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International Crops Research Institute for the Semi-Arid Tropics

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**INTERNATIONAL PEARL MILLET DISEASE RESISTANCE TESTING PROGRAM
(IPMDRTP)**

**REPORT ON
THE EIGHTH (1984) INTERNATIONAL PEARL MILLET ERGOT NURSERY
(IPMEN)**



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ABSTRACT

The 32-entry 1984 International Pearl Millet Ergot Nursery (IPMEN), eighth in the series, was evaluated at 8 locations in India. Although no entry remained ergot-free at all locations, five entries had across-location mean severities of not more than 1% and the maximum of not more than 7% at any one location. Fourteen entries had across-location mean severities of 2 to 5% and the remaining 9 had 8 to 16% compared with 42, 59, 29 and 59% severities on WC-C75, BJ 104 (trial checks), local resistant and local susceptible, respectively. Fifteen of the 22 entries which were common in 1983 and 1984 consistently showed high resistance to ergot across-locations for the second successive year. Ten entries (ICMPES-15; -16; -23; -24; -26; -27; -34; -37; ICMPE 134-6-25 and -134-6-34) besides showing high resistance to ergot were also resistant to smut and downy mildew for over 2 years across Indian locations.

RESUME

Les 32 entrées de la huitième Pépinière internationale de l'ergot du mil (International Pearl Millet Ergot Nursery - IPMEN), ont été testées dans huit localités de l'Inde en 1984. Bien qu'aucune entrée n'ait été indemne dans toutes les localités, cinq d'entre elles ont eu une sévérité moyenne $\leq 1\%$, avec une valeur maximale de $\leq 7\%$ à une localité quelle soit-elle. Quatorze entrées ont eu une sévérité moyenne comprise entre deux et cinq pourcent, et les neuf restantes ont eu entre 8 et 16% de sévérité comparée avec 42, 59, 29, et 59% de sévérité sur WC-C75 et BJ 104 (témoins), le local résistant et local sensible, respectivement. Quinze des vingt-deux entrées qui étaient utilisées en 1983 et 1984 ont montré une haute résistance à l'ergot à travers les localités pour la dernière année. Dix entrées (ICMPES-15; -16; -23; -24; -26; -27; -34; -37; ICMPE 134-6-25 et -134-6-34) ont montré non seulement une résistance élevée à l'ergot mais se sont révélées aussi résistantes au charbon et au mildiou depuis plus de deux années et dans toutes les localités de l'Inde.

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**REPORT ON THE EIGHTH (1984) INTERNATIONAL PEARL MILLET ERGOT NURSERY
(IPMEN)**

INTRODUCTION

The International Pearl Millet Ergot Nursery (IPMEN) is a component of the International Pearl Millet Disease Resistance Testing Program (IPMDRTP) coordinated by the Pathology Sub-Program in the ICRISAT Pearl Millet Improvement Program with the following objectives:

1. To test the stability of ergot resistant entries identified at ICRISAT Center;
2. To monitor variations in populations of the pathogen, and
3. To provide scientists with disease resistance sources for utilization in their resistance breeding programs.

ENTRIES

The 1984 IPMEN consisted of 32 entries including 22 promising entries from the 1983 IPMEN, 6 new entries identified in 1983 advanced screening at ICRISAT Center and 4 controls (two trial checks, one local resistant, and one local susceptible). The local resistant and local susceptible controls were chosen by cooperators at each location.

IPMEN DISTRIBUTION

The IPMEN was distributed to cooperators at 13 locations in India and the results were received only from 8 of these locations (Table 1).

IPMEN MANAGEMENT

Each entry was planted in two 4m-row plots in 2 replications. Cultural practices followed were as per the recommendations for the individual locations. Ten plants per row were bagged at the boot-leaf stage and inoculated at full protogyny 2-3 days later using an aqueous honeydew conidial suspension and rebagged immediately after inoculation. Ergot severity scores were recorded 15-20 days after inoculation using the standard severity assessment key provided with the IPMEN field book.

DATA RECEIVED

In addition to ergot scores cooperators provided data on weather (temperature and rainfall), days to 75% stigma emergence (flowering) and scores on other prevalent diseases such as smut, downy mildew (DM), and rust.

RESULTS

Weather

Data on rainfall, number of rainy days and temperature (max. and min.) during the period from inoculation to disease evaluation were received from 8 locations (Table 2). The number of rainy days varied from 30 at Pune to none at New Delhi. The amount of rainfall was maximum at Pune (294.5 mm) and no rainfall at New Delhi. At ICRISAT Center and Jalna in addition to 238.5 mm (in 11 days) and 141 mm (in 10 days) precipitation, respectively, sprinkler irrigations were provided once or twice a day for 30 min. each on rain-free days to

maintain high humidity.

The highest maximum temperature was at New Delhi (33.7C) and lowest maximum at Mysore (28.3C). The highest minimum temperature occurred at ICRISAT Center (21.2C) and the lowest minimum at Ludhiana (16.7C).

PERFORMANCE OF ENTRIES

The mean ergot severities, scores for other diseases, and days to 75% flowering for each entry at individual locations are presented in Tables 3 to 10.

Ludhiana (Table 3): The mean ergot severities of test entries varied from 0 to 15%. Two entries remained ergot free, 18 had $\leq 1\%$ severity, 7 had 2 to 4% and 1 scored 15% severity compared with 53 to 61% in the susceptible controls.

Twentythree ergot resistant entries ($\leq 5\%$ severity) were also resistant to DM ($\leq 4\%$ incidence) while BJ 104 had 60% DM incidence.

Jamnagar (Table 4): The mean ergot severity of test entries varied from $< 1\%$ to 9%. Eighteen of the 28 test entries had $\leq 1\%$ severity and the remaining 10 entries scored between 2 and 9% severity, compared with 25 to 34% in controls.

Twentythree ergot resistant entries ($\leq 5\%$ severity) were also resistant to DM ($\leq 5\%$ incidence), while BJ 104 showed 50% DM incidence. Since natural smut pressure was not high (only 3% severity on BJ 104) at this location, smut severities on test entries varied from 0 to

<1%. Natural rust pressure, however, was moderately high (42 to 55% severity on controls) and four entries which were highly resistant to ergot, DM and smut, were also resistant to rust (5-17% severity).

New Delhi (Table 5): The mean ergot severities of test entries ranged from 0 to 24% compared with 29-57% on the susceptible controls. Nine entries were ergot free, other 9 had <1% severity, 8 had between 2 and 5% severity and the remaining 2 had 14 and 24% severity.

The DM incidence varied from 0 to 9% in the test entries compared with 92% in the local susceptible and 18% in BJ 104. Twentyone of the ergot resistant lines (<5% severity) were also resistant to DM (<5% incidence).

Pune (Table 6): Although no entry was ergot free, the mean severities ranged from <1 to 11% on the test entries compared with 71 to 89% on controls. Fourteen entries scored <1% ergot and the remaining 14 between 2 and 11%.

DM incidence was quite high on some entries. Eight of the ergot resistant entries were also resistant to DM (<5% incidence), and the remaining 20 entries had 6 to 77% incidence, compared with 95% on the local susceptible control, HB 3, and 39% on the trial check, BJ 104.

Rust severity was moderate to high (10 to 60%) on the test entries compared with 60 to 80% on controls. Three ergot resistant entries showed <20% severity and the remaining 25 scored between 25 and 65% severity.

Patanchery (ICRISAT Center) (Table 7): Though only one entry was ergot free, 20 entries showed <1% severity and the remaining 7 scored between 5 and 19% compared with 73 to 86% severity on susceptible controls.

Screening was done in the DM nursery. In test entries DM incidence varied from 0 to 7% and the trial check, BJ 104 showed 31% incidence. Fifteen of the 28 ergot resistant entries remained DM-free and the remaining 13 had 1 to 7% incidence.

Smut severity ranged from 0 to 1% on test entries while the trial check, BJ 104 and the local susceptible control had 58 and 68% severity, respectively. All the ergot resistant entries had high levels of resistance to smut under artificial inoculation.

Rust scores were taken under natural conditions. In test entries rust severity ranged from 5 to 20%. Twenty entries had 5% rust severity and the remaining 8 showed severity of 10 to 20% compared with 25 to 65% on controls.

Fifteen of the 28 entries showed combined resistance to ergot, smut, DM and rust.

Aurangabad (Table 8): Although no entry remained ergot-free, 17 entries had mean severity of <2%; 8 scored between 3 and 8% and the remaining 3 showed 11 to 27% severity, compared with 50 to 79% on controls.

DM incidence varied from 0 to 17% on the test entries. Ten entries remained DM-free; 17 scored between 1 and 7% and only one entry had 17% incidence compared to 4 and 8% on trial check, BJ 104 and the local susceptible, respectively.

Rust severity was moderate to high on the test entries (5 to 70%) compared to 50 to 85% severity on controls. Ten entries showed <10% severity and the remaining 18 scored between 12 and 70% severity.

Seven of the 28 test entries showed combined resistance to ergot, DM and rust.

Mysore (Table 9): The mean ergot severities in the test entries ranged from <1 to 26%; 13 entries had <4% severity; 5 between 8 and 9% and the remaining 10 had between 11 and 26% compared with 35 to 67% on susceptible controls and 8% on local resistant control.

DM pressure was usually low, with almost all entries including BJ 104 remaining DM free. Rust severity was low to moderate (5 to 40%) on the test entries and controls. Fourteen entries had rust severity of <10% and the remaining 14 had between 17 and 40%.

Jalga (Table 10): The mean ergot severities in the test entries ranged from 4 to 40% compared with 32 to 68% on controls. Eight entries scored between 4 and 9%, 9 between 11 and 20% and the remaining 11 scored between 21 and 40%.

DM incidence on the test entries ranged from 0 to 21% compared with 18% on one trial check, BJ 104. Seventeen test entries, the other trial check (WC-C75) and the local controls remained DM free and the other 11 entries showed between 1 and 21% DM incidence.

PERFORMANCE ACROSS-LOCATIONS:

Ergot: The minimum ergot pressure, as indicated by severity on the susceptible check, BJ 104, occurred at Jamnagar (28%) and the maximum occurred at Pune (89%). The location mean across entries was minimum (2%) both at Ludhiana and Jamnagar, and maximum (17%) at Jalna (Table 11).

Five of the 28 test entries had overall across-location mean ergot severity of 1% with a maximum of 7% at any one location, 14 entries had between 2 and 5%, and the remaining 9 entries had between 8 and 16%, compared with 42 to 59% on the susceptible controls and 29% on the local resistant control.

Of 11 entries tested for 3 consecutive years (1982-84) across 6 locations 7 showed consistently high resistance (<5% mean severity) indicating stability of resistance in these entries (Table 12). Six of the other 11 entries which were tested at 7 locations for 2 years (1983-84) also showed high resistance across locations.

Downy mildew: Sixteen ergot resistant lines had overall across location DM incidence of 0 to 5% over 2 years and the remaining 8 had 6 to 22% incidence compared with 46 to 49% incidence on susceptible controls (Table 13).

Rust: The overall mean rust severity of test entries across locations varied from 2 to 22% and 6 to 40% for 1983 and 1984, respectively, compared with 54 to 58% on susceptible controls in 2 years. Eight entries which showed resistance to ergot and DM, were also resistant to rust, with mean severity ranging from 2 to 19% (Table 14).

DISCUSSION

Ergot resistant entries (ICMPE & ICMPEs Nos) developed at ICRISAT Center have been tested for 3-4 years at several locations in India and West Africa. Results (Table 11) clearly show the continued stability of resistance of these entries in 1984. Until 1980 a majority of the IPMEN entries were selections from the germplasm and breeding lines and none of these showed consistently high resistance across locations over years. Since 1981, with the inclusion of ICRISAT developed ergot resistant lines (ICMPE and ICMPEs numbers) entries with stable resistance to ergot in India have been identified (Table 12) and some have demonstrated stable resistance to ergot in India and West Africa in previous IPMENs.

Fifteen of the 22 common test entries in the 1983 and 1984 IPMENs consistently showed high resistance to ergot across-locations for the second successive year. Ten entries besides showing high resistance to ergot were also resistant to smut and downy mildew for over 2 years across Indian locations (Table 15). Although rust reactions of the entries were not consistent over years and across locations, several entries which had combined resistance to ergot, smut and DM also showed moderate to high levels of resistance to rust. Several of the multiple disease resistant entries (ICMPEs Nos.) have shown superior

agronomic traits and high grain yield potential at Indian locations (Unpublished results). Wider testing in Africa will be needed to confirm the stability of resistance of many of these lines.

Several of these ergot resistant entries are being utilized at ICRISAT Center and Indian programs to develop ergot resistant hybrids and varieties.

MULTILOCCATIONAL TESTING IN 1985

The 1985 IPMEN with about 30 entries will be made available to cooperators by May-June 1985. Entries are welcome from scientists in the National and Regional programs, provided they were found resistant at the home locations.

SEED SUPPLY

Small quantities seed of entries listed in this report will be made available to interested scientists on request to the Principal Pathologist, Pearl Millet Improvement Program, ICRISAT.

**Table 1. Locations and cooperator(s) in the 1984 IPMEN in India
from whom the results were received by 28 February 1985**

<u>Location</u>	Cooperator(s)
Aurangabad	N.B. Pawar & S.S. Ghughe
Jalna	MAHYCO (Maharashtra Hybrid Seed Co. Ltd.)
Jamnagar	S.D. Nafade & H.R. Dave
Ludhiana	S.S. Chahal
Mysore	H.S. Shetty & H.S. Prakash
New Delhi	S.B. Methur & Janaki Kandhari
Patancheru	R.P. Thakur & V.P. Rao
Pune	S.S. Bangar & M.S. Rane

Table 2. Planting date, temperature and rainfall data at the 1984 IPNEN locations

Location	Latitude ° (N)		Planting date	Inoculation to disease evaluation				
				Period	Temperature C		Rainy days	Rainfall (mm)
					Max.	Min.		
Ludhiana	36	56'	July 18	Sept.15-Oct.27	32.7	16.7	1	4.2
New Delhi	28	35'	July 20	Sept.6 -Oct.28	33.7	18.4	0	0.0
Jamnagar	22	28'	July 21	Sept.6 -Oct.16	33.0	20.9	2	56.4
Aurange- bad	19	53'	July 16	Sept.2 -Oct.13	- ^b	-	8	163.0
Jalna	19	51'	July 25	Sept.26-Nov.3	-	-	10	141.0 ^a
Pune	18	32'	June 30	Aug.18-Oct.8	28.7	20.3	30	294.5
Patan- cheru	17	26'	June 6	July 30-Sep.14	29.4	21.2	11	238.5 ^a
Mysore	12	15'	June 25	Aug.14-Sept.15	28.3	18.2	2	11.0

In addition sprinkler irrigation was provided once or twice a day for 30 min. each on rain-free days.

Data not provided.

Table 3. Ergot and downy mildew (DM) reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at Ludhiana

Entry	Ergot severity (%)				DM ^b incidence (%)	DTF ^b
	Rep 1	Rep 2	Mean ^a	Range		
ICMPES 1	2	1	1	0-10	6	69
ICMPES 2	3	1	2	0-15	0	68
ICMPES 6	2	5	3	0-25	1	77
ICMPES 7	4	3	3	0-10	34	79
ICMPES 8	19	12	15	5-40	9	66
ICMPES 9	1	2	1	0-20	4	79
ICMPES 15	1	1	1	0-5	0	77
ICMPES 16	2	1	1	0-10	0	70
ICMPES 17	1	1	1	0-5	0	71
ICMPES 18	0	<1	<1	0-2	1	78
ICMPES 22	1	2	1	0-10	3	69
ICMPES 23	<1	3	2	0-10	0	74
ICMPES 24	1	1	1	0-5	<1	78
ICMPES 26	1	1	1	0-5	0	73
ICMPES 27	1	1	1	0-5	0	79
ICMPES 28	<1	<1	<1	0-2	0	69
ICMPES 29	1	1	1	0-5	1	75
ICMPES 30	1	1	1	0-5	1	66
ICMPES 31	1	3	2	0-20	0	81
ICMPES 32	2	2	2	0-10	0	64
ICMPES 34	1	1	1	0-5	0	69
ICMPES 35	1	1	1	0-5	1	79
ICMPES 37	1	1	1	0-10	0	69
ICMPE 13-6-27	1	1	1	0-5	7	69
ICMPE 13-6-30	1	2	1	0-10	7	67
ICMPE 34-1-10	5	4	4	0-35	<1	68
ICMPE 134-6-25	0	0	0	0-0	0	72
ICMPE 134-6-34	0	0	0	0-0	0	68
<u>Controls</u>						
Trial check (WC-C75)	2	6	4	0-20	0	56
Trial check (BJ 104)	54	52	53	25-80	60	53
Local Resistant	8	5	6	0-25	3	56
Local Susceptible	58	64	61	35-95	0	63

^a Mean of 40 bagged-inoculated inflorescences.

^b

Mean of 2 reps.

Table 4. Ergot, downy mildew (DM), smut and rust reactions and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at Jamnagar

Entry	Ergot severity (%)				DM ^b incl. (%)	Smut ^b sev. (%)	Rust ^b sev. (%)	DTF ^b
	Rep 1	Rep 2	Mean ^a	Range				
ICMPES 1	1	<1	1	0-2	0	0	37	74
ICMPES 2	1	1	1	0-3	2	0	50	62
ICMPES 6	7	11	9	1-50	0	0	32	64
ICMPES 7	3	1	2	0-15	16	0	12	62
ICMPES 8	8	9	8	0-40	4	<1	42	63
ICMPES 9	5	3	4	0-15	5	0	35	68
ICMPES 15	<1	<1	<1	0-1	0	0	37	71
ICMPES 16	1	2	1	0-5	0	0	32	64
ICMPES 17	1	1	1	0-5	1	0	27	64
ICMPES 18	<1	3	2	0-10	0	0	17	73
ICMPES 22	2	4	3	0-20	0	0	30	63
ICMPES 23	<1	<1	<1	0-2	0	<1	27	75
ICMPES 24	<1	1	1	0-5	0	0	5	74
ICMPES 26	<1	1	1	0-5	0	0	27	69
ICMPES 27	0	<1	<1	0-2	0	0	7	75
ICMPES 28	1	4	2	0-10	0	0	15	64
ICMPES 29	1	<1	1	0-10	0	<1	22	68
ICMPES 30	<1	2	1	0-10	0	0	25	64
ICMPES 31	2	15	8	0-40	0	0	10	68
ICMPES 32	2	6	4	0-25	0	0	30	64
ICMPES 34	1	1	1	0-5	0	0	55	61
ICMPES 35	<1	<1	<1	0-1	1	0	50	67
ICMPES 37	2	<1	1	0-10	0	0	47	64
ICMPE 13-6-27	<1	<1	<1	0-10	2	0	47	70
ICMPE 13-6-30	2	1	1	0-20	1	<1	45	67
ICMPE 34-1-10	7	10	8	0-40	0	<1	45	63
ICMPE 134-6-25	<1	0	<1	0-1	0	0	47	62
ICMPE 134-6-34	<1	1	1	0-5	0	0	55	64
<u>Controls</u>								
Trial check (WC-C75)	25	25	25	10-60	1	2	52	53
Trial check (BJ 104)	22	35	28	10-70	50	3	45	52
Local Resistant	34	28	31	10-70	0	<1	42	62
Local Susceptible	32	36	34	10-70	23	3	55	50

Mean of 40 inoculated inflorescences.

^b

Mean of 2 reps.

Table 5. Ergot and downy mildew (DM) reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at New Delhi

Entry	Ergot severity (%)				DM ^b inci. (%)	b DTF
	Rep 1	Rep 2	Mean ^a	Range		
ICMPES 1	<1	1	1	0-5	9	56
ICMPES 2	4	1	2	0-50	4	65
ICMPES 6	2	5	3	0-40	0	65
ICMPES 7	0	0	0	0-0	8	65
ICMPES 8	22	27	24	1-75	2	56
ICMPES 9	1	<1	1	0-25	0	65
ICMPES 15	0	0	0	0-0	0	60
ICMPES 16	<1	1	1	0-15	0	60
ICMPES 17	1	1	1	0-20	2	56
ICMPES 18	0	0	0	0-0	0	65
ICMPES 22	1	4	2	0-2	2	65
ICMPES 23	<1	<1	<1	0-2	0	62
ICMPES 24	2	1	1	0-40	0	65
ICMPES 26	0	0	0	0-0	0	65
ICMPES 27	<1	<1	<1	0-5	0	65
ICMPES 28	13	16	14	0-50	0	60
ICMPES 29	0	0	0	0-0	0	60
ICMPES 30	2	<1	1	0-25	6	60
ICMPES 31	0	6	3	0-40	2	56
ICMPES 32	2	2	2	0-25	0	58
ICMPES 34	0	0	0	0-0	0	60
ICMPES 35	0	0	0	0-0	0	60
ICMPES 37	1	0	<1	0-5	0	60
ICMPE 13-6-27	3	2	2	0-50	7	56
ICMPE 13-6-30	2	2	2	0-25	6	56
ICMPE 34-1-10	3	7	5	0-25	0	56
ICMPE 134-6-25	0	0	0	0-0	0	65
ICMPE 134-6-34	0	0	0	0-0	0	71
<u>Controls</u>						
Trial check (WC-C75)	50	43	46	5-80	0	49
Trial check (BJ 104)	58	56	57	15-90	18	49
Local Resistant	4	6	5	0-50	5	42
Local Susceptible	32	26	29	5-80	92	49

Mean of 40 inoculated inflorescences.

Mean of 2 reps.

Table 6. Ergot, downy mildew (DM) and rust reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at Pune

Entry	Ergot severity (%)				DM ^b inc. (%)	Rust ^b sev. (%)	DTF ^b
	Rep 1	Rep 2	Mean ^a	Range			
ICMPES 1	1	1	1	0-2	44	40	60
ICMPES 2	1	1	1	0-5	11	60	52
ICMPES 6	15	1	8	0-50	6	40	61
ICMPES 7	2	20	11	0-80	77	55	61
ICMPES 8	14	4	9	0-80	20	55	57
ICMPES 9	1	18	9	0-80	12	35	61
ICMPES 15	1	1	1	0-5	4	40	61
ICMPES 16	1	1	1	0-5	24	40	61
ICMPES 17	2	3	2	0-5	77	25	61
ICMPES 18	2	3	2	0-20	24	25	61
ICMPES 22	9	9	9	0-60	19	40	62
ICMPES 23	1	2	1	0-5	8	35	62
ICMPES 24	6	1	3	0-30	11	30	61
ICMPES 26	1	2	1	0-5	28	20	61
ICMPES 27	1	2	1	0-20	9	10	62
ICMPES 28	1	3	2	0-30	7	20	56
ICMPES 29	2	1	1	0-5	10	30	62
ICMPES 30	3	1	2	0-10	15	35	61
ICMPES 31	5	6	5	0-50	2	20	55
ICMPES 32	1	2	1	0-5	8	30	56
ICMPES 34	1	<1	<1	0-2	0	60	50
ICMPES 35	1	<1	<1	0-1	0	50	58
ICMPES 37	1	<1	<1	0-5	3	40	52
ICMPE 13-6-27	3	4	3	0-10	43	55	62
ICMPE 13-6-30	2	4	3	0-20	10	30	57
ICMPE 34-1-10	5	1	3	0-30	1	55	51
ICMPE 134-6-25	1	<1	<1	0-2	0	40	50
ICMPE 134-6-34	1	<1	<1	0-2	1	40	50
<u>Controls</u>							
Trial check (WC-C75)	75	67	71	20-100	10	60	43
Trial check (BJ 104)	93	85	89	40-100	39	70	43
Local Res. (RHR I)	90	85	88	50-100	5	80	44
Local Suc. (HB 3)	- ^c	78	78	50-100	95	60	49

Mean of 40 bagged-inoculated inflorescences.

^b Mean of 2 reps. ^c Data not available.

Table 7. Ergot, downy mildew (DM), smut and rust reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at ICRISAT Center, Patancheru

Entry	Ergot severity (%)				DM ^b inc. (%)	Smut ^b sev. (%)	Rust ^b sev. (%)	DTF ^c
	Rep 1	Rep 2	Mean ^a	Range				
ICMPES 1	<1	<1	<1	0-1	0	0	5	66
ICMPES 2	1	2	1	0-5	1	0	5	65
ICMPES 6	25	5	15	0-95	6	0	5	63
ICMPES 7	1	<1	1	0-15	6	0	5	70
ICMPES 8	28	10	19	0-90	6	0	5	61
ICMPES 9	8	29	18	0-90	0	0	5	69
ICMPES 15	1	<1	1	0-2	0	0	10	63
ICMPES 16	1	<1	1	0-5	2	0	5	62
ICMPES 17	<1	1	1	0-5	0	0	5	67
ICMPES 18	<1	<1	<1	0-5	3	0	5	65
ICMPES 22	7	7	7	0-50	2	0	5	64
ICMPES 23	1	<1	1	0-10	3	0	5	66
ICMPES 24	1	<1	1	0-5	0	0	5	65
ICMPES 26	1	1	1	0-20	0	0	5	61
ICMPES 27	<1	<1	<1	0-1	0	0	5	68
ICMPES 28	2	1	1	0-10	0	0	5	65
ICMPES 29	1	<1	1	0-20	0	0	5	65
ICMPES 30	<1	1	1	0-5	0	0	5	70
ICMPES 31	9	1	5	0-50	2	0	5	70
ICMPES 32	6	12	9	0-90	1	0	5	61
ICMPES 34	<1	<1	<1	0-2	0	0	5	60
ICMPES 35	0	0	0	0-0	0	0	10	63
ICMPES 37	1	1	1	0-10	0	<1	10	61
ICMPE 13-6-27	<1	<1	<1	0-1	0	0	15	65
ICMPE 13-6-30	0	<1	<1	0-2	5	0	10	67
ICMPE 34-1-10	4	6	5	0-40	0	1	15	60
ICMPE 134-6-25	<1	<1	<1	0-2	5	0	20	61
ICMPE 134-6-34	1	1	1	0-5	7	0	20	60
Controls								
Trial check (WC-C75) 70		77	73	10-98	6	6	25	50
Trial check (BJ 104) 93		79	86	20-100	31	58	65	52
Local Resis. (ICMPE 134-6-18)	<1	2	1	0-10	0	0	25	61
Local Susc. (BK 560) 88		82	85	25-100	3	68	65	50

^a Mean of 40 bagged-inoculated inflorescences.

^b Based on screening in the ICRISAT multiple disease nursery.

^c Based on only 1 replication.

Table 8. Ergot, downy mildew (DM) and rust reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at Aurangabad

Entry	Ergot severity (%)				DM ^b inc. (%)	Rust ^b sev. (%)	DTF ^c
	Rep 1	Rep 2	Mean ^a	Range			
ICMPES 1	<1	0	<1	0-1	5	40	63
ICMPES 2	2	2	2	0-15	2	50	61
ICMPES 6	4	7	5	0-65	0	50	63
ICMPES 7	1	5	3	0-30	17	7	65
ICMPES 8	1	7	4	0-65	2	20	65
ICMPES 9	11	6	8	0-65	7	35	65
ICMPES 15	1	1	1	0-2	0	20	65
ICMPES 16	1	1	1	0-10	2	5	65
ICMPES 17	1	1	1	0-10	0	5	65
ICMPES 18	2	6	4	0-40	2	7	63
ICMPES 22	1	6	3	0-40	3	30	65
ICMPES 23	6	1	3	0-15	4	12	65
ICMPES 24	2	1	1	0-20	3	5	65
ICMPES 26	<1	1	1	0-10	2	15	63
ICMPES 27	1	<1	1	0-5	0	5	65
ICMPES 28	22	1	11	0-85	0	10	65
ICMPES 29	1	1	1	0-5	1	5	65
ICMPES 30	2	3	2	0-25	2	5	65
ICMPES 31	10	2	6	0-35	1	5	65
ICMPES 32	12	42	27	0-95	1	35	61
ICMPES 34	2	1	1	0-15	0	70	63
ICMPES 35	2	1	1	0-25	0	40	61
ICMPES 37	1	1	1	0-5	1	60	61
ICMPE 13-6-27	<1	1	1	0-5	6	50	61
ICMPE 13-6-30	1	2	1	0-15	6	40	65
ICMPE 34-1-10	2	20	11	0-45	0	20	61
ICMPE 134-6-25	<1	1	1	0-5	0	40	61
ICMPE 134-6-34	<1	<1	<1	0-1	0	70	63
Controls:							
Trial check (WC-C75)	36	68	52	1-100	0	50	51
Trial check (BJ 104)	41	61	51	10-100	4	65	47
Local Resistant	10	90	50	1-100	0	60	61
Local Susceptible	67	80	79	40-100	8	85	90

Mean of 30-40 inoculated inflorescences. Mean of 2 replications.

^c

Based on only 1 replication.

Table 9. Ergot, downy mildew (DM) and rust reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at Mysore

Entry	Ergot severity (%)				DM ^b inc. (%)	Rust ^b sev. (%)	DTF ^b
	Rep 1	Rep 2	Mean ^a	Range			
ICMPES 1	5	4	4	1-10	2	25	66
ICMPES 2	14	14	14	5-35	0	17	53
ICMPES 6	27	18	22	5-35	0	25	65
ICMPES 7	17	18	17	5-35	0	5	65
ICMPES 8	10	12	11	5-20	0	25	62
ICMPES 9	29	23	26	10-50	0	10	64
ICMPES 15	3	4	3	0-10	0	40	68
ICMPES 16	10	14	12	5-20	0	5	64
ICMPES 17	2	2	2	0-5	0	10	68
ICMPES 18	8	5	6	1-10	0	5	66
ICMPES 22	25	17	21	10-35	0	25	65
ICMPES 23	10	8	9	5-20	0	17	66
ICMPES 24	4	3	3	0-10	0	17	65
ICMPES 26	7	6	6	1-20	0	25	65
ICMPES 27	1	1	1	0-5	0	5	68
ICMPES 28	18	24	21	5-35	0	10	64
ICMPES 29	1	2	1	0-5	0	7	68
ICMPES 30	3	2	2	0-10	0	25	66
ICMPES 31	12	14	13	5-35	6	7	67
ICMPES 32	28	16	22	10-50	0	5	53
ICMPES 34	<1	<1	<1	0-1	0	10	55
ICMPES 35	2	3	2	0-5	0	25	55
ICMPES 37	<1	<1	<1	0-1	0	25	55
ICMPE 13-6-27	7	11	9	1-20	0	10	66
ICMPE 13-6-30	3	2	2	0-5	4	32	62
ICMPE 34-1-10	10	8	9	5-20	0	25	53
ICMPE 134-6-25	1	2	1	0-5	0	7	53
ICMPE 134-6-34	1	1	1	0-5	0	5	53
Controls:							
Trial check (WC-C75)	37	34	35	20-50	0	10	51
Trial check (BJ 104)	62	63	62	35-90	0	25	45
Local Resistant	8	8	8	1-20	0	25	55
Local Susceptible	59	75	67	35-90	0	25	45

Mean of 40 bagged-inoculated inflorescences.

^b

Mean of 2 replications.

Table 10. Ergot and downy mildew (DM) reactions, and days to 75 percent flowering (DTF) of the 32-entry 1984 IPMEN at Jaina

Entry	Ergot severity (%)				DM ^b inc. (%)	DTF ^b
	Rep 1	Rep 2	Mean ^a	Range		
ICMPES 1	20	10	15	1-50	6	68
ICMPES 2	4	14	9	0-75	5	66
ICMPES 6	30	50	40	5-90	0	63
ICMPES 7	9	39	24	0-90	21	64
ICMPES 8	31	36	34	1-90	7	65
ICMPES 9	21	13	17	0-75	5	63
ICMPES 15	20	24	22	5-75	0	63
ICMPES 16	22	18	20	0-90	2	66
ICMPES 17	32	24	28	5-75	0	71
ICMPES 18	17	29	23	0-75	0	68
ICMPES 22	30	21	25	1-90	2	66
ICMPES 23	11	21	16	0-75	0	69
ICMPES 24	8	13	11	0-75	0	66
ICMPES 26	5	4	5	0-10	0	66
ICMPES 27	14	2	8	0-75	0	68
ICMPES 28	24	4	14	0-75	1	63
ICMPES 29	16	11	13	0-90	0	66
ICMPES 30	21	30	25	1-75	0	67
ICMPES 31	32	16	24	0-90	0	65
ICMPES 32	40	10	25	0-90	0	64
ICMPES 34	9	4	7	0-20	0	65
ICMPES 35	6	5	5	0-20	0	67
ICMPES 37	6	8	7	0-20	0	66
ICMPE 13-6-27	25	11	18	5-50	11	67
ICMPE 13-6-30	23	13	18	1-50	6	66
ICMPE 34-1-10	27	15	21	5-50	0	65
ICMPE 134-6-25	8	3	5	0-35	0	71
ICMPE 134-6-34	5	3	4	0-20	14	64
<u>Controls</u>						
Trial Check 1 (WC-C75)	42	23	32	0-90	0	67
Trial Check 2 (BJ-104)	39	52	46	5-90	18	65
Local Resistant	56	26	41	1-90	0	65
Local Susceptible	72	66	69	20-90	0	68

Mean of 40 bagged-inoculated inflorescences from 2 reps.

Mean of 2 reps.

Table 11. Mean ergot severity (%) of the 1984 IPMEN entries and controls at eight Indian locations

Entry	Locations								Entry mean
	Ludhiana ^a	Jam-nagar ^b	New Delhi ^b	Pune ^a	Patan-cheru ^a	Auranga-bad ^b	Mysore ^a	Jalna ^a	
ICMPES ^c 1	1	1	1	1	<1	<1	4	15	3
ICMPES 2	2	1	2	1	1	2	14	9	4
ICMPES 6	3	9	3	8	15	5	22	40	13
ICMPES 7	3	2	0	11	1	3	17	24	8
ICMPES 8	15	8	24	9	19	4	11	34	16
ICMPES 9	1	4	1	9	18	8	26	17	11
ICMPES 15	1	<1	0	1	1	1	3	22	4
ICMPES 16	1	1	1	1	1	1	12	20	5
ICMPES 17	1	1	1	2	1	1	2	28	5
ICMPES 18	<1	2	0	2	<1	4	6	23	5
ICMPES 22	1	3	2	9	7	3	21	25	9
ICMPES 23	2	<1	<1	1	1	3	9	16	4
ICMPES 24	1	1	4	3	1	1	3	11	3
ICMPES 26	1	1	0	1	1	1	6	5	2
ICMPES 27	1	<1	<1	1	<1	1	1	8	2
ICMPES 28	<1	2	14	2	1	11	21	14	8
ICMPES 29	1	1	0	1	1	1	1	13	2
ICMPES 30	1	1	2	2	1	2	2	25	5
ICMPES 31	2	8	5	5	5	6	13	24	9
ICMPES 32	2	4	2	1	9	27	22	25	12
ICMPES 34	1	1	0	<1	<1	1	<1	7	1
ICMPES 35	1	<1	0	<1	0	1	2	5	1
ICMPES 37	1	1	<1	<1	1	1	<1	7	1
ICMPE 13-6-27	1	<1	2	3	<1	1	9	18	4
ICMPE 13-6-30	1	1	2	3	<1	1	2	18	4
ICMPE 34-1-10	4	8	5	3	5	11	9	21	8
ICMPE 134-6-25	0	<1	0	<1	<1	1	1	5	1
ICMPE 134-6-34	0	1	0	<1	1	<1	1	4	1
Location mean	2	2	3	3	3	4	9	17	-
<u>Controls</u>									
Trial Check 1 (WC-075)	4	25	46	71	73	52	35	32	42
Trial Check 2 (BJ 104)	53	28	57	89	86	51	62	46	59
Local Resistant	6	31	5	88	1	50	8	41	29
Local Susceptible	61	34	29	78	85	49	67	69	59

^a Mean of 30-40 bagged-inoculated inflorescences from 2 replications.

^b Mean of 30-40 inoculated inflorescences from 2 replications.

^c ICMPES(S) = ICRISAT millet pathology ergot-resistant line (sib-bulk).

Table 12. Performance of the 22 common IPMEN entries over 3 years (1982-84) at seven locations in India

Entry ^a	Ergot severity (%) ^b at																						
	Aurangabad		Patancheru		Ludhiana		Mysore		Pune ^d		Jammagar		New Delhi										
	82	83	84	82	83	84	82	83	84	83	84	82	83	84	82	83	84						
ICMPES 1	1	1	<1	2	1	<1	1	3	1	1	0	4	1	1	1	2	1	1	1	1	1	1	
ICMPES 2	1	2	<1	<1	1	<1	2	2	2	<1	<1	14	1	1	0	<1	1	3	0	2	2	2	
ICMPES 6	^c 31	5	-	26	15	-	4	3	-	4	22	7	8	-	5	9	-	2	3	-	1	1	
ICMPES 9	-	2	8	-	17	18	-	2	1	-	1	26	6	9	-	7	4	-	1	1	1	1	
ICMPES 15	-	1	1	-	<1	1	-	1	1	-	<1	3	<1	1	-	<1	<1	-	<1	0	-	<1	0
ICMPES 16	-	1	1	-	<1	1	-	2	1	-	0	12	1	1	-	<1	1	-	1	1	-	1	1
ICMPES 17	-	3	1	-	1	1	-	3	1	-	0	2	1	2	-	2	1	-	2	1	-	2	1
ICMPES 22	-	1	3	-	11	7	-	3	1	-	1	21	2	9	-	3	3	-	1	2	-	1	2
ICMPES 23	2	1	3	3	2	1	5	2	2	1	0	9	1	1	0	1	<1	2	0	<1	2	0	<1
ICMPES 24	-	1	1	-	1	1	-	1	1	-	0	3	1	3	-	1	1	-	3	1	-	3	1
ICMPES 26	-	1	1	-	<1	1	-	1	1	-	1	6	1	1	-	<1	1	-	<1	1	-	<1	0
ICMPES 27	1	1	1	1	<1	<1	<1	2	1	3	0	1	<1	1	0	<1	<1	<1	<1	<1	<1	<1	<1
ICMPES 28	3	2	11	7	1	1	<1	2	<1	1	0	21	1	2	<1	1	2	3	2	14	3	2	14
ICMPES 31	-	26	6	-	1	5	-	6	2	-	1	13	4	5	-	<1	8	-	1	3	-	1	3
ICMPES 32	4	16	27	2	1	9	1	2	2	1	1	22	2	1	<1	2	4	<1	1	2	<1	1	2
ICMPES 34	-	1	1	-	<1	<1	-	1	1	-	1	<1	1	<1	-	<1	1	-	<1	0	-	<1	0
ICMPES 37	-	1	1	-	<1	1	-	3	1	-	1	<1	1	<1	-	1	1	-	0	<1	-	0	<1
ICMPE 13-6-27	1	2	1	1	1	<1	2	3	1	3	0	9	1	3	1	1	<1	<1	1	2	<1	1	2
ICMPE 13-6-30	1	1	1	2	2	<1	<1	8	1	1	1	2	1	3	1	<1	1	4	2	2	2	2	2
ICMPE 34-1-10	4	22	11	13	2	5	13	10	4	3	5	9	2	3	7	5	8	3	2	5	3	2	5
ICMPE 134-6-25	1	1	1	<1	<1	<1	<1	3	0	2	0	1	1	<1	0	<1	<1	<1	<1	0	<1	<1	0
ICMPE 134-6-34	2	1	<1	1	<1	1	<1	5	0	<1	0	1	1	<1	<1	<1	<1	<1	<1	2	<1	0	0
Susceptible control	97	91	49	98	90	85	65	66	61	33	62	67	89	78	58	44	34	24	54	57	24	54	57

^a ICMPE(S) = ICRISAT millet pathology ergot-resistant lines (Sib-bulk).

^b Based on 20-40 inoculated inflorescences/entry in 2 reps.

^c Entries not tested.

^d Entries not tested in 1982.

Table 13. Downy mildew incidence (%) of the 22 common IPMEN entries over 2 years (1983-84) across six locations in India

Entry ^a	Locations												Overall Mean 1983-1984
	Mysore		Delhi		Pune		Jammagar		Aurangabad		Patancheru		
	1983	1984	1983	1984	1983	1984	1983	1984	1983	1984	1983	1984	
ICMPES 1	0	2	2	9	34	44	8	0	27	5	4	0	12
ICMPES 2	0	0	0	4	0	11	0	2	0	2	2	1	<1
ICMPES 6	0	0	0	0	11	6	0	0	9	0	0	6	3
ICMPES 9	1	0	14	0	13	12	4	5	47	7	2	0	13
ICMPES 15	1	0	0	0	4	4	0	0	17	0	8	0	5
ICMPES 16	0	0	0	0	9	24	1	0	6	2	1	2	3
ICMPES 17	0	0	3	2	10	77	0	1	18	0	0	0	6
ICMPES 22	0	0	5	2	20	19	0	0	12	3	0	2	6
ICMPES 23	0	0	0	0	2	8	0	0	9	4	1	3	2
ICMPES 24	0	0	0	0	11	11	0	0	4	3	0	0	3
ICMPES 26	1	0	0	0	11	28	0	0	0	2	2	0	3
ICMPES 27	0	0	0	0	8	9	0	0	16	0	0	0	5
ICMPES 28	0	0	0	0	9	7	0	0	3	0	1	0	3
ICMPES 31	0	6	4	2	4	2	1	0	7	1	0	2	3
ICMPES 32	0	0	0	0	4	8	0	0	10	1	4	1	3
ICMPES 34	0	0	0	0	1	0	0	0	0	0	3	0	1
ICMPES 37	0	0	0	0	1	3	0	0	0	1	0	0	<1
ICMPE 13-6-27	4	0	11	7	84	43	6	2	28	6	0	0	22
ICMPE 13-6-30	0	4	12	6	44	10	10	1	28	6	0	5	16
ICMPE 34-1-10	0	0	0	0	2	1	1	0	4	0	0	0	1
ICMPE 134-6-25	0	0	0	0	0	0	0	0	2	0	0	5	<1
ICMPE 134-6-34	0	0	0	0	1	1	0	0	0	0	3	7	1
Susc. Control	11	0	70	92	86	95	42	50	1	8	34	31	49

^a ICMPE(S) = ICRISAT millet pathology ergot-resistant line (sib-bulk).

Table 14. Rust severity (%) of the 22 common IPMEN entries over 2 years (1983-84) at five locations in India

Entry ^a	Patan-cheru		Mysore		Auran-gabad		Jam-nagar		Pune		Mean	
	83	84	83	84	83	84	83	84	83	84	83	84
	ICMPES 1	10	5	5	25	17	40	<1	37	10	40	8
ICMPES 2	25	5	5	17	10	50	<1	50	22	60	12	36
ICMPES 6	10	5	5	25	5	50	<1	32	40	40	12	30
ICMPES 9	10	5	5	10	5	35	<1	35	5	35	5	24
ICMPES 15	10	10	25	40	7	20	0	37	17	40	12	29
ICMPES 16	5	5	5	5	5	5	0	32	10	40	5	17
ICMPES 17	5	5	5	10	5	5	0	27	22	25	7	14
ICMPES 22	5	5	5	25	5	30	0	30	7	40	4	26
ICMPES 23	0	5	5	17	0	12	0	27	5	35	2	19
ICMPES 24	0	5	5	17	5	5	0	5	7	30	3	12
ICMPES 26	5	5	7	25	7	15	0	27	10	20	6	18
ICMPES 27	5	5	5	5	0	5	0	7	2	10	2	6
ICMPES 28	5	5	10	10	5	10	0	15	5	20	5	12
ICMPES 31	5	5	5	7	5	5	0	10	7	20	4	9
ICMPES 32	5	5	5	5	5	35	<1	30	10	30	5	21
ICMPES 34	25	5	25	10	37	70	<1	55	25	60	22	40
ICMPES 37	25	10	5	25	25	60	<1	47	40	40	19	36
ICMPE 13-6-27	10	15	7	10	10	50	0	47	10	55	7	35
ICMPE 13-6-30	10	10	5	32	25	40	<1	45	5	30	9	31
ICMPE 34-1-10	25	15	5	25	7	20	0	45	25	55	12	32
ICMPE 134-6-25	10	20	15	7	17	40	0	47	10	40	10	31
ICMPE 134-6-34	10	20	5	5	17	70	0	55	25	40	11	38
Susceptible control	100	65	25	25	100	85	4	55	40	70	54	58

ICMPE(S) = ICRISAT millet pathology ergot-resistant line (sib-bulk)

Table 15. Multiple disease resistance of IPMEN entries across locations in India for 2 years

Entry	Ergot severity (%) ^a		Smut severity (%) ^b		Downy mildew inc. (%) ^c	
	1983	1984	1983	1984	1983	1984
ICMPES 1	1	1	6	0	12	9
ICMPES 2	1	3	0	0	<1	3
ICMPES 6	11	9	<1	0	3	2
ICMPES 9	5	10	1	0	13	4
ICMPES 15	<1	1	0	0	5	1
ICMPES 16	1	3	0	0	3	4
ICMPES 17	2	1	0	0	6	11
ICMPES 22	3	7	0	0	6	4
ICMPES 23	1	2	0	<1	2	2
ICMPES 24	1	2	<1	0	3	2
ICMPES 26	1	2	<1	0	3	4
ICMPES 27	<1	1	0	0	5	1
ICMPES 28	1	7	0	0	3	1
ICMPES 31	6	6	<1	0	3	2
ICMPES 32	4	10	<1	0	3	1
ICMPES 34	1	<1	1	0	1	0
ICMPES 37	1	1	<1	<1	<1	1
ICMPE 13-6-27	1	2	2	0	22	9
ICMPE 13-6-30	2	1	1	<1	16	6
ICMPE 34-1-10	7	6	2	1	1	<1
ICMPE 134-6-25	1	<1	0	0	<1	1
ICMPE 134-6-34	1	<1	0	0	1	1
Susceptible control	71	62	72	35	49	46

^a Based on mean of 7 locations (Aurangabad, Patancheru, Ludhiana, Mysore, Pune, Jamnagar and New Delhi).

^b Based on mean of 2 locations (Jamnagar and Patancheru).

^c Based on mean of 6 locations (Mysore, Delhi, Pune, Jamnagar, Aurangabad, and Patancheru).

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