Indian J. Plant Prot. 23 :142-145, 1995

New Sources of Resistance to Pearl Millet Downy Mildew

S.S. Navi and S.D. Singh
Crop Protection Division, ICRISAT Asia Centre (IAC), Patancheru, 502 324, A.P.

Abstract

Use of host plant resistance is the most effective method of control of downy mildew (*Sclerospora graminicola*) in pearl millet (*Pennisetum glaucum*). To identify new sources of resistance to the disease, we tested 500 accessions of diverse origin in two green house tests (spray and dip inoculations) and in a field disease nursery during 1992-93 at ICRISAT Asia Center. An accession was sown in two pots each in the green house, and in a 4-m row plant in two replications in the field disease nursery. Many accessions that were free from downy mildew in individual tests, but only two accessions, IP 8897 and IP 14619 remained downy mildew free and IP 17311 showed a high degree of resistance (%) in all the tests. Maximum disease incidence recorded was 9%, 44.4% and 61.3% in field, dip and spray-inoculation tests, respectively. The stability of resistance in the newly identified accession will be examined in multilocational tests in coming years.

Introduction

Downy mildew (DM), caused by *Sclerospora graminicola* (Sacc.) Schroet, is the most destructive and widespread disease of pearl millet (*Pennisetum glaucum* (L.)R.Br.) in India and Western Africa (Singh, 1990). Although the disease is under control by the use of DM resistance cultivars, it continues to be a potential threat to the full exploitation of high yield cultivars (Singh *et al.,* 1993). Repeated large scale cultivation of improved, high yeilding cultivars, particularly F_1 hybrids, makes them prone to the disease. As the use of resistant cultivars is the most appropriate method of control for this disease, a continuous search for new sources of resistance is necessary. Therefore, a number of accessions maintained by the Genetic Resources Program at ICRISAT Asia Center (IAC) were screened for their reaction to two Indian Pathotypes of DM in the green house and in the field downy mildew nursery at IAC during 1992-93.

Materials and Methods

Germplasm accessions

A total of 500 germplasm accessions originating from Burkina Faso (307), Camerron (832), Centrl African Republic (33), Chaid (5), India (6), Kenya (1), Namibia (13), Niger (25), Togo (11), Uganda (1), Zambia (8) and Zimbabawe (8) were evaluated.

Inoculum production and inoculation in greenhouse

Two pathotypes of *S. graminicola* were used. The isolate from pearl millet line 852B from Mysore was designated as MYS and that from HB-3 from Patancheru as PTN. Methods of inoculum production and collection of sporangia described by Singh and Gopinath (1985) were used. Seedlings were grown in 10-cm-dia pots filled with Alfisol and farm yard manure in a ratio of 3:1 (v/v). Approximately 30 seedlings were maintained in each pot. Pathogype MYS on 852B in the greenhouse. Each accession was sown in two plots. Seedlings were spray-inoculated with the PTN pathotype when they were at the coleoptile-to-one-leaf-stage as described by Singh *et al.,* (1993). For dip-inoculation, 12-hr-old seedlings were immersed separately in sporangial suspensions (1×10^6 ml^{-1}) of PTN and MYS pathotypes for 12 hr at 25°C. The inoculated seedlings were transplanted into pots The pots were kept in the greenhouse for development of the disease.

Paper presented at the Symposium on " Integrated Pest Management and Environment " held at Madras on 2-4, February 1995

Downy mildew incidence records were taken 15 days after inoculation.

Field screening

One hundred and twentyeight accessions that showed high levels of resistance (% incidence) in greenhouse tests were evaluated in a downy mildew field nursery (Singh, *et al.*, 1993). Each accession was sown in 2 rows, 4-m long, in 2 replications. A highly DM susceptible cultivar, HB-3, was planted as an indicator of DM disease pressure after every 10 test rows. Rows were 75 cm apart and plants, within rows were spaced at 5 cm. DM incidence records were taken twice, at 30 days after planting, and at the late-dough stage.

Results and Discussion

Of the 500 accessions spray-inoculated with the PTN pathotype, 41 remained disease-free and 86 developed 5% DM (Table 1) The DM incidence on the remaining accessions ranged from 5 to 60%. The 41 DM-free accessions were further tested by dip-inoculation with PTN and MYS pathotypes. With the PTN, pathotype, disease incidence ranged from 0 to 40% only three accessions (IP 8897, IP 14619 and IP 19603) remained disease free, and two accessions (IP11 428 and IP 17311) developed <5% disease. With the MYS pathotype incidence ranged from 0 to 24%, 19 accessions were disease-free, and 9 developed <5% disease (Table 2). The dip- inoculation test was more severe than the spray-inoculation and field tests. During the study it was observed that most of the accessions showed variability in resistance against the two pathotypes (Table 2). Most of the disease-free accessions with the MYS pathotype, developed 10% DM with the PTN pathotype. This clearly indicates that the PTN pathotype is more virulent than the MYS pathotype, at least in the genotypes tested. Most of the newly identified accessions developed less disease than the resistant control, 700651. The susceptible control HB-3 developed 95-100% disease in all tests.

In the field screening, 121 of the 128 accessions remained disease-free and four accessions (IP 11431, IP 17293, IP 17337, and IP 17483) developed 5% disease. IP 15560 remained DM-free under spray-inoculation with the PTN pathotype but developed upt 9% disease in the field nursery. Accessions that were disease- free in the spray-inoculation test were later exposed to the more severe dip-inoculation test. Generally there was a higher disease incidence in dip-inoculation plants in spray-inoculated plants. However, the disease incidence varied with pathotype. In all the tests, IP 8897 from Burkina Faso and IP 14619 from Cameroon were disease free (Table 2). Accessions that showed disease-resistance in the dip-

Table 1. Summary of downy mildew reactions of 500 pearl millet accessions evaluated against two pathotypes at ICRISAT Asia center during post-rainy 1993

	% downy mildew inbcidence					
	Accessions				Controls	
	0	<5	6-10	>10	HB 3	700651
Greenhouse test						
Spray-inoculation;PTN pathotype	42	86	287	85	95	14
Dip-inoculation:PTN pathotype	3	2	8	29	100	35
Dip-inoculation: MYS pathotype	19	8	8	7	87	40
Field test*	121	4	3	0	82	4

* Mean of two replications

Table 2. Downy mildew incidence (%) in 41 pearl millet accessions (IP Nos.) in three greenhouse and a field-disease nursery during postrainy 1993 at IAC

IP Nos.	Origin	Greenhouse			Field
		Spray inoculation	Dip inocculation		
		PTN pathotype	PTN pathotype	MYS pathotype	
8897	Burkina Faso	0.0	0.0	0.0	0.0
11347	Burkina Faso	0.0	19.2	6.9	0.0
11350	Burkina Faso	0.0	9.4	0.0	0.0
11408	Burkina Faso	0.0	6.3	0.0	0.0
11428	Burkina Faso	0.0	2.8	13.3	0.0
11526	Burkina Faso	0.0	9.6	0.0	0.0
11545	Burkina Faso	0.0	13.5	0.0	0.0
11547	Burkina Faso	0.0	7.1	0.0	0.0
12863	Burkina Faso	0.0	19.4	23.8	0.0
12881	Burkina Faso	0.0	10.3	0.0	0.0
14295	Cameroon	0.0	25.4	12.2	0.0
14619	Cameroon	0.0	0.0	0.0	0.0
14875	Cameroon	0.0	19.4	6.2	0.0
15523	Burkina Faso	0.0	7.5	4.2	0.0
15525	Burkina Faso	0.0	6.1	0.0	0.0
15560	Burkina Faso	0.0	5.6	4.6	9.1
15567	Burkina Faso	0.0	17.7	3.1	0.0
15574	Burkina Faso	0.0	15.8	0.0	0.0
15611	Burkina Faso	0.0	7.1	0.0	0.0
17212	Burkina Faso	0.0	34.9	3.6	0.0
17240	Burkina Faso	0.0	30.2	6.9	0.0
17282	Burkina Faso	0.0	15.1	3.1	0.0
17300	Burkina Faso	0.0	17.1	7.6	0.0
17302	Burkina Faso	0.0	10.6	0.0	0.0
17304	Burkina Faso	0.0	14.4	0.0	0.0
17308	Burkina Faso	0.0	30.5	0.0	0.0
17311	Burkina Faso	0.0	2.9	0.0	0.0
17319	Burkina Faso	0.0	44.4	9.6	0.0
17321	Burkina Faso	0.0	14.6	0.0	0.0
17323	Burkina Faso	0.0	15.1	7.4	0.0
17324	Burkina Faso	0.0	40.9	3.6	0.0
17328	Burkina Faso	0.0	15.5	3.3	0.0
17333	Burkina Faso	0.0	18.2	0.0	0.0
17435	Central African Republic (CAF)	0.0	28.4	13.8	0.0
17443	CAF	0.0	18.2	0.0	0.0
17448	CAF	0.0	19.9	13.8	0.0
17456	CAF	0.0	19.4	3.3	0.0
17459	CAF	0.0	22.7	7.7	0.0
17492	Togo	0.0	23.2	10.7	0.0
19598	Nigeria	0.0	14.4	0.0	0.0
19603	Nigeria	0.0	0.0	6.3	0.0
Control					
HB-3(Susc)	India	95.0	100.0	95.0	75.0
700651(Res)	Nigeria	14.0	35.0	40.0	4.0

inoculation test are likely have very high resistance under field conditions.

References

Singh, S.D. 1990. Sources of resistance to downy mildew and rust in pearl millet. *Plant diseases* 74:871-874.

Singh, S.D. and Gopinath, R. 1985. A seedling inoculation technique for detecting downy mildew resistance in pearl millet. *Plant Disease* 69:582-584.

Singh, S.D., King, S.B. and Werder, J. 1993. Downy mildew disease of pearl millet. Information Bulletin no.37. Patancheru, A.P. 502 324, India : International Crops Research Institute for the Semi- Arid Tropics. 36 pp.