Effects of certain ITK based medicinal plant parts on seed micro flora of storage rice grains

Santosh, Th, Chhetry G.K.N

Department of Life sciences, Manipur University Canchipur, Manipur, India- 795003

Abstract- Stored grains of five varieties of rice (*Oryza sativa* L.) viz. Moirangphou khongangbi, Maipakphou, Chakkhao poireiton, RCM -9 and Daramphou were studied to investigate the effect of some plant extracts and cowdung mixed oil on the occurrence of seed-borne mycoflora using blotter technique. There were 19.73%,17.89%,13.12%,17.29% and 21.89% mycoflora found associated with the seeds of Moirangphou khongangbi, Maipak phou, Chakkhao poireiton, RCM-9 & Daram phou respectively. Ten fungal species namely *Fusarium moniliforme, Fusarium sp., Alternaria* sp.,*Helminthosporium* sp., *Curvularia* sp., *Pithomyces*, *Aspergillus* sp.,*Penicillium* sp., *Nigrospora* sp., Rhizoctonia sp were isolated from different test rice varieties. Four plant parts viz., shade dried leaves of *Zanthoxylum acanthopodium* (Rutaceae), *Melia azadarach* (Meliaceae), *Meriandra bengalensis* (Lamiaceae), powdered rhizome of *Acrorus calamus* (Acoraceae) and cowdung mixed oilcake were used to investigate their effect on seed-borne mycoflora of rice. Seed treatment with different plant materials exhibited significant effect on the occurrence of organisms.

Index Terms- Traditional rice storage, seed borne fungi, indigenous medicinal plants

I. INTRODUCTION

Rice (*Oryza sativa*) is the staple cereal crop of Northeastern India. Seed borne diseases cause enormous losses to our crops. The infected seeds fail to germinate, carry, transmit and spread diseases from seed to seedling and then to growing crop plants. The field fungi like *Alternaria*, *Cladosporium*, *Curvularia*, *Fusarium* and *Helminthosporium* invade seeds as they developed on the plants in the field as and when plants matured, but before they are harvested (Christensen and Kaufmann, 1965). These fungi usually do not continue to grow in grains after harvest, but may remain alive for years in grains stored at low moisture content and low temperature (Christensen, 1963). Farmers and traditional grain processors have been evolving number of traditional practices through trial and error methods, to avoid huge loss that are occurring in stored grain due to insects and pests. Certain practices are unique to given culture of a society and vary between countries, region, villages and even communities. Indigenous practices emanate from the cultural contact with specific traditional societies in tune with their environment. These reasons simply imply that indigenous knowledge is eco-friendly and safe to both man and his environment. Proper storage of food grains is necessary to prevent spoilage, increase keeping quality of storage grains by using natural sources for storage of various household items date back to the very earliest period of known history.

The people in the valley of Manipur, especially the Meiteis have been using various indigenous traditional knowledge for controlling the menace of diseases and pests in their field crops as well as their stored grains. Moreover, many literature suggests that small holders farming based communities possess various indigenous traditional knowledge (ITKs), affecting their crops and reveals their alternative control of pests and pathogens (Altieri, 1993; Chhetry and Belbahri, 2009; Price and Bjornsen ,2006; Sileshi et al., 2008). Also, the state Manipur in particular is inhabited by many ethnic communities each having its own traditional knowledge of conserving and utilizing natural and domesticated plant resources. Management of rice against pests and pathogens are mostly controlled through their pedigree descended traditional knowledge using available natural resources such as plant materials. Considering the used of various plant materials by the indigenous farmers in controlling the pests and pathogens of stored rice grains, their scientific evaluation is of utmost importance. Although, there is little information available on the use of various plant parts/ plant extracts effective against fungal pathogens of stored rice grains, the present study was initiated to find and recommend if possible the most effective plant (parts/extract) against various fungal pathogens associated with stored rice grains.

II. MATERIALS AND METHODS

The traditional agricultural practices of seed storage by the valley farmers of Manipur were documented and evaluated as to their effects on quality and storability of their rice seeds. Data were collected through informal interviews, prepared questionnaires and group discussions with key persons in the community. The study on storability of rice seed associated microflora was conducted in Biometric and Plant Pathology Laboratory, Manipur University. Five rice varieties viz., Moirangphou khongnangbi, Chakkhao poireiton, Maipakphou, Drum phou and RCM-9 were collected from the experimental field at Mayang Imphal, Imphal West District of Manipur. The rice grains were collected from the rice field at harvest (matured and dried) and each variety from each location packaged in a sealed envelope to avoid contamination by secondary inoculums and brought to the laboratory. Envelope containing the rice varieties were properly labeled giving information about the variety, date and place of collection. For the experiment, a traditional single bamboo mat storage structure plastered/coated with cow dung mixed mud was used. Treatment of seed storability consisted of six different storage treatments for each

variety which includes storing of rice in bamboo mat plastered with cowdung mixed oil cake. Similarly, shade dried leaves of *Melia azadarach*, *Xanthozylum acanthopodium* and *Meriandra benghalensis* Benth. @ 25g/kg of grains properly mixed with the grains and the other treatment includes mixing of rice grains with 50g of dried powered rhizome of *Acrorus calamus.* The rice grains stored in basket plastered with cow dung mixed mud serve as control. The seeds kept in different containers were stored for six months upto July 2012. Samples of seeds were drawn from each container at four different storage duration (0 day, 60days, 120 days and 180 days) from January (prior to storage) upto July.

Occurrence of seedborne microflora on seed was determined by the modified blotter method. Twenty five seeds of each cultivar selected at random were spaced on damp 9-cm Whatman No. 1 filter paper in plastic petridishes and each was replicated 3 times. The experiment was repeated 4 times. The plates were incubated in 12 hr light and 12 hr darkness at 25 ±1 C for 8 days. After 8 day incubation period, conidia and hyphae of fungi growing on the seeds were picked off each infected seed with fine sterile forceps, mounted on a slide and examined with a stereo compound microscope. Each fungus was identified on the basis of its conidia and or hyphae characteristics and frequency of isolation was tabulated using the formula,

$$\text{Percent frequency (\%)} = \frac{\text{Number of seeds on which growth of the particular fungal species is detected}}{\text{Total number of seeds examined}} \times 100$$

III. RESULT AND DISCUSSION

The fungal species isolated from the seeds of five rice cultivars treated with different plant parts and cowdung mixed oilcake are listed in table 1,2,3,4 & 5. The numbers of fungal species isolated from the treated seeds are shown in table 6. As seen from these tables, it was found that treatment profoundly affected the fungal population associated with the five types of seeds. The number of fungal species associated with the seeds was significantly reduced by these treatments during the whole storage period of 180 days. Among the different treatments, seeds treated with powdered rizhome of *Acrorus calamus* were found to be infested by minimum number of fungal species. Much higher number of fungal species could be isolated from the untreated control seeds. The percent frequencies of fungal species like *Curvularia sp*., *Helminthosporium oryzae, Fusarium moniliforme*, *Alternaria sp*., *Pithomyces sp*., etc. were differentially affected by different treatments.

Table 7.1(a),(b),(c),(d),(e) shows the total fungal infestation (% frequency) of treated and untreated seeds of the five rice cultivars. The percentage of seeds infested with fungi was greatly reduced by the treatments. The greatest reduction in overall fungal infestation was observed in seeds treated with powdered rhizome of *Acrorus calamus*. The maximum percentage of seeds infested with fungi in powdered rhizome were 22.4% in Moirangphou khongangbi, 18.4% in Maipakphou, 14.4% in Chakkhao poireition, 21.2% in RCM-9, and 26.4% in Daram phou, while that of the untreated control seeds were 41.1%, 34.4%, 29%, 41.1% & 35.8% respectively. The other treatments also reduce the fungal infestation but not as effectively as powdered rhizome of *Acrorus calamus*. Even after the 180 days of storage, the fungal populations were found to be significantly lower among the treated seeds in comparison to the untreated seeds. The use of *Acrorus calamus* was also reported by many workers and is said to be effective antifungal agent (Arora & Pandey, 1984) and also the oil extract of the said plant species worked as an effective controlling agent of *Aspergillus oryzae* cannot be ruled out (Alankararao & Rajender, 1981). The plant species (*Meriandra bengalensis, Acrorus calamus*, *Zanthozylum acanthopodium*, *Melia*, etc. used for the seed treatment are closely associated with the traditional culture of Manipur. The plants have been especially used as antiseptics and pest repellants and also its uses during rice harvesting season have been reported.

The present study reveals the effectiveness of powdered rhizome in controlling many of the seed borne microflora of stored rice grain and suggest an alternative to use of costlier chemicals and moreover being organic by default poses no harm to human subjects.

IV. TABLES

Table 1: Frequency (%) of isolation of seed borne fungal species in rice Variety Moirangphou (Local Cultivar)

Fungal species	Storage period																							
	0 days						60 days						120 days						180 days					
	Treatment						Treatment						Treatment						Treatment					
	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*
Aspergillus sp.	4	2.6	4	2.6	2.6		5.3	1.3	-	-	1.3	-	4	-	1.3	1.3	1.3	2.6	9.3	2.6	4	2.6	5.3	1.3
Helminthosporium sp.	5.3	2.6	2.6	5.3	5.3	9.3	2.6	1.3	-	1.3	-	1.3	5.3	1.3	2.6	1.3	2.6	-	1.3	2.6	1.3	2.6	4	2.6
Curvularia sp.	1.3	-	1.3	--	5.3	4	4	-	1.3	2.6	1.3	1.3	9.3	-	4	2.6	1.3	-	-	-	2.6	4	-	1.3
Pithomyces sp.	-	1.3	-	2.6	1.3	1.3	-	2.6	1.3	-	2.6	-	4	2.6	1.3	-	-	-	5.3	2.6	4	2.6	1.3	1.3
Alternaria sp.	2.6	-	4	2.6	1.3	-	2.6	-	2.6	1.3	2.6	2.6	1.3	1.3	-	1.3	2.6	1.3	2.6	4	2.6	1.3	4	2.6
Fusarium semeticum	-	2.6	-	-	-	4	9.3	1.3	2.6	-	-	1.3	4	-	-	-	1.3	2.6	4	4	-	1.3	5.3	-
Fusarium moniliforme	5.3	5.3	4	8	9.3	4	5.3	4	1.3	-	1.3	1.3	5.3	1.3	-	-	4	2.6	5.3	2.6	1.3	2.6	1.3	-
Rhizoctonia sp.	1.3	1.3	2.6	-	-	1.3	-	2.6	-	-	1.3	-	4	1.3	2.6	2.6	2.6	1.3	1.3	-	2.6	-	1.3	2.6
Nigrospora sp.	1.3	-	1.3	-	-	1.3	-	1.3	2.6	1.3	4	4	2.6	2.6	-	2.6	5.3	4	1.3	-	1.3	-	2.6	4
Penicillium sp.	-	1.3		1.3	-	-	2.6	1.3	4	-	-	1.3	1.3	-	-	-	4	1.3	-	-	-	-	1.3	1.3
Total	21.1	17	19.8	22.4	25.1	25.1	33	15.7	15.7	6.5	14.4	13.1	41.1	10.4	11.8	11.7	25	15.7	30.4	18.4	19.7	17	26.4	17

Table 2: Frequency (%) of isolation of seed borne fungal species in rice Variety Maipak phou (Local Cultivar)

Fungal species	Storage period																							
	0 days						60 days						120 days						180 days					
	Treatment						Treatment						Treatment						Treatment					
	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*
Aspergillus sp.	2.6	4	2.6	5.3	-	2.6	2.6	1.3	2.6	-	1.3	2.6	4	1.3	-	1.3	2.6	1.3	5.3	4	-	2.6	5.3	2.6
Helminthosporium sp.	5.3	-	4	5.3	4	2.6	5.3	2.6	-	2.6	2.6	1.3	5.3	-	1.3	-	2.6	1.3	4	2.6	4	1.3	2.6	-
Curvularia sp.	1.3	2.6	-	-	5.3	1.3	4	-	2.6	2.6	1.3	-	1.3	-	-	-	1.3	-	2.6	1.3	2.6	-	-	4
Pithomyces sp.	1.3	-	1.3	-	2.6	-	2.6	4	1.3	-	2.6	-	5.3	2.6	2.6	1.3	1.3	-	1.3	1.3	4	2.6	2.6	1.3
Alternaria sp.	-	2.6	2.6	4	2.6	-	4	2.6	-	1.3	1.3	2.6	4	1.3	2.6	-	-	2.6	--	2.6	2.6	1.3	1.3	-
Fusarium semeticum	5.3	9.3	-	1.3	-	2.6	1.3	2.6	-	-	-	-	4	1.3	1.3	2.6	4	1.3	2.6	-	2.6	1.3	1.3	1.3
Fusarium moniliforme	10.6	5.3	-	2.6	2.6	4	2.6	1.3	4	1.3	2.6	1.3	-	2.6	-	-	-	2.6	5.3	4	1.3	-	1.3	1.3
Rhizoctonia sp.	2.6	4	2.6	-	1.3	4	-	-	2.6	2.6	1.3	4	1.3	-	-	-	1.3	-	4	-	1.3	-	-	4
Nigrospora sp.	-	2.6	1.3	2.6	-	1.3	1.3	2.6	-	-	1.3	-	5.3	-	2.6	1.3	1.3	-	-	-	1.3	-	1.3	-
Penicillium sp.	1.3	-	-	-	1.3	-	5.3	4	1.3	-	2.6	1.3	4	1.3	2.6	2.6	-	-	1.3	--	1.3	-	-	-
Total	30.3	30.4	14.4	18.4	19.7	18.4	29	21	14.4	10.4	16.9	13.1	34.4	10.4	13	9.1	14.4	9.1	26.4	15.8	21	9.1	15.7	14.5

Table 3: Frequency (%) of isolation of seed borne fungal species in rice Variety Chakkhao Poireiton (Local Cultivar)

Fungal species	Storage period																							
	0 days						60 days						120 days						180 days					
	Treatment						Treatment						Treatment						Treatment					
	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*
Aspergillus sp.	1.3	-	5.3	1.3	-	1.3	4	1.3	1.3	-	2.6	-	5.3	1.3	-	2.6	2.6	-	5.3	2.6	1.3	1.3	9.3	-
Helminthosporium sp.	5.3	1.3	2.6	2.6	9.3	8	4	-	1.3	-	1.3	2.6	4	2.6	1.3	-	1.3	1.3	2.6	1.3	1.3	-	2.6	1.3
Curvularia sp.	1.3	-	-	-	5.3	1.3	2.6	-	2.6	1.3	1.3	-	1.3	-	-	-	1.3	-	1.3	-	2.6	1.3	2.6	1.3
Pithomyces sp.	1.3	-	1.3	-	1.3	-	1.3	-	-	-	2.6	-	2.6	-	1.3	-	--	-	1.3	2.6	-	-	1.3	-
Alternaria sp.	4	-	2.6	1.3	-	1.3	2.6	-	1.3	-	1.3	-	2.6	-	-	1.3	-	1.3	1.3	1.3	-	-	-	1.3
Fusarium semeticum	-	1.3	-	-	1.3	2.6	4	1.3	-	-	2.6	-	-	-	1.3	-	-	2.6	-	-	-	2.6	5.2	2.6
Fusarium moniliforme	10.6	2.6	1.3	5.3	-	1.3	4	2.6	-	1.3	-	1.3	4	-	2.6	-	2.6	-	9.3	1.3	-	1.3	-	2.6
Rhizoctonia sp.	1.3	-	1.3	1.3	-	2.6	2.6	-	1.3	-	1.3	-	1.3	1.3	-	1.3	-	-	-	-	2.6	1.3	1.3	1.3
Nigrospora sp.	-	2.6	-	1.3	2.6	-	1.3	4	-	-	-	-	1.3	--	2.6	-	-	-	1.3	-	1.3	-	-	-
Penicillium sp.	-	-	-	1.3	1.3	1.3	2.6	2.6	-	-	-	1.3	-		-	-	2.6	-	2.6	-	1.3	-	1.3	-
Total	25.1	7.8	14.4	14.4	21.1	19.7	29	11.8	7.8	2.6	13	5.2	22.2	5.2	9.1	5.2	10.4	5.2	25	9.1	10.4	7.8	23.6	10.4

Table 4: Frequency (%) of isolation of seed borne fungal species in rice Variety RCM - 9 (Hybrid)

Fungal species	Storage period																							
	0 days						60 days						120 days						180 days					
	Treatment						Treatment						Treatment						Treatment					
	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*
Aspergillus sp.	1.3	1.3	4	2.6	5.3	-	2.6	1.3	2.6	-	2.6	1.3	2.6	1.3	1.3	-	2.6	1.3	5.3	2.6	4	2.6	1.3	1.3
Helminthosporium sp.	1.3	1.3	2.6	4	4	-	4	-	-	-	2.6	1.3	5.3	-	1.3	-	1.3	1.3	4	-	2.6	-	2.6	2.6
Curvularia sp.	1.3	-	1.3	4	1.3	2.6	1.3	1.3	4	2.6	4	-	4	1.3	-	1.3	2.6	-	4	2.6	1.3	1.3	1.3	-
Pithomyces sp.	-	-	-	-	1.3	2.6	1.3	2.6	1.3	1.3	1.3	-	2.6	2.6	1.3	1.3	-	2.6	2.6	2.6	2.6	2.6	1.3	-
Alternaria sp.	2.6	-	-	-	2.6	1.3	-	1.3	1.3	1.3	2.6	-	-	2.6	-	2.6	1.3	1.3	-	4	-	4	-	2.6
Fusarium semeticum	4	2.6	4	5.3	-	2.6	4	2.6	-	-	-	2.6	4	-	1.3	1.3	2.6	-	9.3	2.6	2.6	1.3	2.6	1.3
Fusarium moniliforme	5.3	2.6	2.6	5.3	4	4	4	2.6	-	1.3	4	1.3	4	1.3	1.3	-	2.6	1.3	5.3	-	2.6	-	4	2.6
Rhizoctonia sp.	1.3	1.3	-	-	-	2.6	1.3	-	1.3	-	1.3	1.3	5.3	2.6	2.6	1.3	1.3	2.6	4	1.3	1.3	1.3	2.6	1.3
Nigrospora sp.	-	-	1.3	-	-	-	1.3	4	-	-	-	-	1.3	-	-	-	-	2.6	4	-	4	-	5.3	4
Penicillium sp.	1.3	-	1.3	-	-	2.6	4	1.3	1.3	-	2.6	1.3	4	-	1.3	-	1.3	-	2.6	1.3	1.3	-	1.3	-
Total	18.4	9.1	17.1	21.2	18.5	18.3	23.8	17	11.8	6.5	21	9.1	33.1	11.7	10.4	7.8	15.6	13	41.1	17	22.3	13.1	22.3	15.7

Table 5: Frequency (%) of isolation of seed borne fungal species in rice Variety Daram Phou (Hybrid)

Fungal species	Storage period																							
	0 days						60 days						120 days						180 days					
	Treatment						Treatment						Treatment						Treatment					
	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*	Control	*Zanthoxylum*	*Melia*	*Acrorus calamus*	*Cowdung mixed oil cake*	*Meriandra bengalhensis*
Aspergillus sp.	9.3	2.6	4	4	1.3	2.6	4	2.6	1.3	2.6	2.6	-	4	2.6	1.3	1.3	-	-	9.3	2.6	2.6	1.3	9.3	4
Helminthosporium sp.	12	-	2.6	5.3	12	8	5.3	4	2.6	1.3	1.3	2.6	5.3	1.3	1.3	1.3	4	2.6	2.6	-	2.6	-	2.6	2.6
Curvularia sp.	4	2.6	4	2.6	4	2.6	4	-	4	2.6	2.6	2.6	4	1.3	2.6	-	1.3	1.3	-	2.6	1.3	2.6	2.6	1.3
Pithomyces sp.	-	1.3	4	-	9.3	4	2.6	1.3	-	-	4	1.3	-	-	1.3	-	2.6	2.6	1.3	2.6	-	2.6	-	-
Alternaria sp.	4	2.6	-	4	-	-	-	2.6	4	-	-	1.3	4	4	-	2.6	4	-	4	1.3	5.3	4	5.3	4
Fusarium semeticum	2.6	-	1.3	2.6	4	2.6	4	-	-	-	2.6	1.3	5.3	2.6	2.6	-	5.3	2.6	4	-	2.6	2.6	5.3	2.6
Fusarium moniliforme	-	4	5.3	5.3	2.6	2.6	5.3	2.6	2.6	2.6	4	-	5.3	1.3	1.3	1.3	2.6	2.6	5.3	2.6	1.3	1.3	-	2.6
Rhizoctonia sp.	-	-	1.3	2.6	-	1.3	4	1.3	1.3	-	2.6	4	4	-	-	1.3	4	1.3	-	2.6	-	1.3	4	1.3
Nigrospora sp.	2.6	1.3	-	-	-	2.6	1.3	-	1.3	-	1.3	-	2.6	-	1.3	-	-	-	2.6	1.3	1.3	-	2.6	1.3
Penicillium sp.	1.3	4	-	-	1.3	1.3	1.3	2.6	-	-	1.3	1.3	1.3	-	2.6	-	1.3	-	2.6	-	2.6	1.3	-	4
Total	35.8	18.4	22.5	26.4	34.5	27.6	31.8	17	17.1	9.1	22.3	14.4	35.8	13.1	14.3	7.8	25.1	13	31.7	15.6	19.6	17	31.7	23.7

Table 6: Number of fungal species isolated from seeds of five rice cultivars treated with plant parts and cowdung mixed oilcake

Treatments	Storage periods																			
	0 days					60 days					120 days					180 days				
	C1	C2	C3	C4	C5	C1	C2	C3	C4	C5	C1	C2	C3	C4	C5	C1	C2	C3	C4	C5
Zanthoxylum	7	7	4	5	7	8	8	4	8	7	6	6	3	6	6	6	6	5	7	7
Melia	7	6	6	7	7	7	6	5	6	7	5	6	5	7	8	8	9	6	9	8
A. calamus	6	6	5	6	7	4	5	2	4	4	6	5	3	5	5	7	5	5	6	8
Cowdung +oilcake	6	7	6	6	7	7	9	7	8	9	9	7	7	8	8	9	7	7	9	7
M.bengalensis	7	7	8	7	9	7	6	3	6	7	7	5	3	7	6	8	6	6	7	9
Control	7	8	7	8	7	7	9	10	9	9	10	9	8	9	9	8	8	8	9	8

C1- Moirangphou khongangbi C2- Maipak phou
C3- Chakkhao poireiton C4- RCM- 9
C5- Daram phou

Table 7.1 (a): Effect of plant parts and cowdung mixed oilcake on fungal incidence (% frequency) on seeds of local rice cultivar – Moirangphou khongangbi

Treatment	Storage period			
	0 days	60 days	120 days	180 days
Zanthoxylum	17 (24.35)	15.7 (23.34)	10.4 (18.81)	18.4 (25.4)
Melia	19.8 (26.42)	15.7 (23.34)	11.8 (20.09)	19.7 (26.35)
Acrorus calamus	22.4 (28.25)	6.5 (14.77)	11.7 (20)	17 (24.35)
Cowdung mixed oilcake	25.1 (30.07)	14.4 (22.3)	25 (30)	26.4 (30.92)
Meriandra bengalensis	25.2 (30.13)	13.1 (21.22)	15.7 (23.34)	17 (24.35)
Control	21.2 (27.42)	33 (35.06)	41.1 (39.87)	26.4 (30.92)

Figures in parenthesis are Angular transformed values.
$CD._{05}$ (Treatment) = 5.18

Table 7.1(b): Effect of plant parts and cowdung mixed oilcake on fungal incidence (% frequency) on seeds of local rice cultivar – Maipakphou

Treatment	Storage period			
	0 days	60 days	120 days	180 days
Zanthoxylum	30.4 (33.46)	21 (27.27)	10.4 (18.81)	15.8 (23.42)
Melia	14.4 (22.3)	14.4 (22.3)	13 (21.13)	21 (27.27)
Acrorus calamus	18.4 (25.4)	10.4 (18.81)	9.1 (17.56)	9.1 (17.56)
Cowdung mixed oilcake	19.7 (26.35)	16.9 ((24.27)	14.4 (22.3)	15.7 (23.34)
Meriandra bengalensis	18.4 (25.4)	13.1 (21.22)	9.1 (17.56)	14.5 (22.38)
Control	30.3 (33.4)	29 (32.58)	34.4 (35.91)	26.4 (30.92)

Figures in parenthesis are Angular transformed values.
$CD._{05}$ (Treatment) = 3.78

Table 7.1(c): Effect of plant parts and cowdung mixed oilcake on fungal incidence(% frequency) of local rice cultivar – Chakkhao poireiton

Treatment	Storage period			
	0 days	60 days	120 days	180 days
Zanthoxylum	7.8 (16.22)	11.8 (20.09)	5.2 (13.18)	9.1 (17.56)
Melia	14.4 (22.3)	7.8 (16.22)	9.1 (17.56)	10.4 (18.81)
Acrorus calamus	14.4 (22.3)	2.6 (9.28)	5.2 (13.18)	7.8 (16.22)
Cowdung mixed oilcake	21.1 (27.35)	13 (21.13)	10.4 (18.81)	23.6 (29.06)
Meriandra bengalensis	19.7 (26.35)	5.2 (13.18)	5.2 (13.18)	10.4 (18.81)
Control	25.1 (30.07)	29 (32.58)	22.2 (28.11)	25 (30)

Figures in parenthesis are Angular transformed values.
$CD._{05}$ (Treatment) = 4.16

Table 7.1 (d): Effect of plant parts and cowdung mixed oilcake on fungal incidence (% frequency) on seeds of rice cultivar – RCM-9

Treatment	Storage period			
	0 days	60 days	120 days	180 days
Zanthoxylum	9.1 (17.56)	17 (24.35)	11.7 (20)	17 (24.35)
Melia	17.1 (24.43)	11.8 (20.09)	10.4 (18.81)	22.3 (28.18)
Acrorus calamus	21.2 (27.42)	6.5 (14.77)	7.8 (16.22)	13.1 (21.22)
Cowdung mixed oilcake	18.5 (25.47)	21 (27.27)	15.6 (23.26)	22.3 (28.18)
Meriandra bengalensis	18.3 (25.33)	9.1 (17.56)	13 (21.13)	15.7 (23.34)
Control	18.4 (25.4)	23.8 (29.2)	33.1 (35.12)	41.1 (39.87)

Figures in parenthesis are Angular transformed values.
$CD._{05}$ (Treatment) = 5.03

Table 7.1(e): Effect of plant parts and cowdung mixed oilcake on fungal incidence (% frequency) on seeds of rice cultivar – Daram phou

Treatment	Storage period			
	0 days	60 days	120 days	180 days
Zanthoxylum	18.4 (25.4)	17 (24.35)	13.1 (21.22)	15.6 (23.26)
Melia	22.5 (28.32)	17.1 (24.43)	14.3 (22.22)	19.6 (26.28)
Acrorus calamus	26.4 (30.92)	9.1 (17.56)	7.8 (16.22)	17 (24.35)
Cowdung mixed oilcake	34.5 (35.97)	22.3 (28.18)	25.1 (30.07)	31.7 (34.27)
Meriandra bengalensis	27.6 (31.69)	14.4 (22.3)	13 (21.13)	23.7 (29.13)
Control	35.8 (36.75)	31.8 (34.33)	35.8 (36.75)	31.7 (34.27)

Figures in parenthesis are Angular transformed values.
$CD._{05}$ (Treatment) = 3.30

V. CONCLUSION

It is known fact that plants contain thousands of useful biologically active compounds and antifungal compounds among them. At present, investigations are being done by various scientists working on various biologically active plant products. The paper also reveals the inhibitory effect of Acrorus calamus and others plant parts on fungal microflora. Hence, it is therefore, concluded that all the working scienticfic bodies should give more importance to the locally available plants, understand the traditional / indigenous knowledge possess by the farmers towards controlling the menace of pests and pathogens of various crop plants, using various plant parts and their products as well. It can be the alternative way of minimizing the use of costlier, harmful chemical pesticides in controlling and managing the menace of pests and pathogens of our crops.

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AUTHORS

First Author- Th. Santosh Singh, Research Scholar, Department of Life Sciences, Manipur University, Canchipur, Imphal, India. e-mail: thsantosh2013@yahoo.com
Second Author- G.K.N. Chhetry, Professor, Department of Life Sciences, Manipur University, Canchipur, Imphal, India