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SEED BORNE FUNGI OF THREE MINOR-MILLETS IN CENTRAL, KARNATAKA, INDIA

Manjula T* and M. Krishnappa

Department of P.G Studies and Research in Botany, Kuvempu University, Jnanasahyadri, Shankaraghatta, Shivamogga-577451 (Karnataka) India.

Abstract

The study revealed on seed mycoflora of minor millets in Central dry zone Karnataka. Seed mycoflora associated with three minor millets was studied on different seed health testing methods. Standard blotter method, PDA, Water agar plate, 2, 4. D and Deep Freeze Blotter method. Seed-borne fungi, viz. *Alternaria alternata* (74.81%) *Aspergillus niger* (12.0%) *A. flavus* (9.4%) *A.ochraceus* (4.6%) *A.versicolor* (10.1%) *Botryotrichum* sp. (12.3%). *Chaetomium* sp. (23.6%) *Cladosporium cladosporides* (18.2%) *Colletotrichum* sp.(24.1%) *Curvularia lunata* (54.5%) *Drechslera* sp. (73.7%). *Fusarium moniliforme* (67.8%) *Nigrospora* sp. (16.0%) *Penicillium* sp. (18.6%) *Phoma* sp. (14.3%) *Rhizopus* sp. (8.3%) and *Stemphylum* sp., (7.2%) recorded on millets. The obtained results revealed that the standard Blotter method was found to be the best method, compared to the other methods.

Key words: Minor millets, seed-borne mycoflora, pathogen.

Introduction

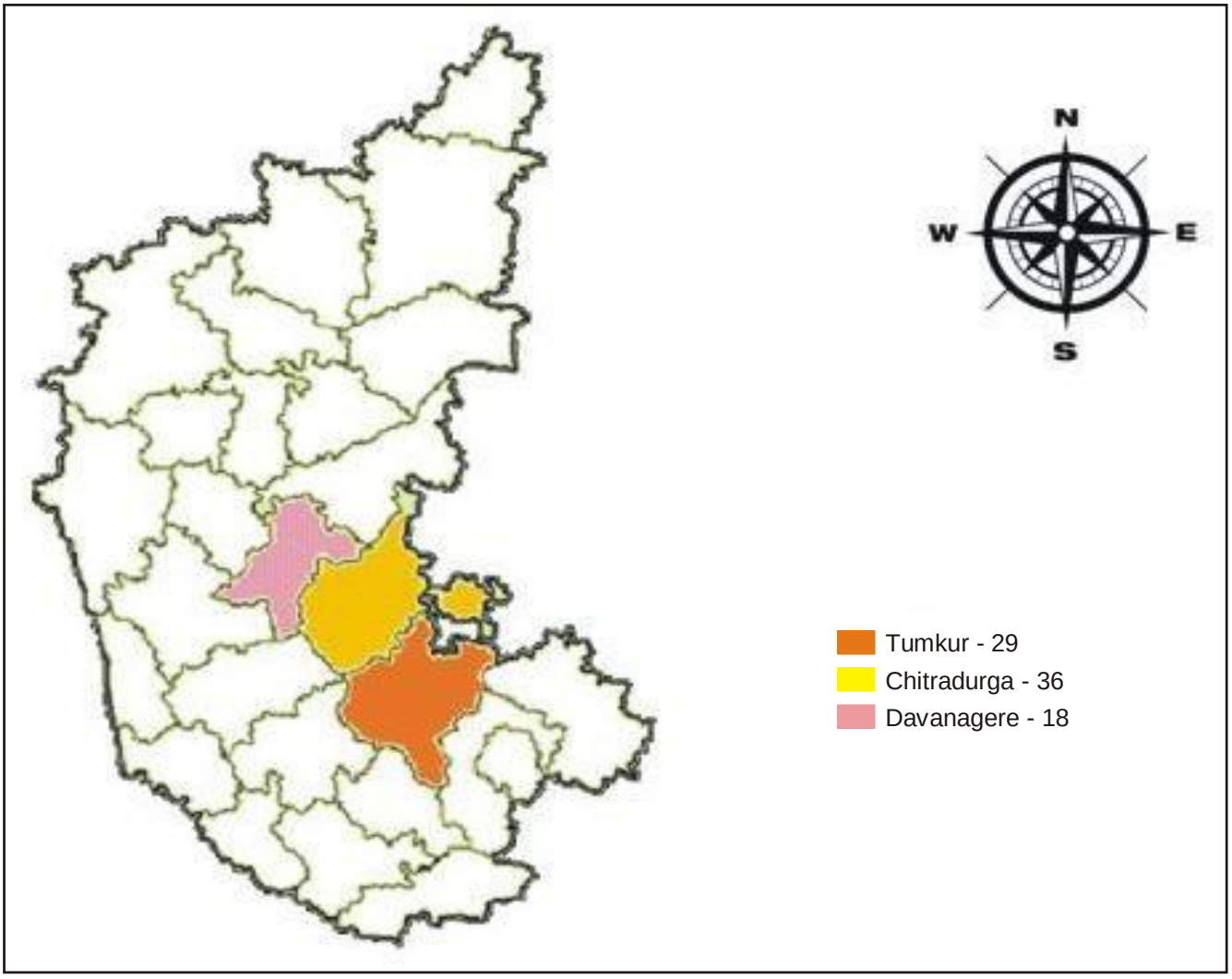
Seeds are regarded as highly effective means for transporting plant pathogens over long distances. Numerous examples exist in agriculture literature for the international spread of plant diseases as a result of the importation of seeds that were infected or contaminated with pathogens (Agarwal and Sinclair, 1996). Seed-borne diseases have been found to affect the growth and productivity of crop plants (Kubiak and Korbas, 1999; Weber *et al*., 2001; Dawson and Bateman, 2001). Aseed-borne pathogen present externally or internally or associated with the seed as a contaminant. This infected seed may cause seed rot, seed necrosis, reduction of germination and seedling damage resulting in the development of disease at later stages of plant growth (Khanzada *et al*., 2002; Bateman and Kwasna, 1999).

Minor millets can cultivate even in low fertile soil and in less rain fed areas. In central Karnataka is considered as a central dry agricultural zone (Map 1). The major production of minor millets is from this area Chitradurga, Davanagere and Tumkur districts. In India 6.83 million hectares is under cultivation and production of 0.39 million tons of minor millets (Anon, 2016).

Author for correspondence : E-mail:tstmanju88@gmail.com

The important minor millets growing in central Karnataka are, Foxtail millet *Setaria italic*, Brown top millets *Panicum ramosum*, Little millet *Panicum sumatrense*, (Fig. 1 a, b, c). These millets are suffering from a number of fungal and a couple of bacterial

Fig. 1: (a) Foxtail millet; (b) Brown top millet ; (c) Little millet.



Map : Central dry agricultural zone of Karnataka.

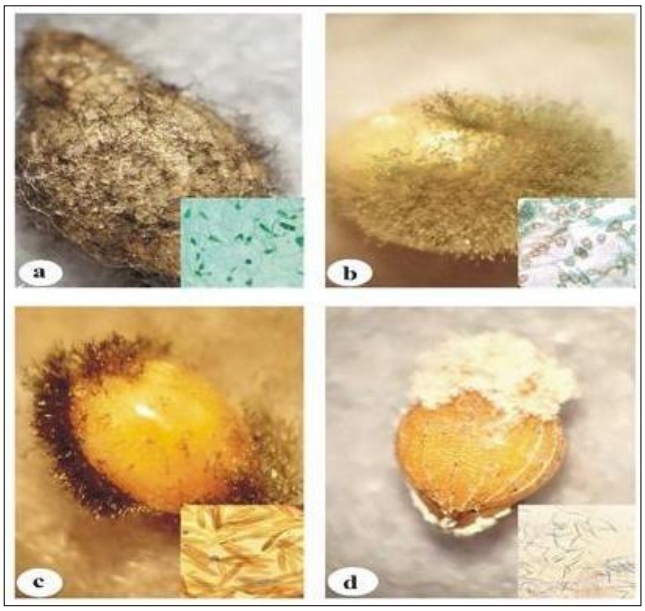


Fig. 2: a) *Alternaria alternata*; b) *Curvularia lunata;* c) *Drechslera* sp.; d) *Fusarium moniliforme*

Table 1: Details of seed collection during 2019-2020.

S. No	Name of District	Variety	Source	Number of sample collected
1	Chitradurga	Local	Field	36
2	Davanagere	Local	Field	18
3	Tumkur	Local	Field	29
Total				83

Pathogens are Seed borne and seed to seedling transmitted. The present investigation is concentrated on seed-borne fungi of minor millets on different seed health methods. Standard blotter method found superior over other Seed health methods.

Materials and Methods

Seeds collection

The millets were collected from different locations of central Karnataka during 2019-2020. A total of 83 samples were collected from standing crops of central

Table 2: Seed mycoflora of minor millets on S.B.M.

S. No	Name of the Fungi	Seed Mycoflora of Minor Millets			Total fungal colony
		a) *Setaria italica*	b) *Panicum sumatrense*	c) *Panicum ramosum*	
*	Germination %	69	54	43	166
1)	*Alternaria alternata*	14.61	26.5	33.7	74.81
2)	*Aspergillus niger*	3.2	2.8	6.0	12.0
3)	*A. flavus*	1.2	3.7	4.5	9.4
4)	*A.ochraceus*	0.9	2.6	0.7	4.6
5)	*A.versicolor*	3.6	4.3	2.2	10.1
6)	*Botryotrichum sp.*	5.0	-	7.3	12..3
7)	*Chaetomium sp.*	9.0	9.6	5.0	23.6
8)	*Cladosporium cladosporioides*	11.7	3.2	3.3	18.2
9)	*Colletotrichum sp.*	6.3	5.8	12	24.1
10)	*Curvularia lunata*	42.7	3.8	8	54.5
11)	*Drechslera sp.*	16.4	10.4	46.9	73.7
12)	*Fusarium moniliforme*	25	30.8	12	67.8
13)	*Nigrospora sp.*	9.5	-	6.5	16.0
14)	*Penicillium sp.*	5.3	6.3	7.0	18.6
15)	*Phoma sp.*	3.7	2.8	7.8	14.3
16)	*Rhizopus sp.*	3.9	0.6	3.8	8.3
17)	*Stemphylum sp.*	-	6.0	1.2	7.2
a) 38; b) 20 and c) 25, seed sample					

Karnataka, (Table 1) and were stored in cloth bags at room temperature for subsequent studies.

Dry seed examination

Inspection of dry seeds can be applied to detect seed-borne pathogens present in the seed. It may cause discoloration of seed coat or changes in the seed size and shape. Four hundred seeds were examined in a Transparent Petri-plate with the unaided eye. Seeds with mechanical damage, abnormalities, discoloration, smut balls and other fungal bodies were observed under a stereoscopic microscope and percentage recorded. Were also separated. As per 1STA rules (ISTA, 1993), these impurities are considered the inert matter

Standard blotter method

Four hundred seeds were used from each seed sample. For the Standard blotter method (ISTA, 2006). Twenty-five seeds were plated in sterilized Petriplate (9cmdia,) containing three moistened blotter discs. The seeds were plated at equidistance in the Petri- discs with the help of sterilized forceps. The plates were incubated at 28 ± 2°C for alternate periods of 12 hours light and 12 hours darkness for 7 days. And screened under a stereo-binocular microscope.

PDA Method

Four hundred seeds were placed in the Petri plates containing 20 ml of acidified PDA (Ataga and Akushi, 1996) after pretreatment of seeds with 1% sodium hypochlorite solution for 2 min the plate was kept for incubation; the mycoflora was recorded on 7th day.

Table 3: Mycoflora of *Setaria italica* in different Seed health testing method.

S. No	Name of the Fungi	S B M *	P D A**	W A**	D.F**	2 ,4,D**
*	Seed germination %	69	73	61	-	-
1	*Alternaria alternata*	4.61	6.0	4.0	3.5	9.0
2	*Aspergillus flavus*	3..2	3.6	2.7	14.0	4.8
3	*A.niger*	1.2	8.5	2.7	3.0	4.2
4	*A.ochraceus*	0.9	6.2	2.4	2.7	6.5
5	*A.versicolar*	3.6	3.7	4.2	3.7	6.0
6	*Botryotrichum sp.*	5.0	9.0	2.7	3.1	10
7	*Chaetomium sp.*	9.0	3.8	9.2	5.7	4.0
8	*Cladosporium cladosporioides*	11.7	4.0	1.4	2.5	13.7
9	*Curvularia lunata*	42 7	25	17.0	32.0	29.0
10	*Colletotrichum sp.*	6.3	4.25	4.7	5.7	8.0
11	*Drechslera sp.*	16.4	9.3	5.0	4.7	5.0
12	*Fusarium moniliforme*	35	18.0	22.0	27.0	19.7
13	*Nigrospora sp.*	9.5	12.3	0.0	6.0	10.0
14	*Penicillium sp.*	5.3	18	7.0	7.2	20.0
15	*Phoma sp.*	3.7	4.0	5.0	2.0	3.8
16	*Rhizopus sp.*	3.9	8.5	5.0	4.0	5.3
1) * 38 seed samples; 2) ** 5 seed samples						

Table 4: Mycoflora on *Panicum sumatrense* on different Seed health testing methods.

S. No	Name of the Fungi	S B M *	P D A**	W A**	D.F**	2 ,4,D**
*	Seed germination %	54	55	48	-	-
1	*Alternaria alternata*	6.5	5.2	6.7	13.5	16
2	*Aspergillus flavus*	3.7	3.1	3.0	6.2	3.8
3	*A.niger*	2.8	7.75	5	10.2	11.7
4	*A.ochraceus*	2.6	7.3	4.2	6.2	2.7
5	*A.versicolar*	4.3	8	5.0	2.7	4.6
6	*Chaetomium sp.*	9.6	12	6.2	7.2	10.2
7	*Cladosporium cladosporioides*	3.2	1.7	4.7	2.4	6.5
8	*Colletotrichum sp.*	5.8	9	11	7	3.9
9	*Curvularia lunata*	3.8	4.1	12.5	9.0	5.7
10	*Drechsler sp.*	10.4	9.3	18	19.7	8.4
11	*Penicillium sp.*	6.3	26	6.7	19.7	4.7
12	*Phoma sp.*	3.8	4.5	8.3	7	3.2
13	*Fusarium moniliforme*	33.8	8.6	7.5	11.7	6.5
14	*Rhizopus sp.*	0.6	4	15	17	13
15	*Stemphylum sp.*	6.0	2.2	0.0	1.7	11.0
1) * 20 seed samples; 2) ** 5 seed samples						

Water agar plate method

Four hundred seeds are placed in Petri plates of 2% water agar (Neergard, 1977). The Petri plates are incubated. The fungal colony growth was examined under a stereo binocular microscope on the 7th day.

Deep Freezing Method

Twenty-five seeds per plate were plated on three layers of moistened blotters (Limonard, 1968). The seeds Were incubated for one day at 22°C followed by 24 hours of freezing at -20°C. The plates were then placed for 4-5 days at 22°C± 1°C. After incubation, the growth characters, as well as percentage of infection, were recorded.

2, 4. D – Blotter method

Four hundred seeds are placed at the rate of 25 seeds per plate on moistened blotter dipped in a 0.2% solution of the sodium salt of 2.4 dichlorophenoxine acetic acids (Khare, 1996). The Petri plates were incubated at 22°C in an alternate cycle of light and dark on 7th days of incubation. The incubated seeds were screened and recorded the mycoflora

Results and Discussion

All the 83 samples were screened On S B M the expressed seed mycoflora was recorded (Table 2*) Alternaria alternata* recorded highest percentage (74.81%) on *Setaria italica* seeds from *Curvularia lunata* (54.5%) *Drechslera sp*. (73.7%) *Fusarium moniliforme* (67.8%), from Chitradurga district collected seeds.

The present investigation is in accordance with the work of Reedy, (1983); Nwanama and Paul, (1991); Kumar,(2010) they studied the isolation identification & pathogen city of seed borne fungi of some barley cultivars. Nadeema, (2014). Lower percentage of pathogenic fungi *Alternaria alternate* (4.61%) *Curvularaia lunata* (3.8%) *Drechslera sp*. (10.4%) *Fusarium moniliforme* (14%) (Fig. 2 a,b,c,d) Tumkur, Chitradurga, Davanagere districts respectively. The present study showed highest fungal incidence in central Karnataka might be due to the environmental conditions during 2019-2020.

Among the 83 samples Screened maximum percentage of pathogenic fungi was observed in S.B.M among them five seed sample showed high incidence of *Alternaria alternata, Curvularia lunata, Drechslera sp., Fusarium moniliforme* and were selected for subjected other seed health tests Viz PDA, WA, DF, 2.4-D, method

Table5: Mycoflora on *Panicum ramosum* in different Seed health testing methods.

S. No	Name of the Fungi	S B M *	P D A**	W A**	D.F**	2 ,4,D**
*	Seed germination %	43	50	54	-	-
1	*Alternaria alternata*	33.7	11.2	16.3	19	21.5
2	*Aspergillus flavus*	4.5	3.5	0.9	6	2.7
3	*A.niger*	4.5	12	2.7	9	2.5
4	*A.ochraceus*	0.8	2.5	2.0	2.5	4.2
5	*A.versicolar*	2.2	5.25	3	6.75	6.5
6	*Botryotrichum sp.*	7.3	2.4	0.0	4.5	6.9
7	*Chaetomium sp.*	5.0	4.2	0.0	5.6	6.0
8	*Cladosporium cladosporioides*	3.3	2.5	5.25	4.3	10.6
9	*Colletotrichum sp.*	12.0	7.3	5.0	9	11
10	*Curvularaia lunata*	8.0	5	3.5	4.0	3.0
11	*Drechslera sp.*	46. 9	14	18	15.0	20
12	*Fusarium moniliforme*	14	17.7	16	22.2	21
13	*Nigrospora sp.*	6.5	9	5.1	3.0	20.0
14	*Penicillium sp.*	7.0	27	14.7	8.2	5.7
15	*Phoma sp.*	7.8	6.5	1.2	6.7	6.2
16	*Rhizopus sp.*	3.8	2.5	4.1	7	27.0
17	*Stemphylum sp.*	1.2	4	3.9	6.3	8.3
1) * 25 seed samples; 2) ** 5 seed samples						

favors more incidence (Table 3,4,5) of *Alternaria alternata* in 2.4-D method *Panicum ramosum* (21.5%) from Tumkur district & also in DF method in *Setaria italica* (3.5%) in DF method *Curvularia lunata* was more in *Setaria italica* (32%) of Chitradurga district and also in 2-4 D method in *Panicum ramosum* (3%) in Davanagere district in 2-4,D method, *Drechslera* sp. (73.7%) was maximum in *Panicum ramosum* of Davanagere district and also in DF method in *Setaria italica* (4.7%) Tumkur district was more *Setaria italica*. *Panicum ramosum* (3%). Collected from in and around Tumkur district also in *Setaria italica* higher incidence in Chitradurga district, maximum seed germination. Was recorded in P.D.A. (73%) in *Setaria italic* and in PDA *Panicum sumatrense* (55%), in Panicum *ramosum* (54%).

The seed borne pathogens play a majored role in reducing seed germination up to 40% (Reedy, 1983). The current study recorded the mycoflora of minor millets & provide that these mycoflora reduce the germination, the pathogenic fungi are seed-borne & seed transmitted. The present study recorded the seed borne and seed to seedling transmission. The precautionary measure is necessary before sowing the seed samples.

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