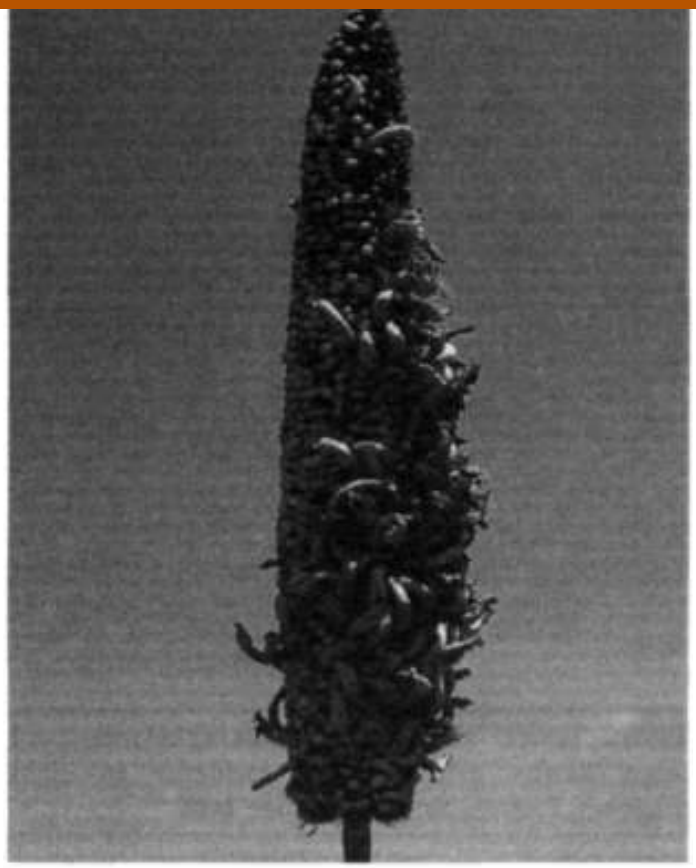

Figure 1. Long smut on pearl millet in Eritrea

Figure 2. Long smut on pearl millet in Eritrea showing the shape and size of sori

authority on the taxonomy of smut fungi, confirmed this as a first record on pearl millet. The authors have heard anecdotal reports of long smut on pearl millet in dry regions of Kenya and the Sudan.

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Prevalence of Pearl Millet Downy Mildew in Eritrea

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Introduction

Pearl millet [*Pennisetum glaucum* (L) R.Br.] is the second most important food crop grown mainly by small-scale farmers in low and mid elevations in Eritrea. Downy mildew (DM) caused by *Sclerospora graminicola* (Sacc.) J. Schrot., a major constraint to pearl millet production in much of the semi-arid tropics (Singh et al. 1993) is widely distributed in Eritrea where it often occurs in epidemic form on farmers' landraces. A systematic survey of the prevalence and severity of DM in farmers' fields was carried out under an ICRISAT-Danida-Eritrea project to better understand its distribution and develop control measures.

Materials and methods

A roving survey was conducted in 8 subzones: Keren, Hamemalo and Hagaz of Anseba Zone, and Mogolo, Barentu, Gogne, Haycota, and Dghe of Gash Barka Zone. Local administrators and personnel from the Eritrea Ministry of Agriculture accompanied the team in their respective zones. The survey covered 32 fields sown with pearl millet landraces, and 7 fields sown with an improved open-pollinated ICRISAT variety, ICMV 221 (4 in Keren, 1 in Hamemalo, and 2 in Hagaz). The latitude, longitude and altitude of the sites visited were recorded using Geographic Positioning System (GPS) equipment (GPS 12 XL*, Garmin International, Olathe, Kansas 66062, USA). In each field DM incidence was recorded in five random subplots (1 m^2) with 40-50 plants in each. DM incidence (%) was calculated from the ratio of diseased to total plants. At the time of survey the crops were at anthesis to soft dough stages.

Data on total rainfall and number of rainy days from sowing to soft dough stage in each subzone were collected from the Department of Agriculture. Rainfall and crop sequence data were used to ascertain if there were relationships between these factors and disease development. Diseased leaf samples were collected to assess variations in the pathogenicity of DM isolates.

Results and discussion

DM was present in most fields, incidence was low to high on landraces in the Keren (40-78%), Hagaz (32-86%), Hamemalo (36-56%) subzones of Anseba Zone, and in Barentu (13-48%), Gogne (5-94%) and Haikota (1-46%) subzones of Gash Barka Zone (Table 1). In contrast. DM incidence was very low (<1%) in Mogolo and Dghe. Twentyseven samples of infected tissue were collected from landraces at different locations and sent to the University of North Wales, Bangor, UK for studies on pathogenic variability.

Pearl millet variety, ICMV 221 was introduced to Eritrea in 1999 by ICRISAT and DARHRD, as a DM-resistant, early-maturing and high-yielding cultivar. It showed < 1 % incidence at Sutur and Bogu, but up to 28% across 4 fields in Halib Mentel in Keren subzone. Because it matures early, ICMV 221 is more vulnerable to bird damage than local landraces.

Total rainfall varied from 109 mm in Hagaz to 303 mm in Barentu and the number of rainy days varied from 5 in Gogne to 18 in Hamemalo and Barentu (Table 2). The variation in DM incidence at different locations did not directly relate to either the variation in total rainfall, or to the number of rainy days. This indicates a likely variation in the virulence within populations of the pathogen in the region.

Table 1. Downy mildew (DM) incidence on local landrace cultivars across eight subzones of two Zones in Eritrea, rainy season, 2000

Zone	Subzone	Number of fields[1]	DM incidence (%)[2] Mean	Range
Anseba	Keren	4	54	40- 78
	Hamemalo	4	44	36-56
	Hagaz	4	53	32 86
Gash Barka	Mogolo	1	1	1-1
	Barentu	3	25	13-48
	Gogne	7	41	5-94
	Haikota	4	13	1-46
	Dghe	4	<1	0-1

1. Field size varied from 0.2-0.5 ha
2. Based on the mean of 5 subplots $field^{-1}$, 1-m^2 $subplot^{-1}$

Table 2. Total rainfall (mm), number of rainy days and mean downy mildew (DM) incidence in eight subzones, Eritrea, July-September, 2000

Zone	Subzone	Rainfall Total (mm)	Days	DM incidence (%)
Anseba	Keren	245	15	40-78
	Hamemalo	116	18	36-56
	Hagaz	109	12	32-86
Gash Barka	Mogolo	261	12	<1
	Barentu	303	18	13-48
	Gogne	155	5	5-94
	Haikota	206	14	1-46
	Dghe	-[1]	-	0-1

1. Data not available

The pearl millet after pearl millet was the predominant cropping sequence, practiced by most farmers. The cropping sequence sorghum [*Sorghum bicolor* (L.) Moench]-sorghum-pearl millet had 42-48% DM incidence, pearl millet-sorghum-pearl millet had 48 78% DM incidence, onion *(Allium cepa* L.)-onion-pearl millet had 80% DM incidence, compared to 47-86% incidence in pearl millet followed by pearl millet. Although there was variation in disease incidence among different cropping sequences, there was no consistent effect of cropping sequence on disease incidence. This needs to be studied further.

To effectively manage DM, the development of cultivars with genetic resistance to the disease should be a primary objective of the local pearl millet breeding program. To facilitate breeding for resistance, a DM 'sick plot' (oospore-infested field) could be developed for screening breeding lines at the Hagaz Research Station. A brief (1-2 months) training period for a pathologist and technical staff in DM screening can be provided at ICRISAT, Patancheru. Surveys of DM incidence in farmers' fields should continue to document variation in spatial and temporal virulence patterns on landraces and improved cultivars. The International Pearl Millet Downy Mildew Virulence Nursery, co-ordinated by ICRISAT, could be useful in assessing variation in the pathogen population. A number of new resistant cultivars should be made available to farmers to reduce both the losses from DM and the likelihood of the pathogen overcoming the resistance of any single variety. Ultimately, greenhouse facilities for screening seedlings for DM resistance should be established at the agricultural research headquarters, Halhale.

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Reference

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

Pearl Millet Downy Mildew in Gujarat

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Introduction

Downy mildew (DM) caused by *Sclerosporagraminicola* (Sacc.) J. Schrott., is the most serious disease of pearl millet (*Pennisetum glaucum* (L.) R.Br.), particularly when it affects hybrids. In recent years due to the large-scale cultivation of hybrids in India, several new pathotypes of *S. graminicola* have evolved, and some promising ones have succumbed to DM (Thakur and Rao 1997; Thakur et al. 1999). Monitoring the DM resistance of pearl millet hybrids and virulence in the pathogen is critical for effective utilization of resistance genes. During a collaborative project on characterization of pathogenic variability in the pearl millet DM pathogen between ICRISAT and the All India Coordinated Pearl Millet Improvement Project (AICPMIP) of the Indian Council of Agricultural Research (1CAR), field surveys were conducted in Gujarat. The results of a systematic field survey undertaken to monitor DM incidence on various hybrids in farmers' fields in major pearl millet growing areas of Gujarat during the 2001 rainy season are reported.

Materials and methods

The survey involved 18 *talukas* (subdivisional revenue units) of Jamnagar, Rajkot, Surendranagar, Kheda, Anand, and Panchmahal districts of Gujarat during the 2001 rainy season. It covered 88 fields (17 fields in Anand, 30 in Jamnagar, 3 in Rajkot, 18 in Kheda, 7 in Panchmahal, and 13 in Surendranagar), ranging between 0.25-1 ha per field and encom-passing 21 different hybrids. DM incidence was recorded in five 2-nr random subplots where 50 plants subplot^{-1} were examined for disease symptoms. Disease incidence (%) was calculated from the ratio of diseased to total plants.

Information on cultivars, seed treatment, sowing date, fertilizer application, weeding, latitude and longitude, and cropping sequence were recorded to ascertain the relationship between these components and disease development. Seeds of most hybrids were available on