

RESEARCH ARTICLE

## Studies of grain molds on *sorghum* cultivars from Telangana

<sup>1</sup>Aravinda T. and <sup>2</sup>Manoharachary C.

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**Abstract:** *Sorghum* (family-Poaceae) is an important staple food crop of Telangana and grown during Kharif and Rabi seasons. The Grain molds refer to the condition that is produced by fungal association with *Sorghum* spikelet tissues occurring from anthesis to harvest. Grain mold infection affects the grain size, quality, nutrients and market value resulting in potential damage. Low temperatures and high humidity favour Grain mold infection. In the present investigation, the Grain mold fungi associated with 12 cultivars of *Sorghum* has been worked out and it is reported that around 29 fungal species are found associated with the Grain mold infected seed samples. Interestingly, SPV-1068 and 296-B cultivars were found heavily colonized by Grain mold fungi and the least being Y-75 and White Cultivar which are harboured with few Grain mold fungi. This paper presents indepth analysis of Grain molds on 12 *Sorghum* cultivars grown in Telangana region.

**Keywords:** Cultivar, Disease, Fungi, Grain, Kharif, Mold, Rabi.

### Introduction

*Sorghum* is an important staple food crop of the world and 90% of world's *Sorghum* growing areas are located in Africa and Asia. Around 42% of total *Sorghum* produced by different countries of the world is utilized for food and around 48% is used as animal feed. *Sorghum* is a second largest crop grown in India during Kharif and Rabi seasons including in Telangana.

Grain molds refer to the condition that is produced by fungal association with *Sorghum* spikelet tissues occurring from anthesis to harvest. Infection of Grain mold includes all the floral parts including pedicel. Grain mold infection results in the reduction of grain size, loss of germination percentage and nutrients, thus affecting the *Sorghum* cultivars in the market. Dense fungal mat of pink, white or black colours occur in the grain giving moldy appearance particularly during humid environment. Potential damage occurs in the *Sorghum* cultivars due to different Grain mold

fungi. Grain molds not only affect the quality of the seed but also reduces the size and weight of grain. The survey of literature indicates that the *Sorghum* Grain molds are reported by many (Castor and Frederiksen 1980, Christensen 1957, Forbes *et al.* 1992, ICRISAT 1986, Mathur *et al.* 1967, Williams and Rao 1981, Williams and MC Donald 1983). Recently, Arlyn Ackerman *et al.* 2021 and Berber *et al.* 2021 and others have reported *Sorghum* Grain mold disease complex with reference to the fungi, host response and bioactive metabolites at play. Most of the *Sorghum* cultivars get infected with Grain molds during rainy season and also at the time of occasional rains during harvest. The literature survey indicates that the Grain molds of *Sorghum* have not been worked out from different districts of Telangana region. Therefore, an attempt is made to study the Grain molds associated with twelve cultivars of *Sorghum bicolor* (L.) Moench.

### Materials and methods

The *Sorghum* growing areas located in districts of Mahabubnagar, Ranga Reddy, Medak, and also surrounding areas of Hyderabad, Agricultural farms of Sri Jayashankar Agricultural University of Telangana and ICRISAT have been

✉ Aravinda T.  
aravindatirumala282@gmail.com

<sup>1</sup> Department of Botany, N. G. College(A), Nalgonda,  
Telangana State, India.

<sup>2</sup> Department of Botany, Osmania University, Hyderabad-  
500007, Telangana, India

selected for the collection of Grain mold samples during rainy season and also during the period of occasional rains. The cultivars selected are: 1) SPV-938, 2) SPV-1071, 3) SPV-462, 4) CSV-4, 5) SPV-1068, 6) 296 -B, 7) CSH-11, 8) SPV-881, 9) SPV-104, 10) A-2611, 11) Y-75 and 12) White Cultivar.

The Grain mold seed samples have been collected in fresh polythene covers and brought to the laboratory for further investigation. The Grain molds were also observed with hand lens at the field site. The study period has been January, 2019 to December, 2020. The mold infected grains from panicles have been observed under binocular research microscope and later worked out for Grain mold fungi as per the methods described by the ISTA (2001). 800 grains from each sample of the cultivar were examined to identify the fungi up to species level. The percentage molded area and composition of mold fungi have been analyzed by incubating the grains on moist filter paper (Blotter method). The grains were also surface sterilized with 1% sodium hypochlorite and were placed on moist blotter. All these Petri dishes in triplicate were incubated at  $28 \pm 2^\circ\text{C}$  for 48 hours and also up to 5<sup>th</sup> day. The plates were examined regularly from 2<sup>nd</sup> to 5<sup>th</sup> day and Grain mold fungi were isolated in pure culture on Potato Detrose Agar. Different fungi have been identified up to species level using standard Manuals (Barron, 1968; Ellis, 1971, 1976; Nagamani *et al*, 2006; Raper and Thom, 1949; Raper and Fenell, 1965). The fungal numbers were estimated by Peterson's dilution plate method (Peterson, 1959), using 1:10,000 dilution on PDA medium. The fungi were counted on 5<sup>th</sup> day. For qualitative analysis, fungi were observed from 5<sup>th</sup> to



**Figure 1:** A. Healthy *Sorghum* grains B. Grain mold infected samples

10<sup>th</sup> day.

## Results and discussion

*Sorghum bicolor* (L.) Moench grains are reported to be infected by Grain mold resulting in diseased appearance and the infection being by one or more fungal species. (Fig I.A, B).

Similar reports were made earlier by Ravindranath (1978) and Rao and Williams (1977) in their preliminary survey. Severely infected grains appear to be completely covered with white mycelium (*Fusarium* sp.) and black mycelium (*Drechslera* sp.) which disintegrate into powder during threshing. It has been observed that *Sorghum* grains which are asymptomatic may also contain Grain mold fungi. The Grain mold infected *Sorghum* cultivars show less yield, low viability, less germination, loss of nutrients and loss of market value (Williams and Rao, 1981).

From the present data, it is clear that the Grain mold fungi affecting 12 cultivars grown in

**Table-I :** Fungal numbers in Grain mold seed samples of *Sorghum* (Dilution plate method)

Cultivar		Fungal Numbers (in 1000s)			
		Kharif		Rabi	
		NS	SS	NS	SS
1	SPV - 938	20	15	-	-
2	SPV - 1071	31	28	-	-
3	CPV - 462	34	30	-	-
4	CSV - 4	40	35	30	26
5	SPV - 1068	132	120	108	90
6	296 - B	138	130	100	80
7	CSH - 11	10	6	-	-
8	SPV - 881	91	85	-	-
9	SPV - 104	46	40	-	-
10	A - 2611	34	30	-	-
11	Y - 75	32	28	26	20
12	White Cultivar	26	20	20	15

NS = Non-sterilized

SS = Sterilized with 0.01% Sodium hypochlorite

- = Cultivar is not grown in Rabi

**Table 2 :** Percentage occurrence of Grain mold fungi in *Sorghum* (Dilution plate method)

*Cultivar.....	1		2		3		4		5		6		7		8		9		10		11		12	
Fungal species	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS
1 <i>Alternaria alternata</i> (Fr.) Keissl	--	--	--	--	--	--	--	--	15	15	02	--	--	--	56	41	20	30	20	10	--	10	05	05
2 <i>Arthrobotrys superba</i> Corda	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--	--	--	05	10	12	10
3 <i>Cladosporium cladosporioides</i> (Fresen) de Vries	--	--	--	--	10	23	23	19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4 <i>Curvularia lunata</i> (Wakker) Boedijn	18	10	35	21	49	46	13	23	16	25	53	31	--	60	35	26	10	--	10	10	30	20	20	20
5 <i>Curvularia lunata</i> var. <i>aeria</i> (Bot., J. A. Lima & C. T. Vascon)	30	20	25	28	23	19	13	23	10	10	22	30	--	28	09	05	30	40	50	40	20	30	40	50
6 <i>Drechslera halodes</i> (Dreschs.) Subram & Jain	22	19	--	--	18	12	14	10	18	15	13	26	--	12	--	05	--	--	--	--	05	--	--	05
7 <i>Fusarium graminearum</i> Schwabe	--	13	15	10	--	--	03	18	--	--	--	--	--	--	--	--	10	--	05	--	10	10	05	--
8 <i>Fusarium oxysporum</i> Schlecht	10	10	10	23	--	--	24	30	24	25	10	13	--	--	--	--	--	10	10	20	10	10	--	--
9 <i>Fusarium semitectum</i> Berk	20	30	15	18	--	--	--	--	17	10	--	--	--	--	--	23	20	30	05	20	20	10	10	--

\*Cultivars 1 to 12 as given in the Table-1

NS : Non-sterilized

SS : Surface sterilized 0.01% Sodium hydrochlorite

Telangana have recorded Grain mold symptoms. In the present context, altogether 12 cultivar Grain mold infected seed samples were screened (Table-I) during Kharif and Rabi.

Among 12 cultivars, SPV-1068 and 296-B were found heavily colonized by Grain mold fungi. However, Y-75 and White Cultivars did not harbour many Grain mold fungi. Surface sterilized seeds have yielded less fungal numbers than non-sterilized seeds which have yielded more fungal numbers. This data indicates that the disease is intimately connected with fungal load and also with epidemiology and host-resistance. This data also indicates role of host genotype in relation to Grain mold fungi. The Grain molds were not considered as of much sequence and important before 1970 but after 1977, the *Sorghum* Grain molds have become most important in India (ICRISAT, 1987). In the present investigation, it has been observed that the *Fusarium semitectum* Berk infection

resulted in the appearance of dull white growth on the grains of the spikelet. Brown to black mycelium covered *Sorghum* ear head by *Curvularia lunata* (Wakker) Boedijn and *Drechslera halodes* (Dreschs.) Subram & Jain. *Fusarium* sp. has produced pinkish mycelium. Similarly, several other fungi shown different colours.

Altogether, 9 fungal species are recorded along with their percentages from Grain mold seed samples (Table – 2).

The above data clearly indicates that the Grain mold fungi of *Sorghum* cultivars is of much importance as the jowar forms the staple food in Telangana region. Therefore, it is essential to control the Grain mold fungi under field conditions. The data presented above is the indepth analysis of Grain molds on *Sorghum* cultivars grown in Telangana region.

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