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Health Status of Farmers' Saved Paddy, Sorghum, Sunflower and Cowpea Seeds in Karnataka, India

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Abstract: A Survey was carried in 2005 during Kharif and Rabi seasons to find out the health status of farmers' saved seeds with special emphasis on seed mycoflora. Paddy, Sorghum, Sunflower and Cowpea seed samples comprising of different verities were collected in 10 districts of Karnataka (India) from different storage structures *viz.*, Gunny bag, Polythene bag, *Kanaja,* Metal bin and Mud pot. The seed mycoflora were studied by employing Standard blotter method. While storing seeds for next year, 80% of the farmers' did not distinguish between seed and grain. The observation of these samples revealed that they were infected with 28 different genera of fungi. The prevalence of seed mycoflora varied with respect to variety, storage structure and location of the sample collected. The fungi *viz.*, *Alternaria padwickii*, *Bipolaris oryzae*, *Microdochium oryzae*, in Paddy ranged from 0-50, 2-30 and 0-10%, respectively, in Sorghum *Alternaria alternata*, *Fusarium moniliforme*, *Phoma sorghina*, *Acremonium strictum*, *Macrophomina phaseolina*, *Colletotrichum graminicola* ranged from 0-59, 0-32, 0-13, 0-12, 0-10 and 0-9%, respectively, in Sunflower *Alternaria zenniae*, *Verticillium albo-atrum*, *Fusarium equiseti*, *Botryodiplodia theobromae*, *Macrophomina phaseolina* ranged from 0-12, 0-40, 0-10, 0-30 and 0-30%, respectively and in Cowpea *Macrophomina phaseolina*, *Fusarium oxysporum* ranged from 0-23 and 3-40%, respectively. Irrespective of the sample, percentage incidence of mycoflora was highest in the sample stored in Gunny bag followed by Polythene bag, Cloth bag, *Kanaja*, Metal bin and Mud pot. This comprehensive study of seed mycoflora of farmers' saved seeds highlights the importance of seed health at farmers' level in developing countries.

Key words: Survey · farmers saved seed · storage · mycoflora

INTRODUCTION

India is a predominantly agriculture based country. In our country agriculture continues to play a dominant role and contributes about 26% Gross domestic product (GDP) [1]. Seed is considered as a basic input for agricultural development due to the fact that it ensures grain production and adds new genetic resource to the total crop gene pool. The productivity of the crop is directly linked to quality of the seed used, though management practices and supplementary inputs exert profound influences [2].

Farmers' have successfully maintained their indigenous verities over the years by keeping household seed stocks, obtaining seeds through traditional family, community network and through exchanges with nearly communities [3]. Farmers' have been using their own saved seeds for cultivation without completely knowing its properties and thus incurring losses. It is estimated that around three quarters of the worlds farmers' save seeds for sowing from harvest to harvest [4]. In India fragmented land holdings and the lack of inputs forces the farmers' to use farm saved seeds. Low productivity across the major agriculture crops is attributed to the tendency of the Indian farmers' to use farm saved seeds. At present in India only 12% of the seed used for sowing is certified and the rest is farmers' saved seed [5, 6].

Though minimum standards for seed health certification have been prescribed in India [7], farmers' are not yet aware of these standards. Use of seed with poor health status results in lower plant per unit area [8]. 11 out of 22 Rice samples collected from farmers' of Andhra Pradesh (India) were below certification standards [9]. Seed health status of farmers' saved Groundnut seed was also studied and infection of *Macrophomina* sp., *Fusarium* spp., *Aspergillus* spp. and *Penicillium* spp.

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were reported [10]. Though a lot of information by researchers has been provided on different aspects of seed quality but care taken for the maintenance and improvement of the seed quality is quite neglected especially at farmers' level [11]. Since the majority of farmers' use their own saved seeds for cultivation, there was a need to investigate the health status of farmers' saved seeds. This paper presents a brief overview of the farmers' saved seeds of Karnataka with particular emphasis to health status of Paddy (*Oryza sativa* L.), Sorghum (*Sorghum bicolor* L. Moench), Cowpea (*Vigna unguiculata* L. Walp.) and Sunflower (*Helianthus annus* L.)

MATERIALS AND METHODS

Collection of seed samples: Survey was carried out for 2005 during Kharif and Rabi seasons in 10 districts of Karnataka State (India) *viz.*, Bidar, Bijapur, Dharawad, Bellary, Shimoga, Hassan, Mandya, Kodagu, Chamarajanagara and Mysore. The leading farmers' were identified in the villages and after ascertaining seed exchange practice in areas where seed exchange is not a practice, the farmers' saved grain/seed samples (500 g) were collected. A total of hundred seed samples comprising different varieties of Paddy (Jyothi, IR 501, IR 64, Sona masoori, 1001, Jaya and BPT sona), Sorghum (CHS 5, CSH 6, Swarna and local cultivar), Sunflower (Morden, KBSH 2 and PAC 36) and Cowpea (Pusa, C-152, Barsathi and local cultivar) were collected from different storage structures *viz.,* Gunnybag, Polythene bag, Cloth bag, *Kanaja*, Metal bin and Mud pot. These seed samples were used for further evaluation.

Detection of seed mycoflora: 400 seeds of each samples were randomly picked out and were subjected to Standard blotter method as recommended by the International Seed Health Testing Association [12]. The seeds were incubated for a period of 7 days at 22°C under 12 h alternating cycle of light and darkness. After incubation fungi developed on each seed were examined under different magnifications of a stereomicroscope and were identified by observing their habit characteristics on the incubated seeds in the blotter following the key offered by different authors [13] and the percent incidence was recorded.

RESULTS

Mycoflora of paddy seed samples: The variation in number, type of fungi and their frequency of occurrence on different samples of Paddy are recorded (Table 1). *Bipolaris oryzae* was the most predominant fungus observed in all the samples tested with a range from 2-30% and *Alternaria padwickii* (0-50%), *Micrdochium oryzae* (0-10%), *Myrothecium roridum* (0-6%) observed in 85, 75 and 43.75% of samples tested respectively (Fig. 1). The prevalence of fungi varied with respect to variety, storage structure and location of the seed samples collected.

The sample collected from Mandya var. Jyothi which was stored in Gunny bag recorded high level of *Alternaria padwickii* (50%), *Bipolaris oryzae* (14%), *Myrothecium roridum* (6%) and *Microdochium oryzae* (9%). The sample collected from Chamarajanagara var. IR-64 which was stored in Gunny bag recorded *Alternaria padwickii* 35%, *Bipolaris oryzae* 15%, *Microdochium oryzae* 10% and *Fusarium oxysporum* 8%. The prevalence of mycoflora was highest in the sample stored in Gunny bag followed by Polythene bag, *Kanaja* and Metal bin. The sample obtained from Kodagu var. IR-501 stored in Metal bin recorded *Pyricularia oryzae* (2%), *Bipolaris oryzae* (7%) and *Curvularia oryzae* (20%).

Mycoflora of sorghum seed samples: Seed mycoflora of Sorghum showed variation in their composition depending on varieties, storage structure and location of the sample collected (Table 2). *Alternaria alternata* and *Fusarium moniliforme* were the most predominant pathogens observed in 75 and 93.75% of the sample tested respectively. *Acremonium strictum*, *Colletotrichum graminicola*, *Phoma sorghina* *Macrophomina phaseolina* and *Pestalosia guepini* were recorded in 62.5, 62.75, 62.5, 56.25 and 37.5% of the sample tested respectively (Figs. 1 and 2).

The local cultivars collected from Mysore and Chamarajanagar which were stored in Gunny bag recorded *A. alternata* (59 and 28%), *F. moniliforme* (32 and 14%) and *Macrophomina phaseolina* (10 and 6%) respectively. The prevalence of mycoflora was highest in the sample stored in Gunny bag followed by Polythene bag, *Kanaja* and Metal bin. The sample collected from Mysore var. swarna, which was stored in Metal bin recorded least incidence of *F. moniliforme* (1%) and *Alternaria alternata* (9%).

Mycoflora of sunflower seed samples: Percent occurrence of mycoflora and type of fungi in different varieties of Sunflower seed samples were recorded (Table 3). *A. alternata, M. phaseolina* and *V. albo-atrum* were the most predominant pathogens observed with a

Table 1: Percent occurrence of mycoflora in different seed samples of paddy

	IR-501			Jyothi			IR 64			1001		BPT SONA		Jaya		S-masoori
Mycoflora	Gb	K	Mb	K	Gb	Pb	Mb	Gb	Pb	K	K	Pb	Gb	K	Gb	Mb
Alternaria padwickii	35[a]	-	1[a]	6[a]	50[a]	-	9[a]	28[a]	8[b]	-	3[a]	2[a]	10[c]	7[a]	-	-
Bipolaris oryzae	15[b]	7[a]	7[a]	7[b]	14[b]	30[b]	3[c]	13[c]	20[a]	15[c]	2[b]	20[c]	20[a]	19[b]	6[b]	3[a]
Curvularia lunata	1[c]	-	-	10[a]	2[c]	-	-	-	-	6[a]	8[a]	-	15[d]	-	-	1[b]
Curvularia oryzae	3[a]	-	20[d]	-	-	-	-	-	8[a]	-	-	-	-	-	-	9[c]
Fusarium moniliforme	3[c]	8a	10[a]	3[b]	2[d]	10	10[d]	-	10[d]	6[c]	8[b]	4[c]	-	-	25[a]	-
Fusarium oxysporum	8[a]	-	2[b]	8[a]	-	-	9[a]	-	2[c]	-	6[c]	-	12[c]	-	6[d]	-
Microdochium oryzae	10[b]	1c	1[c]	2[c]	9[a]	2	-	7[a]	-	6[d]	-	4[d]	5[b]	3[c]	7[c]	-
Myrothecium roridum	-	-	-	2[d]	6[c]	-	-	-	-	4[a]	-	5[a]	1[a]	-	1[b]	3[d]
Nigrospora oryzae	9[d]	-	2[d]	-	-	-	4[b]	2[c]	8[a]	-	10[a]	6[b]	-	2[d]	15[a]	-
Pyricularia oryzae	-	-	2[b]	-	-	-	-	-	-	-	-	2[c]	-	1[a]	-	-
Sarocladium oryzae	7[a]	-	-	2[a]	-	-	6[a]	-	-	-	-	-	9[a]	-	-	-

Values are means from three repeated experiments with four replications and 100 seed per replication in each experiment. Means followed by the same letter in a column do not differ significantly according to Duncan's Multiple Range Test at p = 0.05, Gb-Gunny bag; Pb-Polythene bag; Mb-Metal bin; Mp-Mud pot

Table 2: Percent occurrence of Mycoflora in different seed samples of Sorghum

	CSH 5					Local cultivar						Swarna				CSH6
Mycoflora	Mb	Pb	Pb	Gb	Mb	Gb	Gb	Gb	Gb	Pb	K	K	Gb	Pb	K	K
Acremonium strictum	-	-	3[a]	11[a]	-	2[a]	6[a]	1[a]	3[a]	4[a]	7[a]	4[a]	-	-	-	12[a]
Aspergillus spp.	10[a]	14[a]	-	8[b]	-	6[c]	23[b]	4[a]	10[a]	11[a]	7[a]	9[b]	6[a]	9[a]	3[a]	-
Alternaria alternata	6[b]	4[b]	-	17[c]	8	28[a]	3[c]	9[b]	59[a]	7[a]	-	-	18[c]	-	9[a]	9[a]
Colletotrichum graminicola	-	-	-	-	9	7[b]	-	6[b]	5[ab]	9[b]	2[ab]	8[b]	3[a]	-	4[ab]	4[b]
Curvularia lunata	7[c]	6[c]	9[a]	-	-	2[b]	7[d]	-	13[c]	-	8[b]	5[c]	-	10[b]	9[b]	-
Drechslera spp.	3[d]	-	6[c]	4[c]	-	-	5[a]	-	4[a]	-	-	-	-	1c	-	2ab
Fusarium moniliforme	9[e]	9[b]	10[c]	12[d]	3	14[a]	7[c]	8[c]	32[c]	-	8[b]	10[d]	6[a]	7[c]	1[c]	9[c]
Fusarium oxysporum	7[a]	-	-	6[c]	-	7[c]	8[c]	-	12[d]	-	-	-	5[c]	-	-	6[cd]
Macrophomina phaseolina	4[b]	3[d]	10[d]	2[a]	-	6[d]	9[a]	5[d]	10[ac]	2[c]	-	-	-	-	-	-
Nigrospora oryzae	-	1[c]	-	3[b]	-	2[d]	6[b]	-	-	-	2[c]	-	-	-	-	6[a]
Pestolasia guepini	-	3[b]	-	-	-	-	-	4[a]	-	-	-	-	6[a]	-	3[d]	5[c]
Penicillium spp.	-	6[a]	-	8[c]	-	-	-	6[c]	6[b]	1[d]	-	-	10[c]	-	-	-
Phoma sorghina	-	-	8[d]	-	-	6[c]	-	7[a]	13[a]	2[d]	4[c]	4[a]	-	6[d]	4[e]	-

Values are means from three repeated experiments with four replications and 100 seed per replication in each experiment. Means followed by the same letter in a column do not differ significantly according to Duncan's Multiple Range Test at p = 0.05, Gb-Gunnybag; Pb-Polythenebag; Mb-Metalbin; Mp-Mud pot

Table 3: Percent occurrence of Mycoflora in different seed samples of Sunflower

	Morden						KBSH 2				PAC-36				
Mycoflora	Gb	Mb	Gb	Gb	Mp	Pb	Gb	Pb	Gb	Gb	Gb	Pb	Mb	Pb	Mp
Acremonium strictum	24[a]	-	-	-	-	-	10[b]	6[b]	-	40[c]	1[cd]	-	3[d]	4[d]	-
Alternaria alternata	45[a]	3a	50[b]	30[bc]	20[c]	15[d]	20[d]	23[e]	-	32[e]	40[ef]	30[f]	9[f]	20[g]	2[g]
Alternaria zinniae	-	-	3[a]	12[a]	6[a]	4[ab]	-	4[b]	-	1[b]	-	-	-	-	6[c]
Aspergillus spp.	2[a]	20a	-	-	-	-	-	-	4[b]	2[c]	-	-	-	3[c]	2[d]
Botryodiplodia theobromae	12[a]	3a	30[b]	-	-	10[c]	-	-	22[c]	-	-	-	1[d]	12[d]	1[e]
Fusarium equiseti	4[a]	3a	2[ab]	-	4[b]	-	-	-	10c	-	-	-	-	-	2[d]
Fusarium moniliforme	7[a]	-	20[a]	-	-	-	10[b]	-	2[b]	3[c]	10c	4[cd]	6[d]	7[a]	-
Fusarium oxysporum	-	-	4[a]	40[a]	3[b]	26[b]	-	-	10[c]	1[c]	20[d]	40[d]	-	-	-
Macrophomina phaseolina	16[a]	-	7[b]	-	-	16[b]	10[c]	-	8[c]	6[c]	30[cd]	6[d]	7[d]	10[e]	1[f]
Myrothicium roridum	17[a]	-	10[a]	-	-	-	6[b]	11[b]	-	4[c]	10c	-	9[d]	-	-
Penicillium spp.	5[a]	-	-	1[b]	-	1[b]	-	-	-	-	2c	10[c]	11[d]	-	-
Verticillium albo-atram	-	-	8[a]	7[ab]	4[b]	7[b]	40[bc]	-	10[d]	12[d]	1e	2[f]	-	7[g]	1[h]

Values are means from three repeated experiments with four replications and 100 seed per replication in each experiment. Means followed by the same letter in a column do not differ significantly according to Duncan's multiple range test at P = 0.05, Gb-Gunnybag; Pb-Polythenebag; Mb-Metalbin; Mp-Mud pot

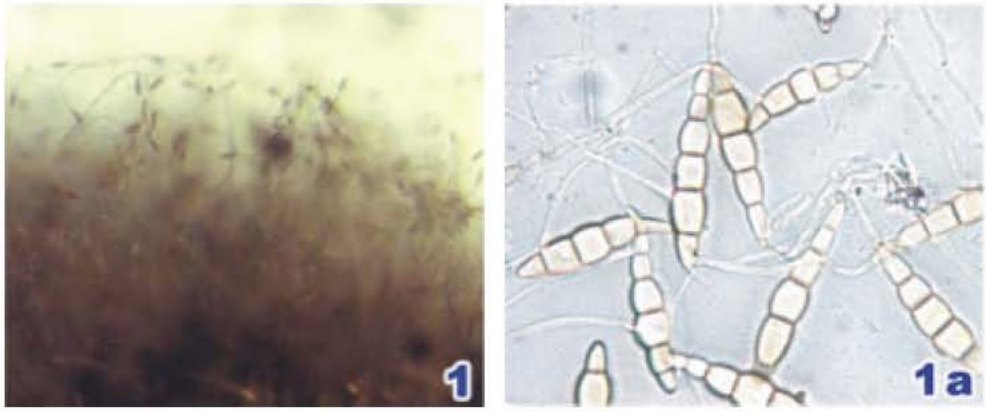

Fig. 1: 1: *Alternaria padwickii*-Habit character on Paddy seed (50×10X), 1a: Conidia of *Alternaria padwickii* (20×12.5X)

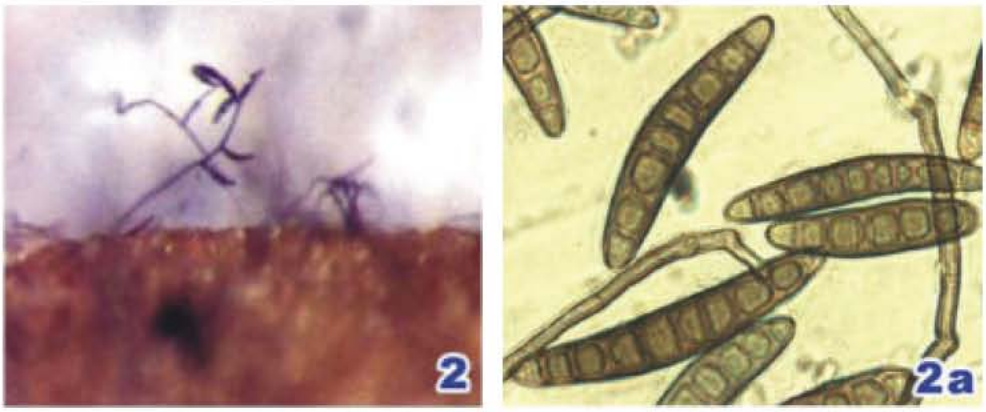

Fig. 1: 2. *Bipolaris oryzae*-Habit character on Paddy seed (25×10X), 2a. Conidia of *Bipolaris oryzae* (20×12.5X)

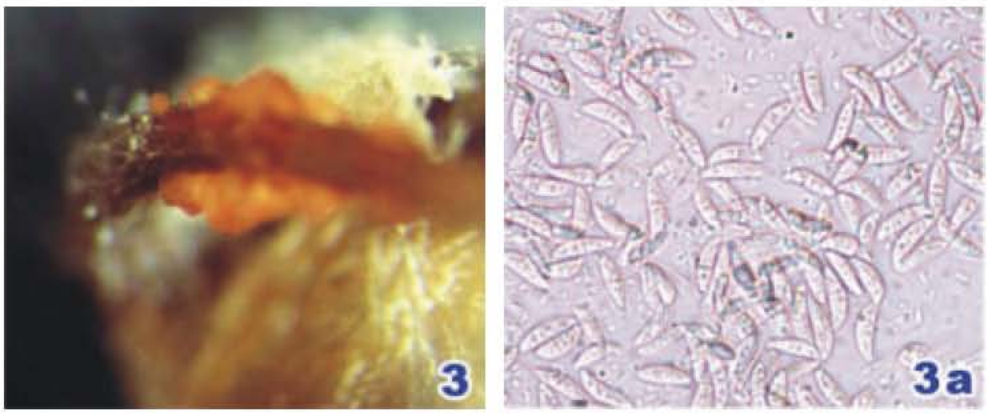

Fig. 1: 3. *Microdochium oryzae*-Habit character on Paddy seed (25×10X), 3a. Conidia of *Microdochium oryzae* (40×12.5X)

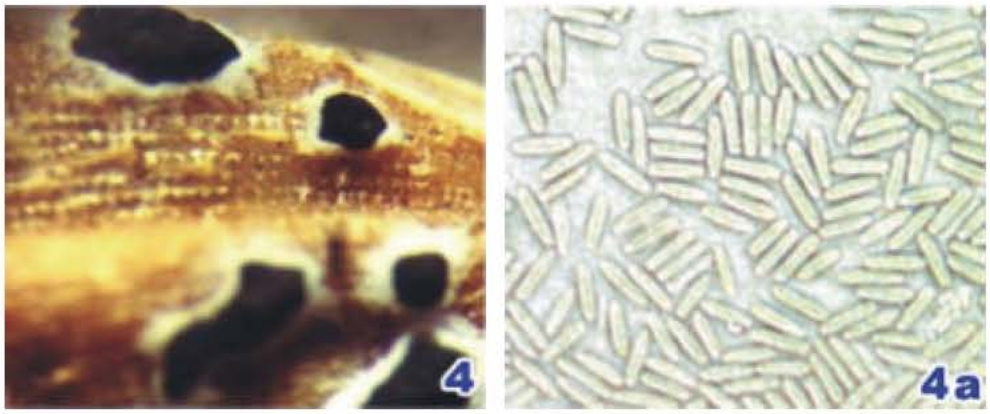

Fig. 1: 4. *Myrothecium roridum*-Habit character on Paddy seed (25×10X), 4a. Conidia of *Myrothecium roridum* (20×12.5X)

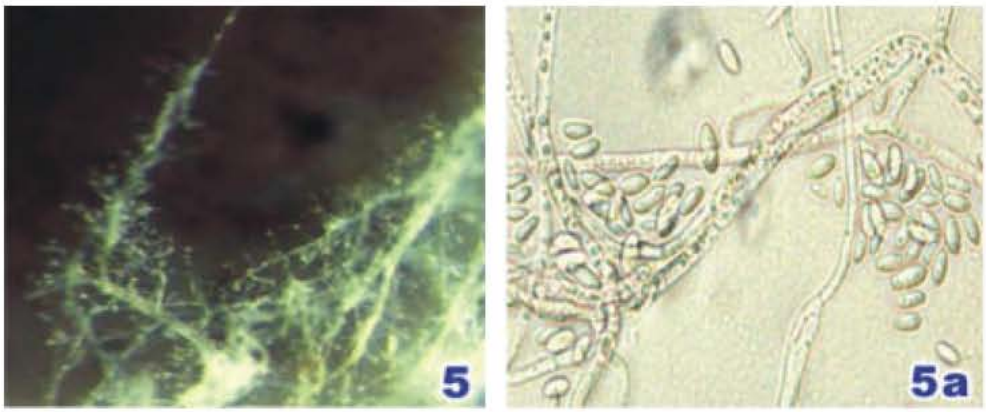

Fig. 1: 5. *Acremonium strictum*-Habit character on Sorghum seed (50×10X), 5a. Conidia of *Acremonium strictum* (40×12.5X)

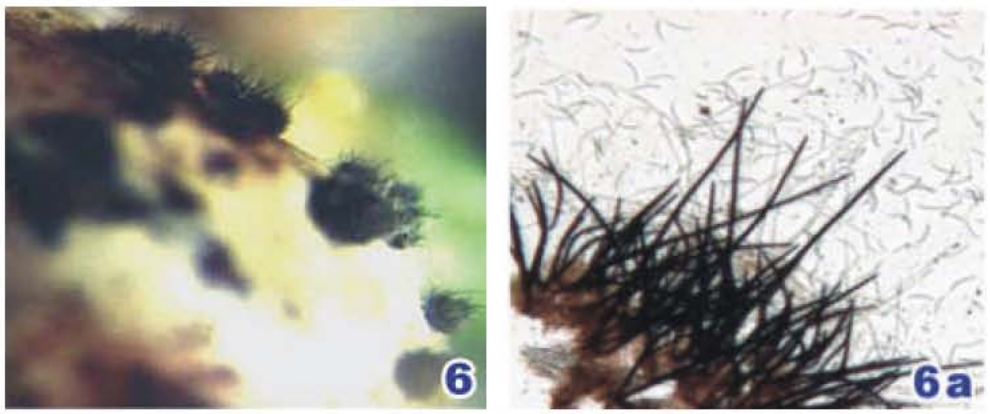

Fig. 1: 6. *Colletotrichum graminicola*-Habit character on Sorghum seed (50×10X), 6a. Conidia of *Colletotrichum graminicola* (20×12.5X)

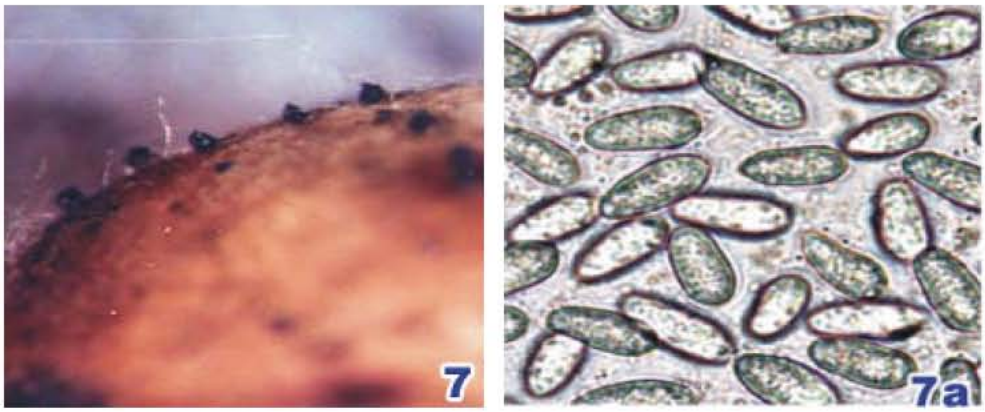

Fig. 1: 7. *Macrophomina phaseolina*-Habit character on Sorghum seed (25×10X), 7a. Conidia of *Macrophomina phaseolina* (40×12.5X)

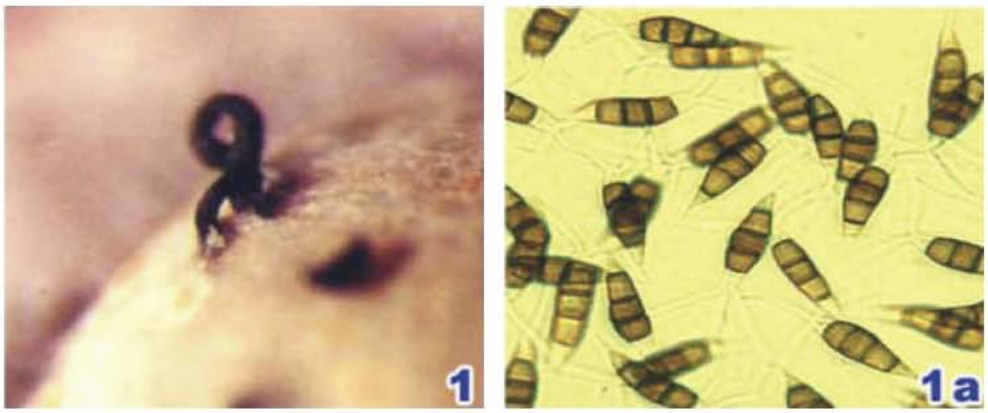

Fig. 2: 1. *Pestolasia guepini*-Habit character on Sorghum seed (25×10X), 1a. Conidia of *Pestolasia guepini* (20×12.5X)

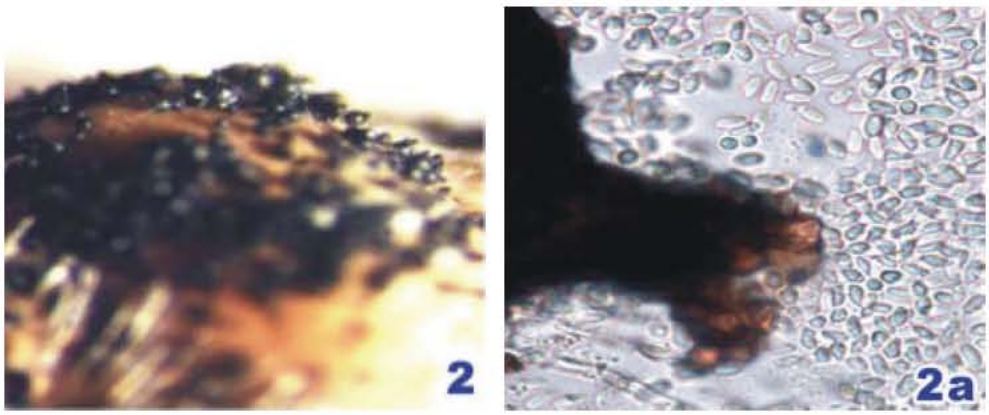

Fig. 2: 2.*Phoma sorghina*-Habit character on Sorghum seed (25×10X), 2a. Conidia of *Phoma sorghina* (40×12.5X)

Fig. 2: 3. *Alternaria zinniae*-Habit character on Sunflower seed (50×10X), 3a. Conidia of *Alternaria zinniae* (20×12.5X)

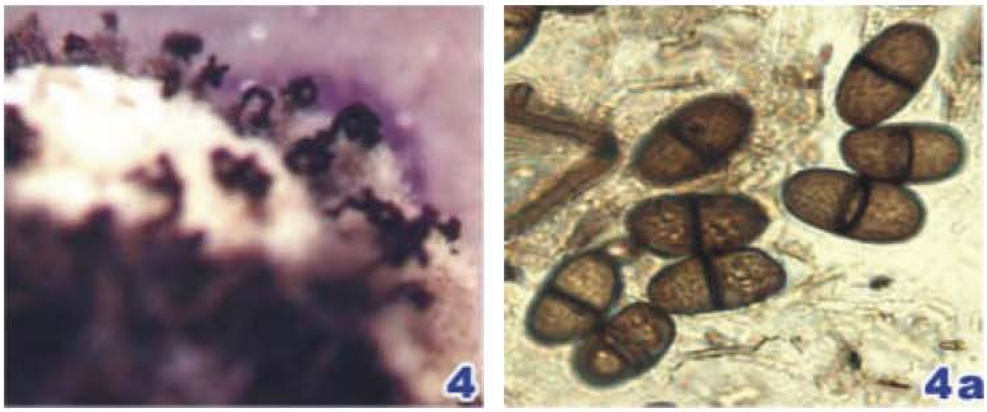

Fig. 2: 4. *Botryodiplodia theobromae*-Habit character on Sunflower seed (12×10X), 4a. Conidia of *Botryodiplodia theobromae* (20×12.5X)

Fig. 2: 5. *Fusarium equiseti*-Habit character on Sunflower seed (25×10X), 5a. Conidia of *Fusarium equiseti* (20×12.5X)

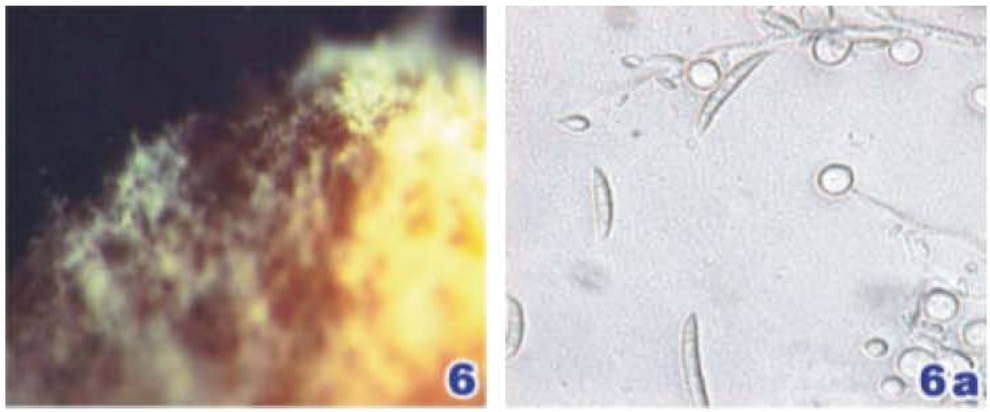

Fig. 2: 6. *Fusarium oxysporum*-**Habit character on Cowpea seed (25×10X), 6a. Conidia of** *Fusarium oxysporum* **(40×12.5X)**

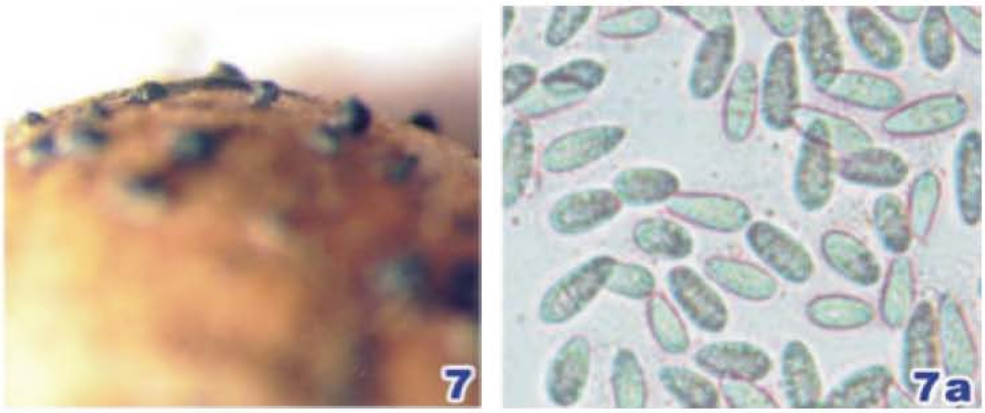

Fig. 2: 7. *Macrophomina phaseolina*-**Habit character on Cowpea seed (50×10X), 7a. Conidia of** *Macrophomina phaseolina* **(20×12.5X)**

Table 4: Percent occurrence of Mycoflora in different samples of Cowpea

	Local cultvar				Barsathi		Pusa		C-152	
Mycoflora	Cb	Mp	Pb	Pb	Cb	Cb	Mp	Mb	Pb	Mp
Ascochyta rabiei	4^{a}	-	-	9^{b}	-	-	2^{bc}	-	3^{c}	1^{d}
Alternaria alternata	20^{a}	26^{ab}	40^{b}	20^{b}	33^{c}	3^{d}	10^{d}	4^{e}	23^{e}	3^{f}
Aspergillus spp.	3^{a}	4^{b}	15^{bc}	5^{c}	5^{c}	6^{c}	9^{d}	6^{d}	6^{e}	7^{e}
Cercospora sp.	-	-	-	-	-	4^{a}	-	-	9^{b}	7^{c}
Cladosporium cladosporioides	33^{a}	13^{b}	18^{b}	23^{c}	49^{cd}	13^{d}	10^{d}	24^{e}	30^{e}	14^{f}
Colletotrichum lindemuthianum	-	12^{a}	-	-	-	7^{b}	-	9^{c}	-	11^{d}
Curvularia lunata	8^{a}	-	4^{b}	1^{b}	-	8^{c}	2^{d}	-	-	-
Fusarium moniliforme	-	4^{a}	-	-	12^{b}	-	4^{c}	-	13^{d}	6^{e}
Fusarium oxysporum	27^{a}	17^{a}	14^{b}	12^{b}	40^{c}	15^{c}	3^{cd}	23^{d}	7^{d}	3^{e}
Macrophomina phaseolina	8^{a}	4^{a}	17^{b}	-	4^{b}	23^{c}	-	3^{d}	-	4^{e}
Penicillium sp.	23^{a}	9^{b}	4^{b}	3^{c}	13^{c}	19^{cd}	8^{e}	8^{ef}	11^{f}	30^{g}

Values are means from three repeated experiments with four replications and 100 seed per replication in each experiment. Means followed by the same letter in a column do not differ significantly according to Duncan's Multiple Range Test at p = 0.05, Gb-Gunny bag; Pb-Polythene bag; Mb-Metal bin; Mp-Mud pot

range from 0-50, 0-30 and 0-40%, respectively. 66.6, 53.3 and 46.6% of the sample showed infection of *B. theobromae*, *A. zinniae* and *F. equiseti* respectively (Fig. 2). The prevalence of fungi varied with respect to variety, storage structure and location of the seed samples collected.

The sample collected from Mysore var. Morden which was stored in Gunny bag recorded *A. alternata* (45%), *B. theobromae* (12%), *M. phaseolina* (16%) and *M. roridum* (17%). The prevalence of mycoflora was highest in the sample stored in Gunny bag followed by Polythene bag, Metal bin and Mud pot. The sample collected from Mysore var. Morden that was stored in Gunny bag showed 50% of *A. alternata*, 3% of *Alternaria zinniae*, 30% of *B. theobromae* and 10% of *M. roridum*. The sample collected from Gadag var. PAC-36 that was stored in Mud pot recorded least incidence of *A. alternata* (2%), *B. theobromae* (2%) and *V. albo-atrum* (1%).

Mycoflora of cowpea seed samples: Seed mycoflora of Cowpea showed variation in their composition depending on varieties, storage structure and location of the sample collected (Table 4). Among the sample tested *A. alternata*, *Cladosporim cladosporioides*, *F. oxysporum* (Fig. 2) and *M. phaseolina* (Fig. 2) were the most predominant pathogens observed which ranged from 3-40, 10-49, 3-40 and 0-23% respectively.

The local cultivar collected from Chamarajanagar, which was stored in Cloth bag recorded *F. oxysporum* (27%), *A. alternata* (20%), *M. phaseolina* (8%) and *Penicillium* spp. (23%). The prevalence of mycoflora was highest in the sample stored in Cloth bag followed by Polythene bag, Metal bin and Mud pot. The sample obtained from Bijapur var. Barsathi which was stored in Gunny bag recorded high level of *F. oxysporum* (40%) and *A. alternata* (33%) and the sample collected from Bellary (var. pusa) and Charamarajnagar (var. C-152) recorded least incidence of *F. oxysporium* (3 and 4%, respectively) and *Ascochyta rabiei* (2 and 3% respectively).

DISCUSSION

The present study reveals that among the survey of farmers saved seeds during 2005 none of the seed samples were free from seed-borne and saprophytic fungi and were infected with 28 different kinds of fungal species. However the abundance of different fungi on seeds varied depending on the variety, storage structure and location of the sample collected. Variation in prevalence of the individual fungi with respect to variety and location is consistent with the findings of Basak and Maridha [14]. Seed mycoflora brings about quality loss in seed by reducing germination and depletion of major seed constituents, along with contamination of the substrate by Mycotoxins [15].

The observation of Paddy samples revealed that they were infected with *A. padwickii*, *B. oryzae*, *P. oryzae* and *Fusarium* spp. On Rice *A. padwickii* is known to cause pre and post emergence mortality of seedling and it is known to reduce seed germination and shoot length. Similarly seed infection by *B. oryzae* is known to cause seed rot, root rot, seedling blight [16, 17] Sorghum samples showed high level of *F. moniliforme*, *A. alternata*, *C. lunata* and *Aspergillus* spp. These pathogens causes seed rot, root rot, seedling blight, stalk rot, pre-emergence ear rot, head blight and grain mould disease in Sorghum [11] and the production of metabolites by *F. moniliforme* is known to inhibit seed germination and seed viability [18, 19]. *Fusarium* spp., *C. luanta*, *Aspergillus* spp., *A. alternata* and *Drechslera* spp. were known to reduce seed germination in Sorghum [20]. The Cowpea samples were infected with *F. oxysporum*, *M. phaseolina*, *C. lindemuthianum* and *Aspergillus* spp. Heavy seed infection of *M. phaseolina* and *Fusarium* spp. in Cowpea causes complete seed rotting, where as their partial infection lead to pre and post emergence rot, root rot and hypocotyl rot [21]. The observation of Sunflower samples revealed that they were infected with *B. theobromae*, *M. phaseolina*, *V. albo-atrum*, *A. alternata* and *A. zinniae*, *B. thoebromae*, *M. phaseolina*, *Rhizopus stolonifer* reduces both quality and quantity of the oil [22] and *A. alternata* can produce alternariols, atertoxins altenuene and tenuazonic acid [23-25].

The most significant finding was that 80% of the farmers' do not distinguish between grains and seeds during storage. Similar work has been reported by Katiyar and Vaish, [8] in wheat seeds of Haryana state (India). As per the information collected, none of the farmers' followed proper storage practices to save their seeds and farmers' save their seeds in Gunnybag, Cloth bag, Metal bin, Polythene bag, *Kanaja* and Mud pot, which was not treated with any pesticides. Deterioration of seeds due to mycoflora is well known and the storage structure is one of the factor that influence seeds during storage and impact of storage system on seed mycoflora, quality and viability of seeds also reported [26].

From the present investigation it can be concluded that Mud pot followed by *Kanaja* may be protected over Metal bin for seed storage and this investigation agrees with the data reported by Giridhar and Reddy [27]. At present only 12% of total seed used for sowing is certified and rest is farmers' saved seed [5, 6] and it has been concluded that farmers' saved seeds are generally substandard and of poor health status [8, 28]. Lack of knowledge of prescribed methods of seed production, poor storage, rough handling, lack of pretreatments etc. may seems to be the cause of poor seed quality of farmers' saved seeds [29]. Present study reveals that the farmers' saved seeds of Paddy, Sorghum, Cowpea and Sunflower were of poor health status therefore farmers' need knowledge of seed-borne pathogens, storage structure and their importance and also farmers' should be aware of difference between seed and grain. If farmers' are educated to take proper measures to keep the seed in good health, the yield can certainly further enhanced.

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