IPMDMN). Although ICMP 85410 showed low DM in 1987, even at West African locations, it was highly susceptible in 1988 at Bengou (68% DM compared to only 1% at this location in 1987), and at Samaru (81%) and Sadore (31%), two locations where it was not tested in 1987. However, DM susceptibility in this line was very low in both years at Kamboinse. Line 863 B again showed highly contrasting reactions between continents, being highly resistant at all Indian locations and highly susceptible at all West African locations. ICMP 451 (selected/unselected pair) was alarmingly susceptible at two Indian locations, Patancheru (33%) and Mysore (22%), and it was highly susceptible at most West African locations.

Most entries, especially breeding materials, showed considerably more DM at African locations than at Indian locations. This contrast was sharpest for ICMR 87003, ICMR 87913, 843B x (GNS x SS), 863B, Togo Yellow B-3, and ICMP 85410. Several entries did not show such marked continental differences, and one line, ICMR 87018, even showed the reverse reaction, being more susceptible at Indian locations than at most West African locations. These differences, and others, emphasize the desirability of studying the reactionsof selections of the host to populations of the pathogen within the same environment, ie. in a country which would allow importation and experimental use of S. graminicola collections (confinement facility possibly required).

The 1988 IPMDMN presents evidence that suggests several possible virulence differences among pathogen populations at different locations. Among these are: 1) the contrast between the Samaru pathogen population and most other West African and one Indian population based on reaction differences for ICTP 8203 (unselected) and ICMP 84122, 2) reaction differences in ICMR 87030 for Samaru from other West African locations and

especially two Indian locations (Bhavanisagar and Kovilpatti), 3) reaction differences in two Togo Yellow sister lines (B-1 and B-3) between Gwalior and two other Indian locations (Patancheru and Bhvanisagar), 4) reaction differences of pathogen populations at Cinzana and Kamboinse from almost all other locations (India and West Africa) expressed on ICMR 87018, and 5) the relatively high susceptibility of ICMR 87030, Togo Yellow B-1, and ICMR 87018 at Bhavanisagar or Kovilpatti, or both locations, in contrast to reactions of other entries at these two locations and these entries at other locations in India. We plan to repeat some of these entries in the 1989 IPMDMN to test the reproducibility of the results.

Selection at the seedling stage for DM resistance for one generation at Patancheru did not have a consistant or significant effect of reducing DM severity in the six selected/unselected pairs of entries when tested in the field at Patancheru or the other locations. This may be a true indication that no progress was made in selection for resistance in these particular lines in one generation, or it may be that there were an insufficient numbers of plants or replications to detect selection effectiveness. It is also conceivable that selection for DM resistance against the pathogen population at Patancheru may not necessarily have a positive effect on reducing susceptibility to pathogen populations at other locations.

It is not possible to determine the incidence or severity of DM at Manga-Bawku, because counts were made on a per hill rather than a per plant basis (Table 10), and, therefore, we are unable to make a valid comparison of the results from this location with those from other locations. Actual frequencies of DM would likely be 0-50% lower on an infected plant basis

than on the 'infected hill' basis that was presented. However, the data at least indicate that there was a fairly high level of DM at this location. They also suggest that infection was largely expressed early (by 24 days after sowing) and that plants were killed by DM at this stage and were therefore not included in much of the data obtained at the time of the second observation (56 days after sowing). Nevertheless, it is very good to have the Manga-Bawku location included in the 1988 IPMDMN, the first time for a location from Ghana, and we appreciate the interest of these cooperators and look forward to their involvement in the 1989 IPMDMN.

1989 IPMDMN

The IPMDMN will be continued in 1989, hopefully at all the same locations used in 1988. The nursery will again emphasize breeding materials. It will repeat several entries from the 1988 nursery and add several new ones.

Table 1. Cooperators and locations for the 1988 IPMDMN.

Cooperator(s)	Location	Country
A.M. Bartaria	Gwalior	India
N.B. Pawar/ICRISAT	Aurangabad	India
ICRISAT	Patancheru	India
H.S. Shetty/ICRISAT	Mysore	India
ICRISAT	Bhavanisagar	India
A. Rajamannar/M. Ernest David	Kovilpatti	India
Oumar Niangado/Sidi Mi Middo	Cinzana	Mali
P. Sereme	Kamboinse	Burkina Faso
Walter Frolich/E.A. Yakubu	Manga/Bawku	Ghana
ICRISAT	Sadore	Niger
ICRISAT	Bengou	Niger
S.K. Manzo	Samaru	Nigeria

Table 2. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Gwalior, India.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	52	84	136	6	4	5	1	2	2
P 310-17	82	70	152	0	0	0	0	0	0
P 1449-3	45	57	102	7	4	6	7	1	4
P 1591	45	70	115	0	0	0	0	0	0
P 2880	23	59	82	9	2	6	4	0	2
ICMP 83506 Selected	19	58	77	5	2	4	5	0	3
ICMP 83506 Unselected	63	52	115	2	2	2	1	2	2
ICMP 85109 Selected	58	50	108	2	24	13	1	8	5
ICMP 85109 Unselected	35	57	92	0	0	0	0	0	0
ICTP 8203 Selected	39	35	74	0	3	2	0	1	1
ICTP 8203 Unselected	72	48	120	1	2	2	1	1	1
ICMP 84122	39	58	97	3	0	2	1	0	1
ICMP 851018	59	71	130	0	0	0	0	0	0
ICMR 87003	81	19	100	0	0	0	0	0	0
ICMR 87913	47	68	115	0	0	0	0	0	0
ICMR 87030	42	26	68	5	0	3	4	0	2
ICMB 87003	67	69	136	0	1	1	0	0	0
[843B X (GNS X SS)]	48	31	79	2	13	8	2	3	3
863 B	35	43	78	0	9	5	0	9	5
Togo Yellow B-3	43	45	88	26	13	20	20	12	16
Togo Yellow B-1	73	49	122	0	2	1	0	1	1
ICMV 87901 Selected	62	27	89	7	0	4	2	0	1
ICMV 87901 Unselected	74	20	94	0	0	0	0	0	0
ICMP 451 Selected	59	39	98	10	3	7	3	2	3
ICMP 451 Unselected	61	42	103	0	0	0	0	0	0
ICMP 423 Selected	62	46	108	0	17	9	0	11	6
ICMP 423 Unselected	47	45	92	4	0	2	4	0	2
ICMP 85410	10	24	34	0	0	0	0	0	0
ICMP 86217	53	55	108	0	0	0	0	0	0
ICMR 87018	67	61	128	5	5	5	4	5	5
Location mean for test entries			101			3			2
Resistant check: P 7-4	68	60	128	2	3	3	0	3	2
Susceptible checks: 7042	44	43	87	2	28	15	2	18	10
NHB 3	54	61	115	31	25	28	16	16	16

Table 3. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Aurangabad, India.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	59	73	132	2	1	2	0	1	1
P 310-17	66	69	135	5	3	4	4	3	4
P 1449-3	68	70	138	0	0	0	0	0	0
P 1591	59	63	122	7	10	9	3	9	6
P 2880	70	69	139	17	10	14	13	7	10
ICMP 83506 Selected	61	72	133	3	0	2	1	0	1
ICMP 83506 Unselected	67	64	131	2	3	3	1	1	1
ICMP 85109 Selected	66	60	126	44	8	26	40	4	22
ICMP 85109 Unselected	50	55	105	34	26	30	30	21	26
ICTP 8203 Selected	59	66	125	3	3	3	2	2	2
ICTP 8203 Unselected	58	70	128	0	0	0	0	0	0
ICMP 84122	49	72	121	8	3	6	4	3	4
ICMP 851018	66	73	139	5	4	5	4	3	4
ICMR 87003	68	75	143	0	0	0	0	0	0
ICMR 87913	66	63	129	2	0	1	2	0	1
ICMR 87030	67	72	139	5	6	6	4	5	5
ICMB 87003	43	65	108	7	3	5	5	2	4
[843B X (GNS X SS)]	69	69	138	0	0	0	0	0	0
863 B	53	68	121	0	0	0	0	0	0
Togo Yellow B-3	62	59	121	0	0	0	0	0	0
Togo Yellow B-1	61	64	125	3	5	4	2	3	3
ICMV 87901 Selected	69	70	139	0	3	2	0	1	1
ICMV 87901 Unselected	70	69	139	0	3	2	0	2	1
ICMP 451 Selected	64	69	133	22	16	19	15	10	13
ICMP 451 Unselected	63	60	123	10	15	13	7	8	8
ICMP 423 Selected	63	74	137	2	1	2	2	0	1
ICMP 423 Unselected	69	70	139	0	0	0	0	0	0
ICMP 85410	67	65	132	0	0	0	0	0	0
ICMP 86217	61	62	123	5	7	6	4	3	4
ICMR 87018	68	62	130	93	92	93	89	90	90
Location mean for test entries			130			8			7
Resistant check: P 7-4	71	70	141	9	3	6	8	3	6
Susceptible checks: 7042	60	61	121	52	57	55	48	50	49
NHB 3	54	52	106	87	82	85	77	71	74

Table 4. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Patancheru, India.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	76	93	169	1	0	1	1	0	1
P 310-17	66	101	167	12	3	8	12	3	8
P 1449-3	64	77	141	2	5	4	2	5	4
P 1591	78	81	159	21	12	17	20	12	16
P 2880	66	73	139	6	3	5	6	3	5
ICMP 83506 Selected	89	101	190	21	19	20	21	19	20
ICMP 83506 Unselected	83	92	175	21	21	21	18	21	20
ICMP 85109 Selected	76	76	152	13	7	10	13	6	10
ICMP 85109 Unselected	73	77	150	18	10	14	18	10	14
ICTP 8203 Selected	70	93	163	13	5	9	13	5	9
ICTP 8203 Unselected	68	85	153	9	7	8	9	6	8
ICMP 84122	76	88	164	17	42	30	17	42	30
ICMP 851018	130	95	225	49	25	37	49	25	37
ICMR 87003	69	84	153	1	0	1	1	0	1
ICMR 87913	84	94	178	12	3	8	12	3	8
ICMR 87030	91	126	217	51	44	48	50	43	47
ICMB 87003	81	89	170	14	14	14	13	14	14
[843B X (GNS X SS)]	61	83	144	0	2	1	0	2	1
863 B	66	78	144	0	3	2	0	3	2
Togo Yellow B-3	48	81	129	0	0	0	0	0	0
Togo Yellow B-1	82	75	157	67	20	44	53	20	37
ICMV 87901 Selected	72	87	159	7	3	6	7	3	6
ICMV 87901 Unselected	74	107	181	7	2	5	7	2	5
ICMP 451 Selected	89	72	161	51	21	36	44	19	32
ICMP 451 Unselected	80	129	209	35	33	34	34	33	34
ICMP 423 Selected	69	69	138	4	4	4	4	4	4
ICMP 423 Unselected	76	107	183	7	2	5	7	2	5
ICMP 85410	70	83	153	6	2	4	6	2	4
ICMP 86217	70	78	148	10	18	14	10	18	14
ICMR 87018	100	90	190	47	50	49	47	48	48
Location mean for test entries			166			15			14
Resistant check: P 7-4	82	84	166	11	6	9	11	6	9
Susceptible checks:7042	86	79	165	76	81	79	69	74	72
NHB 3	113	109	222	87	90	89	80	82	81

Table 5. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Mysore, India.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	125	86	211	2	2	2	2	2	2
P 310-17	104	72	176	4	1	3	4	1	3
P 1449-3	118	118	236	2	3	3	1	2	2
P 1591	91	95	186	8	2	5	7	2	5
P 2880	92	90	182	10	7	9	8	5	7
ICMP 83506 Selected	90	79	169	6	1	4	4	1	3
ICMP 83506 Unselected	94	107	201	3	2	3	3	2	3
ICMP 85109 Selected	71	52	123	17	6	12	15	3	9
ICMP 85109 Unselected	105	80	185	31	28	30	29	27	28
ICTP 8203 Selected	87	91	178	17	3	10	16	3	10
ICTP 8203 Unselected	108	95	203	1	5	3	1	5	3
ICMP 84122	101	107	208	6	9	8	5	8	7
ICMP 851018	85	102	187	99	65	82	99	61	80
ICMR 87003	119	124	243	1	0	1	1	0	1
ICMR 87913	75	85	160	0	0	0	0	0	0
ICMR 87030	100	93	193	68	43	56	68	38	53
ICMB 87003	98	104	202	0	1	1	0	1	1
[843B X (GNS X SS)]	90	111	201	0	0	0	0	0	0
863 B	83	98	181	1	0	1	1	0	1
Togo Yellow B-3	130	92	222	1	0	1	1	0	1
Togo Yellow B-1	96	102	198	2	4	3	2	3	3
ICMV 87901 Selected	107	103	210	11	13	12	9	11	10
ICMV 87901 Unselected	107	91	198	10	9	10	10	9	10
ICMP 451 Selected	73	75	148	18	19	19	14	16	15
ICMP 451 Unselected	65	73	138	40	21	31	39	19	29
ICMP 423 Selected	113	85	198	13	12	13	12	11	12
ICMP 423 Unselected	111	89	200	13	16	15	10	14	12
ICMP 85410	76	65	141	3	6	5	3	5	4
ICMP 86217	95	128	223	31	43	37	27	41	34
ICMR 87018	107	104	211	97	100	99	96	100	98
Location mean for test entries			190			16			15
Resistant check: P 7-4	98	102	200	16	27	22	16	23	20
Susceptible checks: 7042	91	74	165	63	69	66	56	60	58
NHB 3	83	64	147	94	93	94	93	93	93

Table 6. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Bhavanisagar, India.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	72	54	126	0	2	1	0	2	1
P 310-17	68	51	119	4	2	3	4	2	3
P 1449-3	63	65	128	2	0	1	2	0	1
P 1591	46	69	115	7	4	6	3	4	4
P 2880	62	57	119	0	4	2	0	2	1
ICMP 83506 Selected	62	61	123	0	0	0	0	0	0
ICMP 83506 Unselected	61	60	121	2	0	1	2	0	1
ICMP 85109 Selected	74	64	138	3	2	3	2	1	2
ICMP 85109 Unselected	63	59	122	2	7	5	2	3	3
ICTP 8203 Selected	69	64	133	1	2	2	1	2	2
ICTP 8203 Unselected	56	61	117	2	0	1	1	0	1
ICMP 84122	52	45	97	0	0	0	0	0	0
ICMP 851018	65	45	110	0	0	0	0	0	0
ICMR 87003	70	55	125	0	2	1	0	2	1
ICMR 87913	67	63	130	0	0	0	0	0	0
ICMR 87030	58	67	125	64	76	70	51	43	47
ICMB 87003	65	53	118	0	0	0	0	0	0
[843B X (GNS X SS)]	80	70	150	0	0	0	0	0	0
863 B	56	55	111	0	0	0	0	0	0
Togo Yellow B-3	66	68	134	0	0	0	0	0	0
Togo Yellow B-1	54	69	123	93	100	97	74	90	82
ICMV 87901 Selected	60	67	127	0	0	0	0	0	0
ICMV 87901 Unselected	67	73	140	3	4	4	1	4	3
ICMP 451 Selected	54	62	116	9	16	13	5	7	6
ICMP 451 Unselected	75	63	138	0	2	1	0	1	1
ICMP 423 Selected	66	72	138	2	3	3	1	1	1
ICMP 423 Unselected	73	73	146	1	0	1	1	0	1
ICMP 85410	48	57	105	0	0	0	0	0	0
ICMP 86217	55	29	84	0	0	0	0	0	0
ICMR 87018	58	24	82	29	54	42	23	32	28
Location mean for test entries			122			8			6
Resistant check: P 7-4	60	56	116	0	2	1	0	2	1
Susceptible checks: 7042	62	48	110	48	75	62	42	69	56
NHB 3	66	58	124	78	85	82	50	55	52

Table 7. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Kovilpatti, India.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	64	62	126	0	0	0	0	0	0
P 310-17	59	56	115	3	0	2	2	0	1
P 1449-3	58	58	116	0	0	0	0	0	0
P 1591	58	59	117	3	12	8	3	8	6
P 2880	62	58	120	2	3	3	1	2	2
ICMP 83506 Selected	58	58	116	0	0	0	0	0	0
ICMP 83506 Unselected	62	72	134	0	0	0	0	0	0
ICMP 85109 Selected	62	81	143	0	6	3	0	3	2
ICMP 85109 Unselected	70	62	132	4	0	2	3	0	2
ICTP 8203 Selected	58	58	116	0	0	0	0	0	0
ICTP 8203 Unselected	57	68	125	0	0	0	0	0	0
ICMP 84122	66	65	131	0	0	0	0	0	0
ICMP 851018	62	61	123	0	0	0	0	0	0
ICMR 87003	59	64	123	0	0	0	0	0	0
ICMR 87913	63	61	124	0	0	0	0	0	0
ICMR 87030	75	67	142	63	77	70	40	60	50
ICMB 87003	45	45	90	0	0	0	0	0	0
[843B X (GNS X SS)]	60	64	124	0	0	0	0	0	0
863 B	56	62	118	0	0	0	0	0	0
Togo Yellow B-3	60	58	118	0	0	0	0	0	0
Togo Yellow B-1	52	54	106	0	0	0	0	0	0
ICMV 87901 Selected	58	54	112	0	0	0	0	0	0
112V 87901 Unselected	54	56	110	2	0	1	1	0	1
ICMP 451 Selected	67	79	146	3	9	6	2	5	4
ICMP 451 Unselected	61	56	117	0	4	2	0	3	2
ICMP 423 Selected	58	62	120	0	0	0	0	0	0
ICMP 423 Unselected	65	60	125	0	0	0	0	0	0
ICMP 85410	64	61	125	0	0	0	0	0	0
ICMP 86217	61	72	133	0	8	4	0	6	3
ICMR 87018	57	72	129	74	21	48	58	13	36
Location mean for test entries			122			5			4
Resistant check: P 7-4	62	56	118	0	0	0	0	0	0
Susceptible checks: 7042	58	74	132	64	37	51	51	29	40
NHB 3	63	65	128	22	19	20	14	11	13

Table 8. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Cinsana, Mali.

	Downy mildew								
	No. plants			Incidence (%)			Severity (%)		
Entry	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	52	34	86	46	32	39	28	14	21
P 310-17	51	46	97	18	26	22	9	8	9
P 1449-3	43	47	90	16	43	30	8	18	13
P 1591	49	26	75	55	100	78	33	66	50
P 2880	41	38	79	22	29	26	10	18	14
ICMP 83506 Selected	48	27	75	29	56	43	10	25	18
ICMP 83506 Unselected	43	39	82	33	59	46	24	31	28
ICMP 85109 Selected	41	26	67	32	100	66	10	68	39
ICMP 85109 Unselected	41	19	60	55	100	78	26	80	53
ICTP 8203 Selected	37	36	73	35	39	37	25	19	22
ICTP 8203 Unselected	48	48	96	29	44	37	15	19	17
ICMP 84122	42	38	80	100	97	99	100	93	97
ICMP 851018	44	45	89	71	100	86	60	71	66
ICMR 87003	44	28	72	71	79	75	67	55	61
ICMR 87913	36	38	74	22	97	60	13	88	51
ICMR 87030	31	34	65	55	86	71	48	73	61
ICMB 87003	43	43	86	56	65	61	45	50	48
[843B X (GNS X SS)]	40	34	74	85	100	93	66	97	82
863 B	34	42	76	100	100	100	99	99	99
Togo Yellow B-3	45	41	86	73	100	87	69	88	79
Togo Yellow B-1	40	30	70	100	100	100	100	98	99
ICMV 87901 Selected	50	48	98	28	46	37	13	22	18
ICMV 87901 Unselected	33	30	63	49	33	41	28	18	23
ICMP 451 Selected	42	34	76	36	35	36	14	18	16
ICMP 451 Unselected	40	29	69	25	49	37	12	24	18
ICMP 423 Selected	37	35	72	19	29	24	10	9	10
ICMP 423 Unselected	46	34	80	33	38	36	10	15	13
ICMP 85410	43	40	83	37	40	39	17	28	23
ICMP 86217	47	46	93	89	100	95	71	89	80
ICMR 87018	38	45	83	32	22	27	10	7	9
Location mean for test entries			79			57			41
Resistant check: P 7-4	46	45	91	24	31	28	10	11	11
Susceptible checks: 7042	40	23	63	75	95	85	58	85	72
NHB 3	43	37	80	88	98	93	76	82	79

Table 9. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Kamboinse, Burkina Faso.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	46	38	84	0	0	0	0	0	0
P 310-17	40	40	80	0	0	0	0	0	0
P 1449-3	26	27	53	0	0	0	0	0	0
P 1591	41	42	83	34	45	40	29	39	34
P 2880	42	39	81	3	0	1	2	0	1
ICMP 83506 Selected	44	40	84	0	3	2	0	3	2
ICMP 83506 Unselected	42	36	78	0	8	4	0	6	3
ICMP 85109 Selected	8	39	47	10	0	5	8	0	4
ICMP 85109 Unselected	48	43	91	0	9	5	0	9	5
ICTP 8203 Selected	40	26	66	10	8	9	6	5	6
ICTP 8203 Unselected	37	40	77	5	23	14	3	8	6
ICMP 84122	48	38	86	73	82	78	67	73	70
ICMP 851018	45	38	83	9	8	9	4	4	4
ICMR 87003	28	36	64	25	50	38	11	38	25
ICMR 87913	44	35	79	14	34	24	11	28	20
ICMR 87030	40	45	85	100	98	99	87	90	89
ICMB 87003	36	38	74	47	11	29	21	5	13
[843B X (GNS X SS)]	47	36	83	60	92	76	47	79	63
863 B	40	37	77	40	46	43	29	41	35
Togo Yellow B-3	44	44	88	41	52	47	27	40	34
Togo Yellow B-1	38	38	76	40	58	49	30	53	42
ICMV 87901 Selected	40	42	82	28	12	20	20	4	12
ICMV 87901 Unselected	41	45	86	2	11	7	2	9	6
ICMP 451 Selected	2	46	48	0	9	5	0	6	3
ICMP 451 Unselected	40	46	86	23	9	16	19	7	13
ICMP 423 Selected	39	41	80	0	2	1	0	1	1
ICMP 423 Unselected	36	42	78	0	0	0	0	0	0
ICMP 85410	39	25	64	0	8	4	0	4	2
ICMP 86217	40	42	82	8	12	10	8	7	8
ICMR 87018	44	41	85	0	2	1	0	2	1
Location mean for test entries			77			21			17
Resistant check: P 7-4	41	44	85	10	5	8	7	3	6
Susceptible checks: 7042	31	41	72	100	98	99	97	96	97
NHB 3	34	43	77	77	72	75	60	51	56

Table 10. Number of hills and frequency of hills having at least one downy mildew (DM) infected plant for each of two observations in the 1988 IPMDMN at Manga-Bawku, Ghana.

	First observation (24 days after sowing)						Second observation (56 days after sowing)					
	No. hills			Frequency of hills with DM (%)			No. hills			Frequency of hills with DM (%)		
Entry	R1	R2	Total	R1	R2	Mean	R1	R2	Total	R1	R2	Mean
P 24-1	29	24	53	38	58	48	28	18	46	11	0	6
P 310-17	27	17	44	22	24	23	27	15	42	0	0	0
P 1449-3	14	21	35	57	14	36	8	16	24	0	0	0
P 1591	27	26	53	48	46	47	23	26	49	4	19	12
P 2880	18	24	42	28	38	33	12	23	35	0	0	0
ICMP 83506 Selected	14	22	36	57	23	40	16	31	47	0	0	0
ICMP 83506 Unselected	32	23	55	44	30	37	27	11	38	0	0	0
ICMP 85109 Selected	21	16	37	57	69	63	17	4	21	0	0	0
ICMP 85109 Unselected	28	27	55	43	67	55	22	16	38	0	0	0
ICTP 8203 Selected	28	25	53	29	36	33	24	23	47	0	9	4
ICTP 8203 Unselected	28	24	52	39	33	36	28	21	49	46	19	33
ICMP 84122	22	34	56	91	79	85	6	15	21	100	53	77
ICMP 851018	34	30	64	50	67	59	34	29	63	0	0	0
ICMR 87003	26	22	48	65	59	63	22	16	38	18	0	9
ICMR 87913	29	30	59	62	60	61	22	19	41	0	0	0
ICMR 87030	27	26	53	44	73	59	24	10	34	17	50	34
ICMB 87003	18	19	37	78	42	60	12	13	25	0	0	0
[843B X (GNS X SS)]	20	34	54	95	68	82	13	28	41	62	46	54
863 B	28	33	61	79	91	85	15	14	29	60	43	52
Togo Yellow B-3	24	19	43	71	84	78	11	2	13	0	100	50
Togo Yellow B-1	32	30	62	94	80	87	18	13	31	0	0	0
ICMV 87901 Selected	28	27	55	29	33	31	28	26	54	7	4	6
ICMV 87901 Unselected	34	26	60	41	39	40	34	24	58	18	0	9
ICMP 451 Selected	22	14	36	32	43	38	21	13	34	0	0	0
ICMP 451 Unselected	20	21	41	50	48	49	17	21	38	0	0	0
ICMP 423 Selected	8	28	36	38	32	35	3	28	31	67	0	34
ICMP 423 Unselected	18	30	48	33	33	33	13	30	43	0	3	2
ICMP 85410	18	15	33	44	27	36	18	12	30	6	0	3
ICMP 86217	34	34	68	91	82	87	29	31	60	7	0	4
ICMR 87018	[illegible]	16	44	21	31	26	28	14	42	0	14	7
Location mean for test entries	25	25	50	52	50	52	20	19	39	14	12	13
Resistant check: P 7-4	26	30	56	23	47	35	26	30	56	4	0	2
Susceptible checks:7042 DMS	30	32	62	93	91	92	5	0	5	100	0	50
NMB 3	33	33	66	78	79	79	29	26	55	33	17	25

Table 11. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Sadore, Niger.

	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
Entry	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	33	46	79	26	11	19	21	9	15
P 310-17	40	50	90	10	4	7	10	4	7
P 1449-3	45	43	88	0	0	0	0	0	0
P 1591	39	44	83	38	32	35	34	26	31
P 2880	47	51	98	9	10	10	9	8	9
ICMP 83506 Selected	45	46	91	69	59	64	61	53	57
ICMP 83506 Unselected	47	44	91	39	76	58	38	68	53
ICMP 85109 Selected	39	45	84	14	12	13	12	10	11
ICMP 85109 Unselected	22	32	54	14	25	20	14	24	19
ICTP 8203 Selected	45	33	78	5	4	5	5	4	5
ICTP 8203 Unselected	37	40	77	3	5	4	3	4	4
ICMP 84122	32	37	69	47	94	71	47	85	66
ICMP 851018	33	46	79	9	20	15	9	13	11
ICMR 87003	43	46	89	11	22	17	11	15	13
ICMR 87913	46	26	72	14	12	13	13	7	10
ICMR 87030	47	46	93	78	100	89	75	95	86
ICMB 87003	40	35	75	71	65	68	69	65	67
[843B X (GNS X SS)]	44	43	87	8	39	24	8	34	21
863 B	42	43	85	39	44	42	39	41	40
Togo Yellow B-3	34	44	78	50	52	51	50	44	47
Togo Yellow B-1	31	38	69	96	100	98	96	100	98
ICMV 87901 Selected	43	44	87	34	23	29	34	20	27
ICMV 87901 Unselected	44	41	85	15	32	24	14	28	21
ICMP 451 Selected	39	42	81	72	88	80	71	87	79
ICMP 451 Unselected	24	35	59	88	91	90	84	91	88
ICMP 423 Selected	42	41	83	0	3	2	0	1	1
ICMP 423 Unselected	44	47	91	2	2	2	2	2	2
ICMP 85410	25	46	71	17	52	35	17	44	31
ICMP 86217	45	38	83	18	27	23	16	21	19
ICMR 87018	45	40	85	82	68	75	78	63	71
Location mean for test entries			81			36			34
Resistant check: P 7-4	47	45	92	27	27	27	24	26	25
Susceptible checks: 7042	30	32	62	100	100	100	100	98	100
NHB 3	39	41	80	82	54	68	81	49	65

Table 12. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Bengou, Niger.

				Downy mildew					
	No. plants			Incidence (%)			Severity (%)		
Entry	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	42	46	88	55	74	65	40	67	54
P 310-17	41	45	86	8	0	4	4	0	2
P 1449-3	42	44	86	5	10	8	1	5	3
P 1591	41	25	66	34	12	23	26	9	18
P 2880	41	37	78	19	26	23	14	22	18
ICMP 83506 Selected	39	43	82	78	88	83	78	86	82
ICMP 83506 Unselected	47	43	90	81	76	79	81	76	79
ICMP 85109 Selected	36	41	77	8	5	7	5	4	5
ICMP 85109 Unselected	37	22	59	39	0	20	29	0	15
ICTP 8203 Selected	39	40	79	30	14	22	27	10	19
ICTP 8203 Unselected	45	49	94	13	14	14	8	7	8
ICMP 84122	30	24	54	100	100	100	100	99	100
ICMP 851018	43	47	90	33	31	32	32	31	32
ICMR 87003	33	32	65	39	44	42	27	39	33
ICMR 87913	44	40	84	33	72	53	20	67	44
ICMR 87030	43	32	75	90	85	88	84	77	81
ICMB 87003	41	40	81	87	85	86	85	77	81
[843B X (GNS X SS)]	46	36	82	74	57	66	69	49	59
863 B	27	39	66	87	94	91	85	94	90
Togo Yellow B-3	43	43	86	87	86	87	84	73	79
Togo Yellow B-1	17	36	53	100	96	98	100	96	98
ICMV 87901 Selected	50	43	93	22	54	38	20	42	31
ICMV 87901 Unselected	42	36	78	24	30	27	23	20	22
ICMP 451 Selected	38	24	62	88	82	85	75	74	75
ICMP 451 Unselected	40	31	71	97	92	95	95	91	93
ICMP 423 Selected	44	46	90	15	2	9	15	1	8
ICMP 423 Unselected	46	42	88	5	3	4	5	3	4
ICMP 85410	34	45	79	74	70	72	68	68	68
ICMP 86217	50	35	85	13	24	19	9	17	13
ICMR 87018	32	36	68	96	91	94	91	86	89
Location means for test entries			78			51			47
Resistant check: P 7-4	50	44	94	50	60	55	44	53	49
Susceptible checks: 7042	28	36	64	83	91	87	82	86	84
NHB 3	45	42	87	55	33	44	51	32	42

Table 13. Plant population and downy mildew incidence (%) and infection severity index (%) of entries in the 1988 IPMDMN at Samaru, Nigeria.

Entry	No. plants			Downy mildew					
				Incidence (%)			Severity (%)		
	R1	R2	Total	R1	R2	Mean	R1	R2	Mean
P 24-1	19	15	34	26	20	23	26	18	22
P 310-17	16	19	35	0	11	6	0	8	4
P 1449-3	36	28	64	6	14	10	6	13	10
P 1591	29	26	55	28	27	28	24	25	25
P 2880	8	15	23	38	13	26	38	13	26
ICMP 83506 Selected	11	5	16	45	40	43	45	40	43
ICMP 83506 Unselected	26	8	34	8	0	4	7	0	4
ICMP 85109 Selected	10	24	34	10	8	9	10	8	9
ICMP 85109 Unselected	16	18	34	88	83	86	88	78	83
ICTP 8203 Selected	17	24	41	24	21	23	22	17	20
ICTP 8203 Unselected	8	4	12	100	100	100	100	94	97
ICMP 84122	19	26	45	0	0	0	0	0	0
ICMP 851018	19	17	36	37	41	39	37	40	39
ICMR 87003	16	16	32	44	31	38	44	28	36
ICMR 87913	29	19	48	66	68	67	41	63	52
ICMR 87030	30	23	53	10	4	7	8	4	6
ICMB 87003	20	14	34	15	36	26	15	32	24
[843B X (GNS X SS)]	10	16	26	90	88	89	83	78	81
863 B	21	16	37	100	100	100	100	100	100
Togo Yellow B-3	20	27	47	85	67	76	85	64	75
Togo Yellow B-1	19	9	28	47	56	52	42	47	45
ICMV 87901 Selected	35	26	61	23	38	31	21	35	28
ICMV 87901 Unselected	28	42	70	25	26	26	25	25	25
ICMP 451 Selected	18	16	34	22	19	21	22	17	20
ICMP 451 Unselected	24	31	55	33	39	36	33	36	35
ICMP 423 Selected	4	5	9	25	20	23	25	20	23
ICMP 423 Unselected	28	21	49	46	43	45	46	40	44
ICMP 85410	11	14	25	91	79	85	91	70	81
ICMP 86217	21	10	31	67	90	79	60	85	73
ICMR 87018	30	28	58	27	18	23	18	16	17
Location mean for rest entries			39			40			38
Resistant check: P 7-4	27	28	55	35	32	34	26	29	28
Susceptible checks: 7042	34	40	74	100	100	100	100	97	99
NHB 3	21	21	42	70	53	62	56	46	51

Table 14. Mean downy mildew infection severity index (%) of each entry at each location and across all locations in the 1988 IPMDMN.

Entry	Location											Entry mean	MBK[2]
	GWL	ABD	PTN	MYS	BVS	KVP	CZN	KBS	SDR	BNG	SMR		
P 24-1	2	1	1	2	1	0	21	0	15	54	22	11	48
P 310-17	0	4	8	3	3	1	9	0	7	2	4	4	23
P 1449-3	4	0	4	2	1	0	13	0	0	3	10	3	36
P 1591	0	6	16	5	4	6	50	34	31	18	25	18	47
P 2880	2	10	5	7	1	2	14	1	9	18	26	9	33
ICMP 83506 Selected	3	1	20	3	0	0	18	2	57	82	43	21	40
ICMP 83506 Unselected	2	1	20	3	1	0	28	3	53	79	4	18	37
ICMP 85109 Selected	5	22	10	9	2	2	39	4	11	5	9	11	63
ICMP 85109 Unselected	0	26	14	28	3	2	53	5	19	15	83	23	55
ICTP 8203 Selected	1	2	9	10	2	0	22	6	5	19	20	9	33
ICTP 8203 Unselected	1	0	8	3	1	0	17	6	4	8	97	13	36
ICMP 84122	1	4	30	7	0	0	97	70	66	100	0	34	85
ICMP 851018	0	4	37	80	0	0	66	4	11	32	39	25	59
ICMR 87003	0	0	1	1	1	0	61	25	13	33	36	16	63
ICMR 87913	0	1	8	0	0	0	51	20	10	44	52	17	61
ICMR 87030	2	5	47	53	47	50	61	89	86	81	6	48	59
ICMB 87003	0	4	14	1	0	0	48	13	67	81	24	23	60
[843B X (GNS X SS)]	3	0	1	0	0	0	82	63	21	59	81	28	82
863 B	5	0	2	1	0	0	99	35	40	90	100	34	85
Togo Yellow B-3	16	0	0	1	0	0	79	34	47	79	75	30	78
Togo Yellow B-1	1	3	37	3	82	0	99	42	98	98	45	46	87
ICMV 87901 Selected	1	1	6	10	0	0	18	12	27	31	28	12	31
ICMV 87901 Unselected	0	1	5	10	3	1	23	6	21	22	25	11	40
ICMP 451 Selected	3	13	32	15	6	4	16	3	79	75	20	24	38
ICMP 451 Unselected	0	8	34	29	1	2	18	13	88	93	35	29	49
ICMP 423 Selected	6	1	4	12	1	0	10	1	1	8	23	6	35
ICMP 423 Unselected	2	0	5	12	1	0	13	0	2	4	44	8	33
ICMP 85410	0	0	4	4	0	0	23	2	31	68	81	19	36
ICMP 86217	0	4	14	34	0	3	80	8	19	13	73	23	87
ICMR 87018	5	90	48	98	28	36	9	1	71	89	17	45	26
Location mean for test entries	2	7	14	15	6	4	41	17	34	47	38	20	52
Resistant check: P 7-4	2	6	9	20	1	0	11	6	25	49	28	14	35
Susceptible checks: 7042	10	49	72	58	56	40	72	97	100	84	99	67	92
NHB 3	16	74	81	93	52	13	79	56	65	42	51	57	79

1. GWL= Gwalior, ABD = Aurangabad, PTN = Patancheru, MYS = Mysore, BVS = Bhavanisagar, KVP = Kovilpatti, CZN = Cinzana, KBS = Kamboinse, MBK = Manga-Bawku, SDR = Sadore, BNG = Bengou and SMR = Samaru
2. Mean downy mildew incidence. Data based on frequency of infected hills (generally more than one plant per hill) at 24 day after sowing).

Table 15. Mean ergot severity (%) in the 1988 IPMDMN at three locations.

Entry	Location		
	MYS	BNG	SMR
P 24-1	50	10	30
P 310-17	15	2	1
P 1449-3	28	4	2
P 1591	10	10	6
P 2880	15	5	2
ICMP 83506 Selected	28	2	0
ICMP 83506 Unselected	15	-	2
ICMP 85109 Selected	13	4	2
ICMP 85109 Unselected	15	2	33
ICTP 8203 Selected	50	1	0
ICTP 8203 Unselected	50	5	1
ICMP 84122	63	-	1
ICMP 851018	20	10	60
ICMR 87003	63	5	4
ICMR 87913	50	10	2
ICMR 87030	63	5	1
ICMB 87003	63	1	1
[843B X (GNS X SS)]	43	8	1
863 B	55	5	1
Togo Yellow B-3	63	3	1
Togo Yellow B-1	30	-	1
ICMV 87901 Selected	35	3	1
ICMV 87901 Unselected	75	2	1
ICMP 451 Selected	15	8	1
ICMP 451 Unselected	20	-	18
ICMP 423 Selected	23	1	6
ICMP 423 Unselected	35	3	1
ICMP 85410	35	10	40
ICMP 86217	10	7	2
ICMR 87018	-	3	1
Location mean for test entries	36	5	7
Resistant check: P 7-4	35	1	2
Susceptible checks: 7042	50	13	1
NHB 3	38	8	3

1. MYS = Mysore, BNG = Bengou and SMR = Samaru.

Table 16. Mean smut severity (%) in the 1988 IPMDMN at four locations.

Entry	Location			
	GWL	CZN	BNG	SMR
P 24-1	5	5	0	0
P 310-17	3	5	2	0
P 1449-3	15	2	0	1
P 1591	10	8	1	1
P 2880	1	7	1	1
ICMP 83506 Selected	1	3	0	0
ICMP 83506 Unselected	1	1	-	0
ICMP 85109 Selected	3	2	0	0
ICMP 85109 Unselected	3	1	1	2
ICTP 8203 Selected	13	4	0	0
ICTP 8203 Unselected	5	1	1	0
ICMP 84122	3	1	-	1
ICMP 851018	3	1	0	9
ICMR 87003	10	5	1	1
ICMR 87913	5	1	1	0
ICMR 87030	5	3	1	0
ICMB 87003	5	2	0	0
[843B X (GNS X SS)]	8	2	1	0
863 B	0	0	1	0
Togo Yellow B-3	13	1	3	0
Togo Yellow B-1	8	0	-	0
ICMV 87901 Selected	10	1	1	0
ICMV 87901 Unselected	1	1	1	0
ICMP 451 Selected	3	3	1	0
ICMP 451 Unselected	8	2	-	0
ICMP 423 Selected	1	4	1	0
ICMP 423 Unselected	5	7	1	0
ICMP 85410	0	0	0	0
ICMP 86217	1	1	0	1
ICMR 87018	0	0	0	0
Location mean for test entries	5	2	1	1
P 7-4 (DMR) Check	6	7	0	1
7042 DMS	30	2	0	0
NHB 3	7	1	0	0

1. GWL = Gwalior, CZN = Cinzana, BNG = Bengou and SMR = Samaru.

Table 17. Mean rust severity (%) recorded on upper leaves in the 1988 IPMDMN at six locations.

	Location					
	GWL	AUR	PTN	MYS	BVS	KVP
P 24-1	0	3	0	10	3	0
P 310-17	3	0	5	25	18	15
P 1449-3	0	0	5	15	18	10
P 1591	0	13	8	25	25	33
P 2880	0	33	25	33	25	18
ICMP 83506 Selected	3	33	18	40	65	53
ICMP 83506 Unselected	0	33	25	40	53	65
ICMP 85109 Selected	3	40	33	25	40	33
ICMP 85109 Unselected	0	33	33	33	45	25
ICTP 8203 Selected	0	40	25	65	45	33
ICTP 8203 Unselected	3	33	33	65	100	70
ICMP 84122	5	40	45	53	80	83
ICMP 851018	0	5	5	25	10	33
ICMR 87003	5	25	10	18	25	53
ICMR 87913	0	40	40	40	40	25
ICMR 87030	0	40	18	40	40	65
ICMB 87003	25	65	40	65	33	65
[843B X (GNS X SS)]	0	33	10	33	25	53
863 B	0	40	33	40	45	33
Togo Yellow B-3	5	18	18	40	33	33
Togo Yellow B-1	0	8	18	33	40	53
ICMV 87901 Selected	13	40	33	53	70	33
ICMV 87901 Unselected	3	40	33	53	65	70
ICMP 451 Selected	0	8	5	25	25	25
ICMP 451 Unselected	0	5	3	33	18	18
ICMP 423 Selected	0	33	25	40	25	33
ICMP 423 Unselected	18	18	25	40	25	40
ICMP 85410	0	33	18	33	10	25
ICMP 86217	0	25	18	33	33	33
ICMR 87018	0	40	33	65	53	53
Location mean for test entries	3	27	21	38	38	39
Resistant check: P 7-4	0	25	23	40	18	10
Susceptible checks: 7042	8	40	40	40	53	65
NHB 3	0	40	57	34	65	58

1. GWL = Gwalior, AUR = Aurangabad, PTN = Patancheru, MYS = Mysore, BVS = Bhavanisagar and KVP = Kovilpatti.

Table 18. Severity[1] of leaf blast (LB) at Gwalior and Dactuliophora leaf spot (DLS) and rectangular leaf spot (RLS) at Bengou in the 1988 IPMDMN.

Entry	Location[2]		
	GWL(LB)	BNG(DLS)	BNG(RLS)
P 24-1	2	2	3
P 310-17	2	3	3
P 1449-3	1	3	3
P 1591	2	2	2
P 2880	2	3	3
ICMP 83506 Selected	1	2	3
ICMP 83506 Unselected	2	3	3
ICMP 85109 Selected	2	3	3
ICMP 85109 Unselected	3	3	3
ICTP 8203 Selected	3	3	3
ICTP 8203 Unselected	2	3	3
ICMP 84122	1	1	1
ICMP 851018	2	4	2
ICMR 87003	2	2	3
ICMR 87913	3	3	2
ICMR 87030	3	2	3
ICMB 87003	2	4	1
[843B X (GNS X SS)]	3	3	3
863 B	2	2	3
Togo Yellow B-3	2	2	3
Togo Yellow B-1	2	1	1
ICMV 87901 Selected	3	4	3
ICMV 87901 Unselected	2	4	2
ICMP 451 Selected	2	2	3
ICMP 451 Unselected	3	3	2
ICMP 423 Selected	3	4	2
ICMP 423 Unselected	2	3	2
ICMP 85410	1	2	4
ICMP 86217	1	3	2
ICMR 87018	2	3	2
Location mean for test entries	2	3	3
Resistant check: P 7-4	3	3	3
Susceptible checks: 7042	3	3	3
NHB 3	2	4	2

1. Severity based on a 1-5 scale, where 1= no symptoms and 5= >25% of leaf area covered.
2. GWL = Gwalior and BNG = Bengou.

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