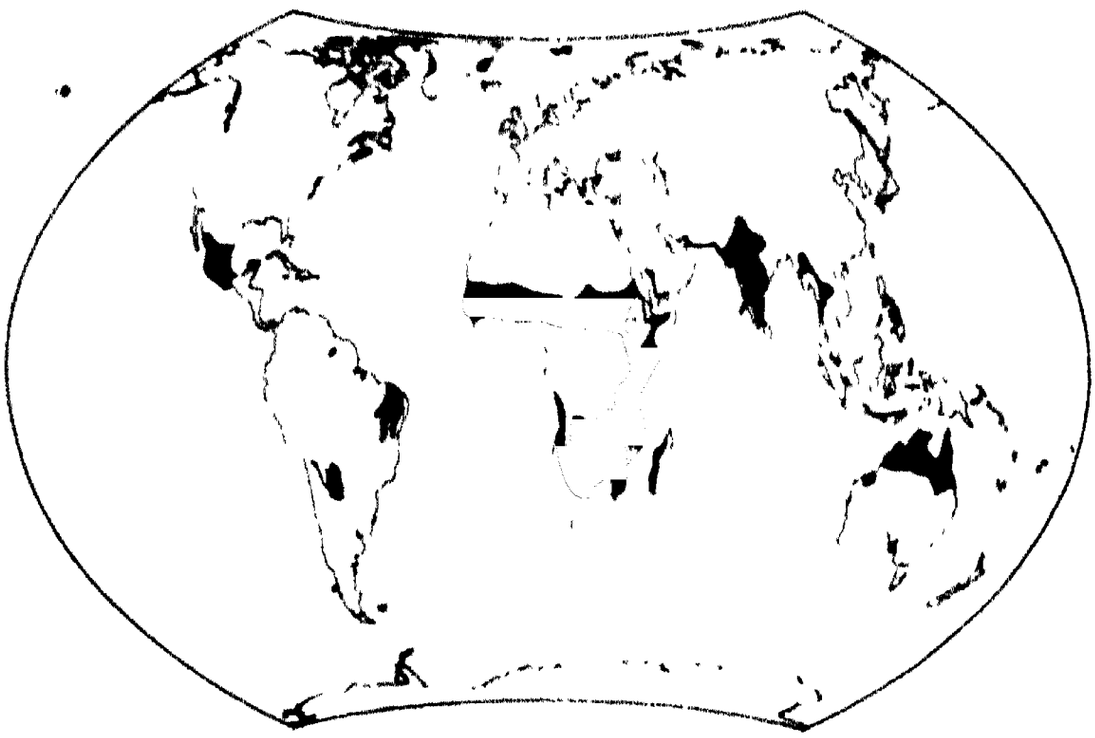
INTERNATIONAL PEARL MILLET DISEASE RESISTANCE TESTING PROGRAM

(IPMDRTP)

PROGRESS REPORT: PM PATH. 65



REPORT ON

THE 1981 INTERNATIONAL PEARL MILLET SMUT NURSERY

(IPMSN)

ICRISAT

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ABSTRACT

The 29 entry 1981 International Pearl Millet Smut Nursery (IPMSN) was tested at 4 West African and 3 Indian locations. Seven entries (SSC FS 252-S-4, EBS 46-1-2-S-2, MLC SN 75-1-6-S-1, EB 229-4-1-S-7-3-DM-1, EB 116-1-1-S-3-1-DM-1, ICI 7517-S-1 and EB 112-1-S-1-1) were highly smut resistant with across locations mean smut severities of 2 to 5%, and mean smut severities at any one location between 0 and 4% except at Kano (Nigeria) where the mean smut severity ranged from 8 to 32%. The remaining 22 entries had across locations mean smut severities of 3 to 16%. The mean smut severities of local susceptible lines and of the susceptible check were 40 and 41% respectively. The stable resistance seen in entry SSC FS 252-S-4 in previous years' trials was confirmed by the 1981 results. Among the test locations Kano provided the greatest smut pressure indicating the possible existence of pathogenic variability within Tolyposporium penicillariae.

RESUME

entrées de la Pépinière internationale de 1981 sur le charbon du mil à chandelle (IPMSN) ont été évaluées sur 4 sites en Afrique de l'Ouest et 3 sites en Inde. Sept entrées (SSC FS 252-S-4, EBS 46-1-2-S-2, MLC SN 75-1-6-S-1, EB 229-4-1-S-7-3-DM-1, EB 116-1-1-S-3-1-DM-1, ICI 7517-S-1 et EB 112-1-S-1-1) se sont montrées très résistantes au charbon. Sur l'ensemble des sites ces entrées avaient une gravité moyenne de charbon se situant entre 2 et 5% et sur chacun d'eux une gravité de 0 à 4%, sauf à Kano (Nigeria) où la gravité moyenne de charbon était de 8 à 32%. Les 22 autres entrées avaient sur l'ensemble des sites une gravité moyenne de charbon de 3 à 16%. La gravité moyenne de charbon des lignées locales et des témoins susceptibles était de 40 et 41% respectivement. La résistance stable dont a fait preuve l'entrée SSC FS 252-S-4 par les années passées a été confirmée par les résultats de 1981. Sur les différents sites, c'est à Kano où s'est le plus manifesté le charbon; ce qui suggère l'existence d'une variabilité pathogénique chez Tolyposporium penicillariae.

REPORT ON THE 1981 INTERNATIONAL PEARL MILLET SMUT NURSERY

INTRODUCTION

The International Pearl Millet Smut Nursery (IPMSN) is one of the component nurseries in the International Pearl Millet Diseases Resistance Testing Program (IPMDRTP) coordinated by the ICRISAT Pearl Millet Improvement Program. Through the assistance of cooperators in diverse locations throughout the semi-arid tropics, the IPMDRTP is used to identify sources of disease resistance that is stable across pathogen populations and environments. The IPMSN was initiated in 1977 with the participation of cooperators in Senegal, Nigeria, and India and five promising lines were identified. The 1978 IPMSN with 34 entries, sent to cooperators at 12 locations in 7 countries, was screened at 6 locations in 4 countries and 10 promising entries were identified with across location mean smut severities of not more than 10 percent. In 1979 the 37 entry IPMSN was screened at 4 locations in 3 countries and 5 entries were identified as highly resistant with across locations mean smut severity of less than 1 percent. The 32 entry 1980 IPMSN was screened at 6 locations in 3 countries and 2 highly resistant entries were identified with across locations mean of not more than 1 percent.

The 1981 IPMSN with 29 entries was sent to cooperators at 7 locations in 4 countries and the results received from all 7 locations are presented in this report.

LOCATIONS AND COOPERATORS

The 1981 IPMSN sets were distributed to five cooperators at seven locations in four countries. Data were received from all cooperators, from four locations in West Africa and three in India (Table 1).

ENTRIES

The 32 entry trial included the 14 best entries from the 1980 IPMSN, 15 new entries selected in the ICRISAT smut screening nursery at Hissar during the 1980 rainy season, and 3 checks (local resistant, local susceptible, and a trial check). The two local varieties being selected by cooperators were different at each location.

NURSERY MANAGEMENT AND INOCULATION

Cooperators were requested to plant the nursery in two 4 m rows in two replications and to follow the normal cultural and fertilization practices recommended at the location. The cooperators were advised to inject-inoculate 10 plants per row per replication at the boot leaf stage with an aqueous sporidial suspension obtained either from culture (on potato-agar/carrot-agar) or from a 24 h water-suspension of spore balls, and to bag the heads with paper bags immediately after inoculation. At locations where inoculation could not be done, bagging the heads at the boot leaf stage was recommended.

At all the locations except Bambey (Senegal) and Niamey (Niger) inoculations were made using smut sporidial suspensions. At Bambey heads were bagged, and at Niamey the heads in one replication were inject-inoculated with a fresh aqueous suspension of spore balls.

SMUT SCORING

Cooperators were provided with a set of standard drawings of variously smutted pearl millet inflorescences, along with the data sheets, to facilitate estimation and recording of percent smut infection severity. Scorings were done at crop maturity on the 10 to 20 inoculated and/or bagged inflorescences per entry per replication. The mean smut severities of all bagged and/or inoculated inflorescences per entry were used in this report.

DATA REQUESTED

In addition to the smut data, cooperators were requested to record weather data (rainfall and temperature), days to boot leaf stage, and to score the entries for other prevalent diseases such as ergot, downy mildew, rust, and blast.

RESULTS

Weather

Data on the number of rainy days, amount of rainfall, and temperature (max. and min.) during the period from inoculation and/or bagging to observation for each location are presented in Table 2. The maximum rainy days (25) and rainfall (354 mm) occurred at Samaru followed by ICRISAT Center (13 days and 293 mm rainfall) and Kano (13 rainy days and 147.6 mm rainfall). There was only one rainy day with 8.8 mm rain at Hissar. Niamey had the highest maximum temperature (38.5 C) followed by Hissar (36.4 C) and Bambey (33.8 C). ICRISAT Center and Samaru had the lower minimum temperatures (19.3 C and 19.4 C respectively).

The planting dates varied from 23 June (Niamey) to 16 July (Jamnagar). The periods from inoculation to observation varied from 5 Aug to 10 September (Kano) to 4 September to 4 October (Bambey).

Performance of test entries

For each entry, the mean and range of smut severity, scores for other diseases, and days to boot leaf stage are presented, by location, in Tables 3 to 9. The individual entry means, entry means across locations, and location means across the test entries are presented in Table 10.

Since there was considerable variability in smut severity among plants within entries, the range, mean, and the maximum severities are all important parameters. However, in order to evaluate the reactions of the test entry at any one location, the mean smut severity compared with the mean smut severity on the trial check ICH 220 and/or local susceptible is a most useful indicator.

The greatest smut in the trial susceptible check (ICH 220) occurred at ICRISAT Center (91% severity), followed by Bambey, Kano, Samaru, Niamey, Jamnagar, and the least pressure occurred at Hissar (11% severity on ICH 220) (Table 10). However, the greatest smut severity on test entries was at Kano (across entry mean of 21%), followed by Bambey (17%). Because of dry weather at Hissar and Jamnagar

during flowering, little smut developed despite inoculation. At ICRISAT Center, inoculation was successful and high smut pressure occurred, because of the combination of viable inoculum and high humidity maintained by sprinkler irrigations during the inoculation to observation period.

At Hissar (Table 3), 3 entries were smut-free, 17 entries had mean smut severities of not more than 1%, 5 entries had mean smut severities between 2 and 9%, and for the remaining 4 entries data were not provided. The local resistant, the local susceptible, and the trial check (ICH 220) had smut severities of ·1, 6 and 11% respectively.

At Jamnagar (Table 4), 7 entries were smut-free, 14 entries had mean smut severities of not more than 1%, and the remaining 8 entries had mean smut severities between 2 and 10%. The local resistant, the local susceptible, and the trial check (ICH 220) had mean smut severities of 10, 25 and 13% respectively.

At ICRISAT Center (Table 5), 9 entries were smut-free, 9 entries had mean smut severities of not more than 1%, and the remaining 11 entries had mean smut severities between 2 and 28%. The local resistant, the local susceptible, and the trial check (ICH 220) had mean severities of 3, 67, and 91% respectively.

At Niamey (Table 6), 2 entries were smut-free, 14 entries had mean smut severities of not more than 1%, and the remaining 13 entries had smut severities of 3 to 25%. The local resistant, the local susceptible and the trial check (ICH 220) had 0, 10 and 28% smut respectively.

At Samaru (Table 7), although no entry was smut-free, 20 entries had mean smut severities between 1 and 5%. The remaining 9 entries had mean smut severities in the range of 6 to 29%. The local resistant, the local susceptible and the trial check (ICH 220) had mean smut severities of 6, 51 and 2% respectively. The apparent low smut susceptibility of ICH 220 at this location is surprising.

At Bambey (Table 8), 2 entries were smut-free, 3 entries had mean smut severities of not more than 1%, 22 entries had mean smut severities between 2 and 73%, and for the remaining 2 entries data were not provided. The local resistant, the local susceptible, and the trial check (ICH 220) had mean smut of 33, 72 and 34% respectively.

At Kano (Table 9), no entry was smut-free, 5 entries had mean smut severities between 7 and 10% and the remaining 24 entries had smut in the range of 11 to 50%. The local resistant, the local susceptible and the trial check (ICH 220) had mean smut severities of 9, 50 and 52% respectively.

Although no entry was smut-free at all locations, 12 entries had across locations mean severities between 2 and 5%, 8 entries scored between 6 and 10% smut and the remaining 9 entries scored between 11 and 16% smut (Table 10). Resistance identified at Hissar and ICRISAT Center seems to be functional at locations in India and West Africa, except at Kano where maximum smut pressure occurred, and only 5 entries had no more than 10% smut.

The most resistant entry was SSC FS 252-S-4 which developed maximum smut severity of only 3% (at Kano). This entry was also the most resistant entry in the 1980 IPMSN. The second best entry P-499-S-3 had a maximum severity of 11% and was a new entry in 1981.

OTHER DISEASES

Ergot

Cooperators from four of the seven locations reported ergot reactions of the entries under natural situation. At Jamnagar, the ergot severity ranged from 0 to 4% and the 10 smut high resistant entries had ergot in the range of <1 to 4% (Table 4). At Samaru, all the IPMSN entries developed heavy ergot with the mean severities ranging from 7 to 62%. The top 10 smut high resistant entries had ergot in the range of 7 to 35% (Table 7). At Sambey, ergot severity ranged between 0 and 50%, and the top 10 smut resistant entries had ergot in the range of 3 to 40% (Table 7) At Kano, the ergot severity ranged between 5 and 47% and the top 10 smut resistant entries had ergot in the range of 5 to 35% (Table 9).

Downy mildew (DM)

Cooperators from six of the seven locations provided DM incidence (%) data.

At Jamnagar, where downy mildew incidence ranged from 0 to 2%, 26 of the 29 test entries were DM-free, and the top 10 smut resistant entries

had no more than 1% DM (Table 4). At ICRISAT Center, DM incidence ranged from 0 to 59% on the test entries and 19 of the 29 entries were DM-free (Table 5). At Niamey, DM incidence ranged from 0 to 26% and the top 10 smut resistant entries had DM incidence between 1 and 15% (Table 6). At Samaru, the DM incidence ranged from 2 to 100% and the top 10 smut resistant entries had DM incidence of 2 to 72% (Table 7). At Bambey, the DM incidence ranged from 1 to 12% and the top 10 smut resistant entries scored between 1 and 12% DM (Table 8). At Kano, the DM incidence ranged from 3 to 92% and the top 10 smut low-susceptible entries had DM incidence between 3 and 76% (Table 9).

Rust

Data on rust were provided by cooperators at 3 locations (Jamnagar, Samaru and Kano). All the test entries were rust-free at Samaru and Kano but developed moderate rust (between 2 and 3 on a 1-5 scale) at Jamnagar (Tables 4,7, 9).

Blast

This disease was recorded at Samaru and Kano. All the entries were blast-free at Samaru (Table 7). At Kano, 15 of the 29 entries were blast-free and only one entry had a score of 4 and the remaining 10 entries scored between 2 and 3 on a 1-5 scale (Table 9).

DISCUSSION

The results from the 1981 IPMSN have provided valuable information on the stability of smut resistance and have confirmed the stability of the most resistant entry in the 1980 IPMSN, SSC-FS-252-S-4. Comparative performances of eight of the common IPMSN entries for 4 years across five locations are presented in Table 11. SSC-FS-252-S-4 was outstanding at all the locations over years with overall mean smut severity of 2%, followed by ICI 7517-S-1 (5% mean severity) and EB 132-2-S-5-2-DM-1 (7% mean severity). Other entries, although giving overall mean smut severities in the range of 8 to 12%, did not perform consistently well in all years at all locations.

It is significant that Kano was, once again, the test location at which the test entries were most severely infected. This result emphasises the need to search for sources of smut resistance in landrace millet cultivars from northern Nigeria.

There were indications of differential reactions of some of the entries (Table 12). Two entries, ICI 7517-S-1 and EB 132-2-S-5-2-DM-1, which had 0-2% smut at four of the seven locations were susceptible at Kano (24% and 23% severity). In contrast, EB 54-1-1-S-7-3 which developed only 9% smut at Kano had 28% and 41% smut at ICRISAT Center and Bambey respectively, and ICH-220 had only 2% infection at Samaru and 31% at ICRISAT Center. These apparent differential reactions indicate the possible existence of variable populations of the pathogen at different locations. Future efforts will be made to understand the causes and effects of this variability.

Utilization of the identified resistance is underway at ICRISAT Center to develop smut resistant hybrids and varieties.

MULTILOCATIONAL TESTING IN 1982 AND BEYOND

The 1982 IPMSN with about 30 entries will be available to cooperators at the end of May 1982. Entries will include selections from the 1981 IPMSN and new entries selected in the ICRISAT screening and breeding programs.

Entries are welcome from scientists in the national and regional programs provided they have been resistant to smut at the home locations. Because of plant quarantine requirements in India, seed sent from abroad will take about a year before it can be included in the trial.

SEED SUPPLY

Small quantities of seed of entries listed in this report are available to any scientist. Please send seed requests to the Principal Pathologist, Millet Improvement Program at ICRISAT Center (to the address at the cover) indicating that seed request is from the 1981 IPMSN entries.

Table 1. Locations and cooperators in the 1981 IPMSH

Country	Location	Cooperators
Niger	Niamey	C.J. Guthrie
Nigeria	Samaru	M.V. Sundaram
	Kano	M.V. Sundaram
Senegal	Bambey	S.C. Gupta
India	Jamnagar	M.A. Thakar & M.R. Dave
	Hissar	R.P. Thakur & K.V. Subba Rao
	ICRISAT Center	K.V. Subba Rao & R.P. Thakur

Table 2. Planting date, rainfall and temperature data from inoculation to observation at 1981 IPMSN locations

Location & Latitude (N°)	Planting date	Inoculation to observation period	No. of rainy days	Rainfall (mm)	Temperature °C	
					Mean Max.	Mean Min.
Hissar 29°10'	Jul 5	Aug 18-Oct 2		8.8	36.4	23.3
ICRISAT Center 17°26'	Jul 11	Aug 21-Sep 21	18	293.0[a/]	28.6	19.3
Jamnagar 22°28'	Jul 16	Aug 27-Sep 29	8	74.4	32.8	-
Bambey 14°32'	Jul 6	Sep 4-Oct 4	9	211.2	33.8	25.5
Kano 11°59'	Jun 25	Aug 5-Sep 10	13	147.6	28.9	21.3
Samaru 11°11'	Jun 26	Aug 5-Sep 14	25	354.0	28.9	19.4
Niamey 13°	Jun 23	Aug 16-Sep 15	9	54.6	38.5	20.6

a/ In addition sprinkler irrigation was provided twice a day 30 min each on rain-free days

Table 3. Smut reactions and days to boot leaf stage (DTBL) of the 1981 IPMSN entries during the 1981 rainy season at Hissar

Sl No	Entry	DTBL	Sample size in 2 reps	Smut severity (%)			
				Rep 1	Rep 2	Mean[a]	Range
1.	EB 112-1-S-1-1	58	40	0	0	0	0-0
2.	P-455-S-1	65	5	0	0	0	0-0
3.	P-492-S-1	62	38	0	0	0	0-0
4.	ICI 7517-S-1	60	40	<1	0	<1	0-1
5.	P-489-S-3	62	22	<1	0	<1	0-1
6.	EB 229-4-1-S-7-3-DM-1	62	40	0	<1	<1	0-1
7.	MLC SN 75-1-6-S-1	60	6	<1	0	<1	0-1
8.	P-483-S-2	62	26	<1	0	<1	0-5
9.	EB 116-1-1-S-3-1-DM-1	58	40	<1	<1	<1	0-5
10	EB 137-2-S-7-1-DM-1	62	40	<1	0	<1	0-5
11	MFP 588-5690-S-8-4	65	20	<1	-	<1	0-5
12	EBS 137-2-S-1-DM-1	67	12	<1	<1	<1	0-1
13	F4FC 1285-8-7-S-1	60	10	1	<1	<1	0-1
14	EBS 46-1-2-S-2	55	32	<1	1	<1	0-5
15	EB 132-2-S-5-2-DM-1	55	34	1	<1	1	0-5
16	EB 54-1-1-S-7-3	65	30	1	<1	1	0-5
17	EB 209-1-6-S-7	62	40	1	1	1	0-20
18	P-20-S-1	49	38	<1	2	1	0-15
19	P-10-S-1	51	37	1	2	1	0-10
20	P-446-S-1	65	21	0	2	1	0-20
21	EB 66-1-S-3-3	65	31	4	<1	2	0-20
22	MC FS 42-S-1-2-DM-1	60	32	6	2	4	0-50
23	IP 2739-S-2-1-DM-1	60	6	9	0	6	0-15
24	MC FS 151-S-1-1	60	27	8	2	6	0-80
25	EB 213-3-2-S-4-1-DM-1	62	15	11	2	9	0-40
26	SSC FS 252-S-4	-	-	-	-	-	-
27	EB 117-4-3-S-2-2-DM-1	-	-	-	-	-	-
28	700130-S-1-DM-1	-	-	-	-	-	-
29	MC FS 148-S-1-DM-1	-	-	-	-	-	-
	ICH 220 (Trial Check)	42	40	1	21	11	0-60
	Local Resistant	65	9	<1	<1	<1	0-1
	Local Susceptible	51	38	3	9	6	0-40

a/ Mean of 5-40 inoc.-bagged inflorescences in 2 replications
- Data not available.

Table 4. Smut, ergot, downy mildew (DM) and rust reactions and days to boot leaf stage (DTBL) of the 1991 IPMS'1 entries during the 1991 rainy season at Jamnagar

Sl No	Entry	DTBL	Smut severity (%)				Ergot[b] (%)	DM[b] (%)	Rust[c]
			Rep 1	Rep 2	Mean[a]	Range			
1.	SSC FS 252-S-4	62	0	0	0	0-0	1	0	2
2.	P-493-S-2	55	0	0	0	0-0	<1	0	3
3.	EB 112-1-S-1-1	54	0	0	0	0-0	<1	0	3
4.	EB 229-4-1-S-7-3-DM-1	60	0	0	0	0-0	3	1	3
5.	MLC SM 75-1-6-S-1	57	0	0	0	0-0	2	1	2
6.	P-492-S-1	57	0	0	0	0-0	1	0	3
7.	P-489-S-3	52	0	0	0	0-0	<1	0	3
8.	ICI 7517-S-1	65	0	<1	<1	0-1	4	0	3
9.	EB 116-1-1-S-3-1-DM-1	57	<1	<1	<1	0-2	<1	0	2
10	EB 137-2-S-7-1-DM-1	55	<1	<1	<1	0-5	1	0	3
11	NEP 588-5690-S-3-4	65	1	<1	<1	0-15	3	0	2
12	700130-S-1-DM-1	66	0	1	1	0-20	1	0	2
13	EB 218-3-2-S-4-1-DM-1	57	<1	1	1	0-5	1	0	2
14	WC FS 148-S-1-DM-1	57	1	<1	1	0-10	1	0	2
15	EB 117-4-3-S-2-2-DM-1	61	1	<1	1	0-10	1	0	2
16	EB 66-1-S-3-3	62	1	<1	1	0-10	1	0	2
17	EBS 137-2-S-1-DM-1	67	1	1	1	0-5	1	0	3
18	EB 132-2-S-5-2-DM-1	54	1	1	1	0-10	1	0	3
19	P-455-S-1	57	1	1	1	0-15	1	0	2
20	P-446-S-1	60	1	2	1	0-10	1	0	2
21	F4FC 1285-8-7-S-1	61	2	1	1	0-25	1	0	3
22	EB 209-1-6-S-7	57	1	2	2	0-20	1	0	2
23	EBS 46-1-2-S-2	54	1	2	2	0-20	<1	0	2
24	WC FS 151-S-1-1	60	1	4	2	0-30	1	0	2
25	IP 2789-S-2-1-DM-1	56	4	2	3	0-15	1	0	3
26	WC FS 42-S-1-2-DM-1	53	4	4	4	0-30	2	1	3
27	P-20-S-1	54	3	6	4	0-60	<1	0	3
28	EB 54-1-1-S-7-3	62	3	7	5	0-50	1	0	3
29	P-10-S-1	53	11	9	10	0-70	1	0	2
	ICH 220 (Trial Check)	48	15	21	18	1-65	8	0	2
	Local Resistant	44	12	9	10	0-40	1	2	3
	Local Susceptible	48	27	24	25	2-60	2	0	3

a/ Mean of 40 inoculated-bagged inflorescences in 2 replications
b/ Mean of 2 replications
c/ Mean of 2 replications, scored on 1-5 scale.

Table 5. Smut and downy mildew (DM) reactions, and days to boot leaf stage (DTBL) of the 1981 IPMSN entries during the 1981 rainy season at ICRISAT Center

Sl No	Entry	DTBL	Smut severity (%)				DM[b] (%)
			Rep 1	Rep 2	Mean[a]	Range	
1.	SSC FS 252-S-4	58	0	0	0	0-0	3
2.	EBS 137-2-S-1-DM-1	68	0	0	0	0-0	58
3.	ICI 7517-S-1	58	0	0	0	0-0	0
4.	EB 229-4-1-S-7-3-DM-1	58	0	0	0	0-0	3
5.	P-483-S-2	62	0	0	0	0-0	0
6.	EB 112-1-S-1-1	52	0	0	0	0-0	0
7.	P-492-S-1	52	0	0	0	0-0	6
8.	MLC SN 75-1-6-S-1	62	0	0	0	0-0	27
9.	P-489-S-3	62	0	0	0	0-0	4
10	EB 116-1-1-S-3-1-DM-1	58	0	<1	<1	0-2	5
11	EB 66-1-S-3-3	62	<1	0	<1	0-2	0
12	EB 137-2-S-7-1-DM-1	52	<1	<1	<1	0-1	19
13	NEP 588-5690-S-8-4	62	0	<1	<1	0-2	0
14	EBS 46-1-2-S-2	50	<1	<1	<1	0-5	0
15	EB 117-4-3-S-2-2-DM-1	58	1	1	1	0-2	0
16	EB 218-3-2-S-4-1-DM-1	55	<1	2	1	0-15	0
17	EB 132-2-S-5-2-DM-1	55	0	2	1	0-40	0
18	P-446-S-1	62	1	1	1	0-20	0
19	P-455-S-1	62	2	2	2	0-20	0
20	F4FC 1285-8-7-S-1	62	0	4	2	0-25	0
21	700130-S-1-DM-1	62	<1	4	2	0-40	0
22	WC FS 151-S-1-1	52	4	3	3	0-35	5
23	WC FS 42-S-1-2-DM-1	58	3	4	3	0-35	0
24	IP 2789-S-2-1-DM-1	52	16	5	11	0-70	0
25	EB 209-1-6-S-7	55	6	16	11	0-70	0
26	WC FS 148-S-1-DM-1	50	7	25	16	0-70	0
27	P-20-S-1	47	11	27	19	0-70	9
28	P-10-S-1	47	42	11	26	0-90	0
29	EB 54-1-1-S-7-3	52	34	22	28	0-80	0
	ICH 220 (Trial Check)	44	92	90	91	45-98	0
	Local Resistant	52	5	<1	3	0-50	27
	Local Susceptible	52	63	70	67	35-95	2

a/ Mean of 40 inoculated-bagged inflorescences in 2 replications
b/ DM incidence recorded in the DM nursery

Table 6. Smut and downy mildew (DM) reactions of the 1981 IPMS'I entries during the 1981 rainy season at Niamey

Sl No	Entry	Sample size in 2 reps	Smut severity (%)				DM[b/] (%)
			Rep 1	Rep 2	Mean[a/]	Range	
1.	SSC FS 252-S-4	16	0	0	0	0-0	1
2.	EB 229-4-1-S-7-3-DM-1	25	0	0	0	0-0	5
3.	EB 112-1-S-1-1	36	0	<1	<1	0-2	9
4.	700130-S-1-DM-1	10	0	<1	<1	0-1	7
5.	EBS 46-1-2-S-2	33	<1	0	<1	0-2	15
6.	WC FS 151-S-1-1	17	<1	<1	<1	0-10	7
7.	MLC SM 75-1-6-S-1	13	0	<1	<1	0-2	4
8.	P-489-S-3	23	<1	1	<1	0-10	15
9.	P-492-S-1	16	<1	0	<1	0-1	10
10	HEP 583-5690-S-8-4	35	<1	1	<1	0-20	14
11	EB 132-2-S-5-2-DM-1	23	<1		1	0-5	1
12	EB 117-4-3-S-2-2-DM-1	12	0	3	1	0-30	20
13	EB 116-1-1-S-3-1-DM-1	31	<1	2	1	0-30	1
14	EB 137-2-S-7-1-DM-1	38		2	1	0-30	0
15	WC FS 148-S-1-DM-1	31	1	1	1	0-15	18
16	P-455-S-1	18	<1	2	1	0-15	6
17	IP 2789-S-2-1-DM-1	30	2	4	3	0-30	2
18	ICI 7517-S-1	10	8	0	4	0-10	26
19	EB 209-1-6-S-7	21	2	7	4	0-20	9
20	EB 54-1-1-S-7-3	37	2	6	4	0-60	5
21	EB 66-1-S-3-3	27	1	8	5	0-80	5
22	WC FS 42-S-1-?-DM-1	33	2	8	5	0-40	3
23	P-483-S-2	29	4	6	5	0-50	9
24	F4FC 1285-8-7-S-1	20	7	5	6	0-40	14
25	EB 218-3-2-S-4-1-DM-1	10	3	12	8	0-60	3
26	P-446-S-1	12	3	12	8	0-30	14
27	P-20-S-1	29	14	3	9	0-40	16
28	P-10-S-1	37	4	18	11	0-70	7
29	EBS 137-2-S-1-DM-1	6	0	50	25	0-50	14
	ICH 220 (Trial Check)	24	31	25	28	5-70	6
	Local Resistant	2	-	0	0	0-0	2
	Local Susceptible	5	17	2	10	0-60	0

a/ Mean of 2-40 inoculated-bagged inflorescences in two replications
b/ Mean incidence of 2 replications

Table 7. Smut, ergot, downy mildew (DM), rust and blast reactions and days to boot leaf stage (DTBL) of the 1981 IPMSN entries during the 1981 rainy season at Samaru

Sl No	Entry	DTBL	Smut severity (%)				Ergot[b] (%)	DM[b] (%)	Rust[c]	Blast[c]
			Rep 1	Rep 2	Mean[a]	Range				
1.	P-439-S-3	47	1	1	1	0-10	7	7	1	1
2.	WC FS 143-S-1-DM-1	47	1	<1	1	0-10	27	72	1	1
3.	WC FS 42-S-1-2-DM-1	52	2	1	1	0-10	30	47	1	1
4.	EB 117-4-3-S-2-2-DM-1	44	3	<1	2	0-20	15	10	1	1
5.	P-433-S-2	47	1	3	2	0-10	7	7	1	1
6.	F4FC 1285-8-7-S-1	48	3	1	2	0-10	10	32	1	1
7.	P-455-S-1	52	2	2	2	0-20	10	6	1	1
8.	P-492-S-1	47	2	2	2	0-20	35	12	1	1
9.	P-446-S-1	50	2	2	2	0-20	30	2	1	1
10	EB 116-1-1-S-3-1-DM-1	49	4	1	2	0-20	27	46	1	1
11	EB 229-4-1-S-7-3-DM-1	44	3	2	3	0-10	42	47	1	1
12	EB 213-3-2-S-4-1-DM-1	49	5	0	3	0-20	17	32	1	1
13	MLC SN 75-1-6-S-1	52	3	3	3	0-20	20	70	1	1
14	ICI 7517-S-1	50	5	2	3	0-20	27	10	1	1
15	WC FS 151-S-1-1	50	6	1	4	0-40	30	72	1	1
16	SSC-FS 252-S-4	46	7	<1	4	0-35	20	15	1	1
17	EBS 137-2-S-1-DM-1	45	6	2	4	0-20	35	3	1	1
18	EBS 46-1-2-S-2	47	-	4	4	0-35	50	79	1	1
19	EB 112-1-S-1-1	52	7	2	4	0-20	35	40	1	1
20	EB 137-2-S-7-1-DM-1	50	7	3	5	0-20	35	27	1	1
21	EB 132-2-S-5-2-DM-1	50	11	1	6	0-50	35	14	1	1
22	NEP 588-5690-S-3-4	51	10	5	7	0-35	20	5	1	1
23	IP 2789-S-2-1-DM-1	44	10	4	7	0-35	27	29	1	1
24	P-20-S-1	50	15	1	8	0-35	35	23	1	1
25	700130-S-1-DM-1	44	14	2	8	0-50	42	10	1	1
26	EB 209-1-6-S-7	49	16	3	9	0-50	42	22	1	1
27	P-10-S-1	45	22	9	16	0-50	30	27	1	1
28	EB 54-1-1-S-7-3	47	46	2	24	0-75	27	52	1	1
29	EB 66-1-S-3-3	50	42	16	29	0-75	62	8	1	1
	ICH 220 (Trial Check)	50	2	1	2	0-10	35	100	1	1
	Local Resistant	49	3	4	6	0-35	35	9	1	1
	Local Susceptible	49	51	50	51	35-75	27	39	1	1

a/ Mean of 20-40 inoculated-bagged inflorescences in 2 replications
b/ Mean of 2 replications
c/ Scored on 1-5 scale, mean of 2 replications
- Data not available

Table 8. Smut, ergot and downy mildew (DM) reactions and days to boot leaf stage (DTBL) of the 1981 IPMSN entries during the 1981 rainy season at Bambey

Sl No	Entry	DTBL	Sample size in 2 reps	Smut severity (%)				Ergot[b] (%)	DM[b] (%)
				Rep 1	Rep 2	Mean[a]	Range		
1.	700130-S-1-DM-1	73	1	0	-	0	0-0	10	9
2.	ICI 7517-S-1	62	15	-	0	0	0-0	3	9
3.	EB 112-1-S-1-1	75	9	<1	0	<1	0-1	35	7
4.	EBS 46-1-2-S-2	67	12	<1	0	<1	0-3	20	2
5.	EB 116-1-1-S-3-1-DM-1	62	14	<1	0	<1	0-5	30	2
6.	EB 132-2-S-5-2-DM-1	59	21	2	<1	2	0-15	10	1
7.	EB 137-2-S-7-1-DM-1	62	21	0	3	3	0-20	40	1
8.	NEP 588-5690-S-3-4	75	18	5	2	3	0-10	30	1
9.	EBS 137-2-S-1-DM-1	71	3	3	-	3	0-5	10	5
10	MLC SN 75-1-6-S-1	68	12	7	0	4	0-25	35	12
11	IP 2789-S-2-1-DM-1	62	20	13	0	6	0-70	25	4
12	EB 218-3-2-S-4-1-DM-1	68	4	0	8	6	0-10	25	4
13	WC FS 151-S-1-1	68	11	0	9	7	0-70	40	2
14	WC FS 42-S-1-2-DM-1	60	23	15	2	8	0-100	20	2
15	EB 117-4-3-S-2-2 DM-1	72	5	5	9	8	0-15	0	10
16	EB 66-1-S-3-3	69	18	20	7	9	0-60	13	4
17	P-489-S-3	48	21	10	5	8	0-80	0	4
18	P-20-S-1	62	22	14	30	18	0-80	15	2
19	WC FS 148-S-1-DM-1	69	9	10	33	18	0-80	10	8
20	F4FC 1285-8-7-S-1	62	20	26	17	21	0-100	20	3
21	P-10-S-1	59	13	20	69	34	0-100	17	2
22	EB 54-1-1-S-7-3	62	26	40	41	41	0-100	10	1
23	P-455-S-1	56	24	43	75	48	3-100	12	6
24	P-492-S-1	56	30	67	30	55	0-100	25	5
25	EB-209-1-6-S-7	67	4	60	40	55	10-100	50	3
26	P-483-S-2	52	37	61	72	67	0-100	7	6
27	P-446-S-1	62	14	10	33	73	0-100	20	12
28	SSC FS 252-S-4	-	-	-	-	-	-	-	-
29	EB 229-4-1-S-7-3-DM-1	-	-	-	-	-	-	-	-
	ICH 220 (Trial Check)	64	40	90	77	84	10-100	20	1
	Local Resistant	56	17	35	0	33	0-100	40	2
	Local Susceptible	44	39	88	57	72	5-100	5	1

a/ Mean of 1-40 bagged inflorescences in 2 replications, - data not available

b/ Mean of 2 replications

Table 9. Smut, ergot, downy mildew (DM), rust and blast reactions and days to boot leaf stage (DTBL) of the 1991 IPMSN entries during the 1991 rainy season at Kano

Sl No	Entry	DTBL	Smut severity (%)				Ergot[b]	DM[b]	Rust[c]	Blast[c]
			Rep 1	Rep 2	Mean[a]	Range	(%)	(%)		
1.	P-10-S-1	44	7	6	7	0-20	7	33	1	1
2.	SSC FS 252-S-4	46	9	6	8	0-20	7	19	1	1
3.	F4FC 1285-8-7-S-1	48	16	1	9	0-35	7	25	1	1
4.	EB 54-1-1-S-7-3	48	1	16	9	0-35	22	3	1	1
5.	WC FS 148-S-1-DM-1	46	11	9	10	0-20	35	30	1	1
6.	P-489-S-3	46	10	12	11	0-35	30	5	1	1
7.	P-446-S-1	82	15	9	12	0-20	10	76	1	1
8.	EB 229-4-1-7-3-DM-1	45	9	18	14	5-35	35	9	1	1
9.	NEP 588-5690-S-3-4	49	20	9	15	5-35	5	25	1	2
10	EB 137-2-S-7-1-DM-1	48	6	23	15	0-35	7	24	1	1
11	IP 2789-S-2-1-DM-1	46	10	20	15	5-35	20	41	1	1
12	MLC SN 75-1-5-S-1	52	15	-	15	10-35	5	82	1	2
13	EBS 46-1-2-S-2	46	30	3	16	0-50	17	5	1	1
14	EB 117-4-3-S-2-2-DM-1	45	2	36	19	0-50	20	29	1	2
15	WC FS 42-S-1-2-DM-1	53	8	31	20	0-75	42	7	1	4
16	EB 132-2-S-5-2-DM-1	49	27	19	23	5-75	20	11	1	2
17	P-20-S-1	47	4	43	24	0-75	20	32	1	2
18	ICI 7517-S-1	49	24	24	24	10-35	20	29	1	1
19	700130-S-1-DM-1	45	49	2	25	0-75	7	14	1	2
20	P-455-S-1	52	22	29	26	10-75	10	40	1	2
21	EB 116-1-1-S-3-1-DM-1	47	2	50	26	0-75	10	2	1	2
22	EB 218-3-2-S-4-1-DM-1	47	2	53	27	0-75	30	10	1	2
23	EB 66-1-S-3-3	49	1	55	28	0-90	22	10	1	2
24	EB 112-1-S-1-1	53	32	32	32	5-75	10	11	1	1
25	EB 209-1-6-S-7	48	51	13	32	10-75	22	31	1	2
26	P-483-S-2	45	22	47	34	5-75	42	32	1	3
27	P-492-S-1	46	14	57	36	10-75	47	39	1	2
28	EBS 137-2-S-1-DM-1	45	47	30	39	5-75	20	29	1	1
29	WC FS 151-S-1-1	47	20	59	50	20-75	42	25	1	1
	ICH 220 (Trial Check)	51	59	45	52	20-90	42	33	1	1
	Local Resistant	50	6	12	9	0-35	20	7	1	1
	Local Susceptible	53	52	47	50	10-90	27	15	1	3

a/ Mean of 10-20 inoculated-bagged inflorescences in 2 replications
b/ Mean of 2 replications
c/ Scored on 1-5 scale, mean of 2 replications

Table 10. Mean smut severity (%)[a/] of the 29 1981 IPMSN entries and the local checks at seven locations with across location entry means[b/] and across entry location means

Sl No	Entry	Location[c/]							Overall mean
		Hissar	Jamnagar	ICRISAT Center	[illegible]mey	[illegible]aru	Bambey	Kano	
1.	SSC FS 252-S-4	-	0	0	0	4	-	8*	2
2.	P-489-S-3	<1	0	0	<1	1	9	11	3
3.	EBS 46-1-2-S-2	<1	2	<1	<1	4	<1	16	3
4.	MLC SN 75-1-6-S-1	<1	0	0	<1	3	4	15	3
5.	EB 229-4-1-S-7-3-DM-1	<1	0	0	0	3	-	14	3
6.	EB 137-2-S-7-1-DM-1	<1	<1	<1	1	5	3	15	3
7.	NEP 588-5690-S-8-4	<1	<1	<1	<1	7	3	15	4
8.	EB 116-1-1-S-3-1-DM-1	<1	<1	<1	1	2	<1	26	4
9.	ICI 7517-S-1	<1	<1	0	4	3	0	24	4
10	EB 132-2-S-5-2-DM-1	1	1	1	1	6	2	23	5
11	EB 112-1-S-1-1	0	0	0	<1	4	<1	32	5
12	EB 117-4-3-S-2-2-DM-1	-	1	1	1	2	8	19	5
13	F4FC 1285-8-7-S-1	<1	1	2	6	2	21	9	6
14	700130-S-1-DM-1	-	1	2	<1	8	0	25	6
15	WC FS 42-S-1-2-DM-1	4	4	3	5	1	8	20	6
16	IP 2789-S-2-1-DM-1	6	3	11	3	7	6	15	7
17	WC FS 148-S-1-DM-1	-	1	16	1	1	18	10	8
18	EB 218-3-2-S-4-1-DM-1	9	1	1	8	3	6	27	8
19	EBS 137-2-S-1-DM-1	<1	1	0	25	4	3	39	10
20	WC FS 151-S-1-1	6	2	3	<1	4	7	50	10
21	EB 66-1-S-3-3	2	1	<1	5	29	9	28	11
22	P-455-S-1	0	1	2	1	2	48	26	11
23	P-20-S-1	1	4	19	9	8	18	24	12
24	P-492-S-1	0	0	0	<1	2	55	36	13
25	P-446-S-1	2	1	1	8	2	73	12	14
26	P-10-S-1	1	10	26	11	16	34	7	15
27	P-483-S-2	<1	0	0	5	2	67	34	15
28	EB 54-1-1-S-7-3	1	5	28	4	24	41	9	16
29	EB 209-1-6-S-7	1	2	11	4	9	55	32	16
	Location means for test entries	1	1	4	4	6	17	21	8
	Trial Check (ICH 220)	11	18	91	28	2	84	52	41
	Local Resistant	1	10	3	0	6	33	9	9
	Local Susceptible	6	25	67	10	51	72	50	40

a/ Each datum is the mean of 2 rep. means and each rep. mean is derived from 10-20 inoculated-bagged heads except for Bambey where heads were just bagged. b/Mean for test entries. c/ All figs. are rounded-off to the nearest whole numbers. (-) data not provided.

Table 11. Smut reactions of eight common entries for 4 years across five locations in India and West Africa

Entry	Hissar				Jamnagar				Ranbey				Samaru				Kano				Mean				Overall mean
	78	79	80	81	78	79	80	81	78	79	80	81	78	79	80	81	78	79	80	81	78	79	80	81	
SSC FS 252-S-4	0	0	0	-	1	1	0	0	<1	1	0	-	12	-	4	4	9	-	3	3	4	1	1	4	2
ICI 7517-S-1	0	0	0	<1	<1	<1	0	<1	1	0	1	0	13	-	10	3	34	-	3	24	10	<1	4	5	5
EB 132-2-S-5-2-DM-1	6	2	<1	1	2	1	<1	1	24	7	<1	2	32	-	15	6	14	-	7	23	16	3	4	7	7
P-20-S-1	2	2	3	1	<1	<1	14	4	1	3	6	18	21	-	10	3	18	-	31	24	8	2	13	11	8
P-10-S-1	1	<1	<1	1	<1	0	1	10	<1	1	3	34	10	-	39	16	33	-	27	7	9	<1	14	14	9
700130-S-1-DM-1	2	1	<1	-	1	<1	<1	1	16	5	1	0	49	-	8	8	64	-	13	25	26	2	4	8	10
EB 54-1-1-S-7-3	1	2	7	1	1	<1	6	5	15	2	29	41	9	-	39	24	4	-	23	9	6	1	22	16	11
EB 209-1-6-S-7	2	1	8	1	1	<1	5	2	3	[illegible]	6	55	46	-	18	9	32	-	12	32	17	2	10	20	12
Susceptible Check	15	25	30	11	4	11	31	13	17	11	31	84	65	-	68	51	87	-	72	52	33	16	46	43	36

- Trial not conducted/data not provided

Table 12. Differential reactions of some of the 1981 IPMSN entries at the test locations

Entry	Mean smut severity (%) at						
	Hissar	Jamna-gar	ICRISAT	Niamey	Samaru	Bambey[a/]	Kano
ICI 7517-S-1	<1	<1	0	4	3	0	24
EB 132-2-S-5-2-DM-1	1	1	1	1	6	2	23
F4FC 1285-8-7-S-1	<1	1	2	6	2	21	9
WC FS 42-S-1-2-DM-1	4	4	3	5	1	8	20
P-20-S-1	1	4	19	9	8	18	24
P-446-S-1	2	1	1	8	2	73	12
FB 54-1-1-S-7-3	1	5	28	4	24	41	9
ICH 220	11	18	91	28	2[b/]	84	52

a/ direct inoculations not done

b/ The validity of the result will need confirmation

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