

RESISTANCE TO DOWNY MILDEW IN PEARL MILLET HYBRID NHB-3

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Abstract : NHB-3, a pearl millet cultivar, which is highly susceptible to downy mildew (*Sclerospora graminicola*) throughout the Indian sub-continent showed resistance to infection by oospores from Durgapura (Rajasthan) Research Station. The cultivar, however, developed a low percentage of downy mildew infection induced by sporangia of the Durgapura isolate. Conversely, the cultivar showed high susceptibility to both oospores and sporangia from ICRISAT Center. It appears that at Durgapura, the pathogen population specific to NHB-3 has either died out, or its pathogenicity has been drastically changed, in the absence of the host.

Keywords : *Sclerospora graminicola*, Downy mildew

Downy mildew (DM) [*Sclerospora graminicola* (Sacc.) Schroet] epidemics beginning in 1971 forced several high-yielding pearl millet hybrids including NHB-3 in India to be abandoned (Safeeulla, 1977 and Williams *et al.* 1981). In the DM sick-plot at Durgapura (Jaipur), however, NHB-3 and HB-3 were last grown during the 1977 rainy season and as usual heavy DM was recorded (Govind Singh, unpublished). The two cultivars were regrown there in the 1980 and 1981 rainy seasons as indicators of disease pressure in the DM sick-plot. Interestingly, during both these years, we observed high levels of DM resistance in both the cultivars with susceptibility expressed only as nodal tiller infection at the heading stage. At other research centers in India, where they are grown every year, the cultivars continue to be highly susceptible. To investigate reasons for the occurrence of such a phenomenon, we compared the pathogenicity of oospores from Durgapura and ICRISAT Center. The results are reported in this paper.

MATERIALS AND METHODS

Test cultivars

Two DM susceptible cultivars (NHB-3 and 7042) were used in all the experiments. Surface-sterilized seed (sterilized with 0.1 per cent HgCl₂ for 5 min followed by several changes in distilled sterile water) of the two cultivars were used.

Oospore samples and inoculation

Two oospore samples were used, that is, oospore from NHB-3 and 7042 grown at the ICRISAT Center during 1981 rainy season, and oospores from two Rajasthan local

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cultivars grown in the sick-plot at Durgapura Research Station during the 1981 rainy season. The leaf debris containing oospores were ground to powder in a contamination-free room. Each sample containing 20-25 oospores per microscopic field (31.25 X) was mixed with sterilized soil at 2g/kg of soil.

Plastic pots of 12 cm diameter were three quarters filled with a mixture of red soil and farmyard manure (in a ratio of 3 to 1, v/v) that had been sterilized at 15 lbs pressure for 2 h/day for three consecutive days. A 2.5 cm thick layer of sterilized oospore-inoculated soil was spread in each pot. Fifteen seeds were equidistantly planted in each pot. The seeds were covered with 1.5 cm layer of sterilized, oospore-inoculated soil. Surface-sterilized seeds of two cultivars planted in sterile non-inoculated soil in pots were maintained as checks. The pots were irrigated and maintained at $30 \pm 2^\circ\text{C}$ and 90 to 95 per cent humidity in a glasshouse. DM incidence records were taken 7, 14, 21 and 28 days after planting (DAP), and at each recording infected plants were uprooted and destroyed.

Inoculation with sporangia

Sporangial inoculum for the two isolates was separately produced on 7042. Emerging seedlings were then inoculated with 25 μl inoculum containing 4×10^5 sporangia/ml by a microsyringe (Singh and Gopinath, 1985). DM incidence records were taken 7 and 14 days after inoculation (DAI).

RESULTS

Oospore Infection

A marked difference between the pathogenicity of the two isolates was observed on NHB-3. No DM was detected on NHB-3 with Durgapura isolate. However, the cultivar was highly susceptible to the ICRISAT isolate, and 7042 was susceptible to both the isolates as shown in Table 1.

Sporangial Infection

The ICRISAT isolate produced heavy DM on both the cultivars within 15 days of inoculation. However, Table 1 shows that the two cultivars greatly differed in their susceptibility to infection by sporangia from the Durgapura isolate.

DISCUSSION

The results reported here confirm the high level of field resistance of NHB-3 to DM at Durgapura Research Station. A small percentage of DM as nodal tiller infection, recorded at the heading stage was probably due to the low susceptibility of this cultivar to sporangia from that isolate, despite its resistance to oospore infection. These results indicate that genes providing resistance to oospores might be different from those giving resistance to sporangial infection as was reported by Frederiksen and Renfro (1980) in the case of sorghum downy mildew on corn.

TABLE 1 : Downy mildew incidence in 7042 and NHB-3 inoculated with oospores and sporangia of downy mildew pathogen from Durgapura and ICRISAT

Cultivars	Inoculum Source	Oospore infection			Sporangial infection		
		Plant No.	Per cent downy mildew at 28 DAI ^a	(S.E. \pm)	Plant No.	Per cent downy mildew 14 DAI ^a	(S.E. \pm)
7042	Durgapura	119	54.0 ^b	4.6	67	70.5 ^c	5.6
NHB-3	"	122	0 ^b	—	68	14.0 ^c	4.2
7042	ICRISAT	86	53.5	5.9	60	91.7	3.9
NHB-3	"	134	67.9	4.0	60	98.3	1.8
7042 (Non-inoculated check)	—	107	0	—	45	0	—
NHB-3 (Non-inoculated check)	—	19	0	—	44	0	—

^aDays after inoculation; ^bMeans of 2 tests; ^cMeans of 3 tests.

The pathogenicity behaviour of *S. graminicola* at Durgapura is interesting. It appears that in the absence of the host the pathogen population that was capable of causing heavy DM in NHB-3 has either died out or its pathogenicity has been drastically changed. Whether it is a case of specific host cultivar-pathogen-environment interaction, or a phenomenon common to other host cultivars also needs to be investigated. If the latter is true, it then offers an excellent opportunity for the long term control of this disease through gene deployment over time.

Undoubtedly the pathogen population at Durgapura is different from those present at other locations as far as NHB-3 is concerned. The possible involvement of a different race is being investigated.

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