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Research Article

ISOLATION OF SEED-BORNE FUNGAL PATHOGENS OF SORGHUM IN SELECTED DISTRICTS OF TAMILNADU – INDIA

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ABSTRACT

Sorghum is the fifth most important cereal crop in the world after wheat, rice, maize and barley. The grain had been used for consumption of both humans and livestock and also different genes of the plant serve many other important uses. The crop has been suffer from various types of diseases, majority of them are known to be caused by fungi, which are mostly seed borne. The present study aims to survey and isolate the seed borne fungi of sorghum in selected agroclimatic regions viz., Cuddalore, Dharmapuri, Salem and Villupuram, Tamil Nadu, India. The composite samples were collected from these regions carefully and transferred to the laboratory. And using PDA method, various fungal pathogens were isolated for the year 2016 and 2017 in the selected districts. It was observed that, species of *Aspergillus*, *Mucor*, *Rhizopus* occurrence is frequent in both the years along with *Penicillium*, *Fusarium* and *Geotrichum*. Presence of many pathogenic fungi with considerable number in the samples indicates the need of field surveys for these and other pathogens.

INTRODUCTION

Sorghum is the most important cereal crop in the world after wheat, rice, maize, and barley. It is found in the arid and semi-arid parts of the world, due to its feature of being extremely drought tolerant. The nutritional value of sorghum is same as that of corn and that is why it is gaining importance as livestock feed. Sorghum is also used for ethanol production, producing grain alcohol, starch production, production of adhesives and paper other than being used as food and feed. The production of sorghum in India reaches up to 9 million metric tons mark each year but last few years have shown a marginal but gradual decline in the production and productivity of the crop. The area under cultivation of the crop too has a steep decline in the last 15 years i.e. 50% and 25% in the Khariff and Rabi season respectively (CRN India, 2010).

Grain Sorghum continues to be an economically important crops however numerous fungal diseases of grain sorghum can be found wherever the crop is grown. Some of the diseases have been investigated in the past which are either continuing to be an important pathogens that affect yields are very common and provoke interest from producers. Head diseases of sorghum in terms of lost production, potential, thus commanding considerable research time and expenditure. Hence, this study was focussed on the survey of the fungal pathogens in the selected districts of Tamil Nadu, that could affect the sorghum grains viz, Cuddalore, Dharmapuri, Salem and Villupuram. More than 50 diseases have been reported to attack sorghum of which ten are not major importance. In general the important fungal diseases which affect the yield are grain mold, ergot, downy mildew, smut, rust and charcoal rot. It is important for sorghum growers to be able to identify the disease that frequently occur in their growing environment.

A diverse community of microorganisms is associated with the caryopsis of all weed and crops plants in the poaceae that have been investigated (Pitty *et al*., 1987; Ikeda *et al*., 2006). Deleterious fungal communities in particular, differ, depending upon grass host species, environment, geographical location and level of resistance to grain mold, weathering, post harvest seed deterioration and associated disease complexes such as head blight.

Grain mold of sorghum is caused by a complex of fungal pathogens, which infect the developing caryopsis as early as anthesis, proceed through grain development and also result in post harvest deterioration including the production of potentially harmful mycotoxins (Leslie *et al*., 2005; Sharma *et al*., 2010). In sorghum, the grain mold complex is that are capable of infecting and colonizing sorghum grain at all levels of maturity and in storage (Williams & Rao; 1981; Singh and

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Bandyopadhyay, 2000; Thakur *et al*., 1987; 2003; Erpelding and Prom; 2006; Dos Reis *et al*., 2010). Hence, Present study aims at the survey and study on the isolation and identification of seed-borne fungal pathogens which is causing deterioration in yield and production potential over in several districts of Tamil Nadu, viz, Cuddalore, Dharmapuri, Salem and Villupuram in the year 2016 December and 2017 November.

Analysis of Mycoflora

The collection of fungal infected sorghum grains were transferred in to the laboratory and then the fungi isolated from sorghum grains were surface sterilized with 0.5% Sodium hypochlorite solution, washed by sterile distilled water and placed on the PDA medium in petridishes at 27 – 30^{o}C for 2 – 3 days. The PDA media was used for sporulation depends on type of fungi. The streptomycin antibiotic was used to avoid the bacterial contamination. After the incubation, the development of fungal colonies were observed. The fungal cultures were then transferred, subcultured and pure cultures were maintained. The isolated colonies were subjected in to macroscopic and microscopic observation. Microscopic observation carried out with Lacto Phenol Cotton Blue (LPCB) staining method (Dring 1976). The slides were observed under microscope and identified with the help of keys given by the taxonomic arrangements proposed in the 6th edition of Ainsworth and Bisby's Dictionary of Fungi. (Ainsworth, 1971).

RESULTS

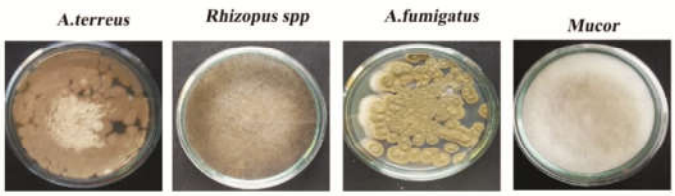
Over the years, numerous studies have characterized the fungal communities of sorghum caryposis. In sorghum (*Sorghum bicolor*) covered smut (*sphacolotheca sorghi*), head smut (*sphacelotheca reiliana*) and long smut (*Tolyposporium ehrenbergii*) have been reported to be the destructive pathogens, causing heavy losses in third world countries (Frowd, 1980). Microbes investing grains were seeded into the PDA medium in petridishes for the sporulation of fungi. And on the occurrence of growth of microorganisms after 2-3 days, the recovered fungi were maintained on half strength PDA slants in the test tube as stock cultures. After incubation period, Subcultures was performed frequently inorder to obtain pureculture of total number of isolates in each districts taken for the study.

Table 1 Year wise Distribution of Fungal Pathogans on Sorghum in Selected Districts of Tamil Nadu

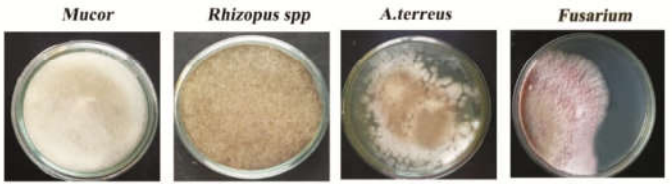
S. No.	Name of the Fungi	2016 (December)				2017 (November)			
		Cuddalore	Dharmapuri	Salem	Villupuram	Cuddalore	Dharmapuri	Salem	Villupuram
1.	*Aspergillus fumigates*	+	-	-	-	-	-	+	-
2.	*A.niger*	-	+	+	-	-	+	+	-
3.	*A.terreus*	+	-	-	-	+	+	-	-
4.	*Fusarium*	-	-	-	-	+	-	-	-
5.	*Geotrichum*	-	+	-	-	-	-	-	-
6.	*Mucor*	+	+	+	+	+	+	+	+
7.	*Penicillium*	-	-	+	+	-	-	-	-
8.	*Rhizopus*	+	+	+	+	+	+	+	+
9.	*Aspergillus species*	-	-	+	-	-	+	-	-

The Table – 1 results shows various species belongs to fungi that affected sorghum have been recorded as *Mucor*, *Rhizopus*, *Fusarium*, *Aspergillus*, *Penicillium* and *Geotrichum* from the samples collected at selected districts of Tamil Nadu. In Cuddalore samples isolated the fungal pathogens includes *A.terreus spp*, *Rhizopus spp,* and *Mucor* in both the years and *Fusarium and A.fumigatus in 2017 samples (Fig1a & b).*

Fungi Isolated from Cuddalore Samples (2016) (Fig. 1a.)

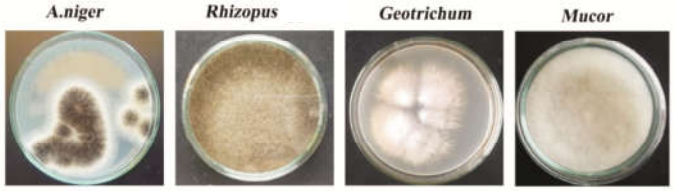


Fungi Isolated from Cuddalore Samples (2017) (Fig. 1b.)



Whereas, in Dharmapuri samples includes *Aspergillus* spp, *Mucor* and *Rhizopus* in 2016 and 2017 with the *Geotrichum, A.terreus* and one more Aspergillus species have been isolated in 2017 (Fig 2a & b).

Fungi Isolated from Dharmapuri Samples (2016) (Fig. 2a.)

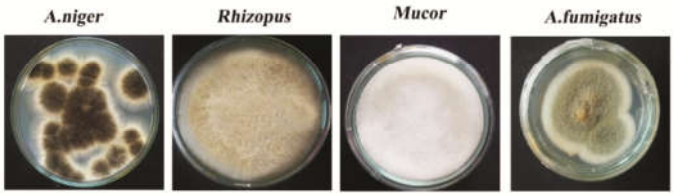


Fungi Isolated from Dharmapuri Samples (2017) (Fig. 2b.)

The Seed-borne mycoflora of Salem samples includes *Aspergillus*, *Rhizopus*, *Mucor* in both the years with penicillium (Fig 3a. &b).

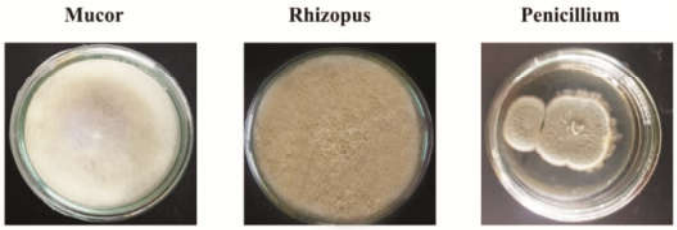
Fungi Isolated from Salem Samples (2016) (Fig. 3a.)

Fungi Isolated from Salem Samples (2017) (Fig. 3b.)



The isolated seed-borne mycoflora of Villupuram includes *Mucor*, *Rhizopus* in 2016 and 2017 and *Pencillium* species in 2016 respectively. (Fig. 4a&b)

Fungi Isolated from Villupuram Samples (2016) (Fig. 4a.)



Fungi Isolated from Villupuram Samples (2017) (Fig. 4b.)

DISCUSSION

Commercially, discoloured sorghum seeds caused by fungi are of poor quality (Castor and Frederikser, 1980; Gopinath and Shetty, 1987), reducing their acceptability and thus, the market value of the produce. Grain mold causes crop loss by reducing seed size and weight, the food value and keeping quality of grains (Gopinath, 1984; Bandyopadhyay, 1986). In the present study, *Aspergillus* species have been reported in both the years at, all the four districts studied which is considered to be notorious plant pathogen so far reported from all sides. Many of the diseases that cause reduced yields in Sorghum have seed-borne phases. Seed borne inoculums therefore, has severe implications for yield, seed production and distribution systems, trade, human nutrition and germplasm.

The isolated *Mucor*, *Rhizopus*, *Aspergillus* were the dominant fungi present in all the districts studied. This indicates that it can cause reduction in the yield, production of the sorghum grains. Because these pathogens can cause a yield loss of 58 to 70% of hybrid sorghum and millet growing countries of these, losses in potential yield, mold fungi which grow on the seed substratum produce mycotoxins which are hazardous to man and animals. The management of these pathogens during the seed-brone phase is considered to be the cheapest disease control strategy. (Shenge, 2007).

CONCLUSION

The presence of so many pathogenic fungi at high levels in various geographical areas indicates a clear need for field surveys for these and other pathogens. There is also a clear need to increase public awareness on aspects related to seed health and to develop suitable management practices for improving the quality of the seeds. However, details on the role of seed borne fungi and their metabolites in the deterioration of seed quality and viability are meagre. The effective management can only be implemented with the perfect field trials. It is in this view of this that the current study aimed at detecting seed borne pathogens on sorghum seeds.

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