Identification of Sources of Resistance to Sorghum Downy Mildew in Late-flowering Sorghum Germplasm

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Sorghum downy mildew, caused by *Peronosclerospora sorghi* (Weston & Uppal) C.G. Shaw, is a serious disease of sorghum [*Sorghum bicolor* (L.) Moench] and maize (*Zea mays* L.) in many parts of Asia, Africa, and the Americas. At the ICRISAT Asia Center (IAC), we have been evaluating sorghum germplasm accessions for resistance to this disease. During 1991–92, we evaluated 800 sorghum accessions (taking more than 80 days to flower at IAC) for their reaction to downy mildew using a greenhouse screening technique. Seeds of each accession were soaked for 2 h in tap water in plastic petri dishes lined with blotting paper. Excess water was drained off and the plates were incubated at 30°C for 24 h. Sprouted seeds (25–30) of each accession were transplanted to pots filled with a potting mixture (consisting of 3 parts of Vertisol and 1 part of farmyard manure) and irrigated immediately. DMS 652 was used as the susceptible control. At the coleoptile-to-one-leaf stage, the seedlings were spray-inoculated with a conidial suspension (1×10^5 spores mL^{-1} water). The IAC isolate of the pathogen was used. The details of the technique have been described by Singh and Gopinath (1985). This technique ensures that plants are inoculated when they are the most susceptible, with adequate inoculum concentration and under conditions optimum for disease development. Disease incidence was recorded 20 days after inoculation.

The incidence of downy mildew in DMS 652 was more than 95%. Ten entries (IS 18512, IS 18552, IS 18713, IS 18714, IS 19018, IS 19096, IS 19105, IS 19239, IS 20049, and IS 20205) remained free from downy mildew. In four others (IS 18716, IS 19019, IS 19506, and IS 19971), downy mildew incidence was less than 5%, and in nine entries (IS 18549, IS 18555, IS 19147, IS 19175, IS 19187, IS 19189, IS 19417, IS 19490, and IS 20220) it was 5 to 10%. In the remaining entries, the incidence ranged from 11 to 100%. This shows that good sources of resistance are available in late-flowering sorghum accessions. These sources will be particularly useful in breeding long-duration downy mildew resistant sorghum cultivars.

Reference

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

Evaluation of Wild and Weedy Sorghums for Downy Mildew Resistance

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Downy mildew of sorghum [*Peronosclerospora sorghi* (Weston & Uppal) C.G. Shaw], is one of the widespread diseases of sorghum [*Sorghum bicolor* (L.) Moench] (Williams 1984). Systemically infected plants fail to produce panicles, resulting in complete loss of grain yield (Craig and Odvody 1985). Sources of resistance to this disease have been reported in wild sorghums (Mughogho et al. 1982). In an attempt to identify additional sources of resistance, we screened 308 wild and weedy sorghums belonging to 29 species and sub-species in greenhouse conditions at ICRISAT Asia Center (IAC) during 1990–91. Seeds of each accession, supplied by ICRISAT's Genetic Resource Division, were sown in two 12-cm square pots. Seedlings at the coleoptile-to-one-leaf stage were spray-inoculated with conidia (6×10^5 conidia mL^{-1}) as described by Reddy et al. (1992). The IAC isolate of the pathogen was used. Downy mildew incidence was recorded three weeks after the inoculation.

Twenty-nine accessions were found to be free from downy mildew. Eight more showed very high levels of resistance with incidence ranging from 1–10% (Table 1). Of the downy-mildew-free accessions, eight belong to Para sorghums (IS 14262, IS 14275, IS 18926, IS 18941, IS 18942, IS 18946, IS 23159, and IS 23177), five belong to *Sorghum purpureosericeum* (IS 18939, IS 18947, IS 22191, and two without an IS number), two each belong to *S. drummondii*, *S. stipodeum*, *S. matarankense*, *S. nitidum*, and *S. dimidiatum*, and one each belongs to *S. australience*, *S. brevicallosum*, *S. affstipodeum*, *S. plumosum*, Sorgastrum, and *S. laxiflorum* (Table 2). The results showed that the accessions varied greatly in their resistance/susceptibility to downy mildew. None of the accessions belonging to 12 species/subspecies/races including *S. virgatum*, *S. aethiopicuum*, and *S. helepense* was downy-mildew-free or highly resistant (<10% downy mildew). Conversely, all the accessions belonging to Para sorghum were either free of the disease or highly resistant.

Table 1. Downy mildew reaction of 308 wild and weedy sorghum accessions under greenhouse conditions at ICRISAT Asia Center, 1990-91.

Sorghum species/ sub-species/race	Countries of origin (number)	Lines screened (number)	Number of entries with downy mildew			Downy mildew incidence
			Free	1–10%	>10%	(% range)
S. verticilliflorum	10	91	0	1	90	7-100
S. virgatum	5	19	0	0	19	14-100
S. aethiopicuum	4	13	0	0	13	44-100
S. arundinaceum	9	23	0	1	22	7-100
S. drummondii	16	78	2	1	75	0-100
S. helepense	5	15	0	0	15	26-100
S. almum	2	5	0	0	5	66- 88
S. miliaceum	2	5	0	0	5	54-100
S. lanceolatum	2	5	0	0	5	12-100
S. usamberance	2	3	0	0	3	36-100
S. hewisonni	2	2	0	0	2	42- 54
S. purpureosericeum	4	6	5	0	1	0- 50
S. stipodeum	2	2	2	0	0	0
S. matarankense	2	2	2	0	0	0
S. nitidum	2	2	2	0	0	0
S. propinquum	1	3	0	0	3	16- 85
S. australience	1	1	1	0	0	0
S. brevicallosum	1	1	1	0	0	0
S. affstipodeum	1	1	1	0	0	0
S. plumosum	1	1	1	0	0	0
Para sorghum	6	12	8	3	1	0- 12
S. dimidiatum	1	2	2	0	0	0
Sorgastrum	5	8	1	2	5	0- 93
S. controversum	2	2	0	0	2	69- 88
S. rhizomatous	2	2	0	0	2	58-100
S. laxiflorum	1	1	1	0	0	0
Unknown species	2	3	0	0	3	85-100
IS 18433 (Susceptible control)	-	-	-	-	-	90-100
IS 18757 (Resistant control)	-	-	-	-	-	0

Table 2. Species, sub-species and races of wild relatives of sorghum resistant to downy mildew at ICRISAT Asia Center, India.

Species/sub-species/race	IS Number	Origin
S. affstipodeum	IS 18959	Australia
S. australience	IS 18956	Australia
S. brevicallosum	IS 18957	Australia
S. dimidiatum	IS 18944	Sudan
S. dimidiatum	IS 18945	Sudan
S. drummondii	IS 21575	Malawi
S. drummondii	IS 10983	USA
S. laxiflorum	-	Unknown
S. matarankense	IS 18952	Australia
S. matarankense	-	Unknown
S. nitidum	IS 18958	Australia
S. nitidum	-	Unknown
Para sorghum	IS 14262	Angola
Para sorghum	IS 18946	Botswana
Para sorghum	IS 18926	South Africa
Para sorghum	IS 18941	Tanzania
Para sorghum	IS 18942	Tanzania
Para sorghum	IS 23159	Tanzania
Para sorghum	IS 23177	Tanzania
Para sorghum	IS 14275	Unknown
S. plumosum	IS 18961	Australia
S. purpureosericeum	IS 18947	India
S. purpureosericeum	IS 22191	India
S. purpureosericeum	-	Somalia
S. purpureosericeum	IS 18939	Unknown
S. purpureosericeum	-	Unknown
S. stipodeum	IS 18963	Australia
S. stipodeum	IS 18965	Australia
Sorgastrum	IS 23176	Tanzania

This indicates that Para sorghums in general have high levels of resistance to downy mildew. This, however, needs to be confirmed with a larger number of accessions.

References

Craig, J., and **Odvody, G.N.** 1985. Assessment of downy mildew yield loss with isogenic sorghum populations. Phytopathology 75: 1300.

Mughogho, L.K., Karunakar, R.I., and **Pande, S.** 1982. Wild sorghum species as sources of resistance to *Peronosclerospora sorghi*. International Working Group on Graminaceous Downy Mildews Newsletter 4: 3–4.

Reddy, B.V.S., Mughogho, L.K., Narayana, Y.D., Nicodemus, K.D., and **Stenhouse, J.W.** 1992. Inheritance pattern of downy mildew resistance in advanced generations of sorghum. Annals of Applied Biology 121: 249–255.

Williams, R.J. 1984. Downy mildews of tropical cereals. Pages 1–103 *in* Advances in Plant Pathology, vol. 2 (Ingram, D.S. and Williams P.H., eds.). London, UK and New York, USA: Academic Press.

Variability in *Curvularia lunata* (Wakker) Boedijn Causing Grain Mold in Sorghum

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Sorghum grain mold is a serious problem in India; losses in grain yield have been estimated to be 30% (Murty and Rana 1993). Among various fungi causing grain mold, *Curvularia lunata* (Wakker) Boedijn and *Fusarium moniliforme* Sheld. are more important.

Curvularia lunata can infect the grains at any stage of their development. The affected grains turn black. The pathogen appears to interfere with the translocation of carbohydrates resulting in smaller and lighter grains. It may cause seed rot also. Sorghum lines tested at different locations showed variation in their reaction to grain mold. Therefore, isolates of *C. lunata* collected from four locations in India (Surat, Akola, Dharwad, and Jalgaon) were studied for their cultural characteristics and pathogenicity.

The isolates from all four locations were similar in growth and sporulation on different media. All the isolates, except the Jalgaon isolate, reduced the pH of both synthetic and non-synthetic media. The Jalgaon isolate increased the pH of synthetic media, although its effect on non-synthetic media was similar to that of other isolates. The pH of Richards' medium was greatly reduced by the Akola and Surat isolates.

Maltose and starch were the best carbon sources for all the isolates. Xylose was also utilized efficiently by the Akola and Dharwad isolates. No change in pH of the filtrates was noticed with the Jalgaon isolate when glucose or fructose was used as carbon source. On the contrary, reduction in pH was maximum with the Dharwad isolate when cellulose was used. The Akola and Jalgaon isolates, and the Dharwad and Surat isolates, induced similar changes in color of the media containing sucrose or starch.