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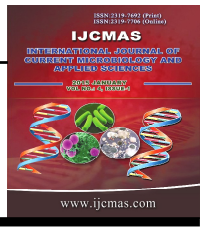

Original Research Article

Mycogenera of Stored Cereal Grains In Ogbete Main Market, Enugu State, South East Nigeria

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Keywords

Ogbete main market, cereal grains, mycogenera

A B S T R A C T

Ogbete Main Market is the largest market in Enugu State. It receives cereal grains in and around Enugu, from other states including Northern states of the federation. Business men and women trading on cereal grains are more interested in the gains they make and would care less about how to store their grains to avoid mould infestations. Only retailers see the great damage to the grains while others who buy wholesale go home most of the time with mouldy cereal grains as they would not see the bagged grains. Thus they would make losses as they go home to retail. This study looked at the type of moulds associated with Ogbete Main Market cereal grains in the central ware houses and possibly offer pieces of advice on how best to store their grains to stop their fast deterioration and defacing by moulds. The stored grains in Ogbete Main Market were collected aseptically in sterile universal bottles. The cereal grains used for the study include; yellow and white maize, white and brown beans, foreign and local rice, red and white sorghum, wheat, bambara nut and fio-fio. Sabourand dextrose agar (SDA, Lab M) supplemented with chloramphenicol was used to isolate these moulds. The pure cultures resulting from the samples were slide cultured and examined under the microscope that was linked to the computer for visual identification with standard mycological atlas. The result showed that *Aspergillus niger*, *Penicilluim* species, *Fuscirium spp*, *Aspergillus flarus*, *Rhizopus* species, *Mucor spp*, *Rhizoctoria spp*, and *Sporotricum spp* were all present in the cereal grains. However, *Aspergillus niger* yielded the highest occurrence.

Introduction

Cereal grains are major sources of food for animals and millions of humans in Nigeria. Most of these grains are not well processed and packed for storage purposes. Businessmen at Ogbete main-market, Enugu, South-East Nigeria are almost always interested in the gains they make instead of finding ways to preserve their grains. Thus most of these grains are exposed to varieties of microorganisms, rodents and insect pests. Among the microorganisms, fungal invasion is of major concern. Fungal invasion starts from the farm and when allowed to progress to

processing and storage, they could losses and eventually may result to production of mycotoxin (flatoxin) with consequent public health implications (Suleiman and Akaajime, 2011). Sources of spoilage mycogenera may be from machinenery, vehicle for transportation, handling and from the storage facilities (Siegel and Feist, 2010). It has been noted that in a situation where the cereal grains have several of mycotoxins, their effect accumulate and cause disease symptoms in the form of eye-burns, shortness of breath, chest pain, fever, dry cough etc (Rola and Prabhu, 2011). Reduction of moisture content, aeration of the storage area, constant fumigation of the central stores and use of food-grade antifungal antibiotics will reduce fungal infestation.

In view of the negative public health and economic impacts of fungi in stored cereal grains, this work looks at the isolation of mycogenera associated with stored cereal grains in Ogbete main market, Enugu, South-East Nigeria.

With the advent of agriculture in human civilization, grain consumption became prominent especially in developing countries (Lacey and Magan, 2008). Cereal grains are grown in greater quantities and provide more food energy worldwide than any other type of crop. These grains constitute a major source of energy in most households today in Nigeria. When combined with a variety of both animal and plant based foods; grains are reliable sources of cheap energy, capable of sustaining and promoting human life. Examples of cereal grains are: maize, cowpea, millet, rice and bambara nut. These grains are consumed moderately in mixed diets (Caldwell and Tuite, 2010). Fungi have been isolated from cereal grains (Alexopolous and Mims, 2011) and have been associated with the production of mycotoxins that are toxic to humans and animals (Ciegler, 2005).

Fungi invade cereal grains during storage which may have been carried from the farm. Their development is influenced by moisture content of the stored grains, the temperature of the environment, time of storage and the presence of insect pests and rodent activity on the grains. The most common storage fungi are species of *Aspergillus, Fusarium* and *Penicillium* (Daby and Caddick, 2011).

Mycotoxins produced by fungi in cereal grains pose great problems in the tropics than in the temperate regions (Magan and Olsen, 2013). Mycotoxicosis is due to the ingestion or inhation of mycotoxins produced by fungi. Whenever this occurs, the implications are wide and span from health to economic consequences (Magan and Olsen, 2013).

Materials and Methods

Sample Collection

The cereal grain samples used for the study were collected from Ogbete main market ware houses and they include brown and white beans, yellow and white maize, rice, okpa (Bambara nut), akidi, white and red sorghum. The grains were originally brought in jutes bags and jumbo polythene bags from the producers in and around Enugu and from Northern region of Nigeria. The samples were gotten by severing open the bags with sterile commercial grain collectors while sterile dried universal bottles were used to collect the grain samples. The samples were then taken to the laboratory for analysis.

Isolation of fungi from cereal grains

Sabourand Dextrose Agar (SDA) (Lab M) supplemented with chloramphenicol was

used to isolate the moulds. Each of the cereal grains was placed at the centre of the in petridishes containing SDA and incubated at room temperature (30-32^{o}C) for 5-7 days (Collins and Lyne, 1980). Pure cultures resulting from the plates were sub- cultured, and stored on slants. Slide cultures were prepared according to (Collins and Lyne 1980) and the cultures were stained with lactophenol cotton blue solution and examined under the microscope linked to the computer for appropriate photographic pictures. Standard mycological atlas was used to identify the moulds. The resulting spore heads and mycelia were compared with existing pictures in the atlas.

Result and Discussion

The identification using the atlas yielded the following: *Aspergillus niger, Penicillium* species, *Fusarium spp., Aspergillus flavus, Rhizopus spp, Mucor spp, Rhizoctoria spp and Sporotricum spp.* However, *Aspergillus niger* yielded the highest occurrence.

Table I: describes the general characteristics of the mycogenera isolated from cereal grains in Ogbete main market with *Aspergillus niger* being encountered more frequently.

Figures 1-9 show the mycelia and spore heads of mycogenera of fungi isolated from Ogbete main market ware houses.

Cereal grains are the most important stable food in Nigeria, which favour fungi contamination and mycotoxin production.
The high viable fungi count recorded in stored grains in Ogbete main market may be associated with inadequate post processing handling practices such as the open display of grains bowls and basins in the market, measurement with the aid of bare-hand, coughing and sneezing while selling and the use of non-microbiologically determined hessian bags for packaging and haulage. These may be responsible for the vast array of fungi detected and isolated (Karunakaram and Muir, 2001., Lacey, 2006, Sinha, 2011; Marfleet, *et al*., 2011).

During storage, the development of fungi, especially *Aspergillus, Fusarium* and *Penicillium* species, is an unresolved problem. They are responsible for quantitative and qualitative deterioration of cereal grains. These groups of fungi have also been variously linked with the production of various types of mycotoxins under various conditions. Exposures to mycotoxins through ingestion of contaminated grains and inhalation of this toxin have been linked to acute and chronic toxicity in animals (Alexopolous and Mims, 2011).

In Nigeria Suleiman and Akaajime (2010), have reported toxin levels far above the limits allowed by international regulation agencies in food and agricultural product. Effects such as acute liver cirrhosis, induction off tumor and other genetic effects in animals and humans are well documented. Furthermore, no single governmental or private organization has the resource in personnel, expertise, money or time to fight mycotoxin contamination. Therefore, collaboration, in projects involving multidisciplinary team is needed for effective research, documentation, monitoring, evaluation and control of mycotoxin in Nigeria. Meanwhile if the environment is clean and moisture free and the grains packaged with cellophane bags first before bagging in jute bags. These would reduce mould infestation other control methods include limiting the O_2 content or increasing the CO_2 content of the atmosphere. In Nigeria constant power outage precludes systems that involve electricity living us with use of antifungal

food grade chemicals, regular fumigation of ware houses and general cleanliness as alternatives to making the environment free from fungi and hence their deterioration.

Conclusion and Recommendations

Contamination of stored grains by various types of toxigenic fungi is a serious and a widely neglected problem. High bioload of *Aspergillus, fusarium* and *Penicillium spp.* which are well-known pathogenic storage fungi were found in almost all the stored grains examined. This is very alarming and threatening and therefore warrants renewed vigilance on the efficacies of stored cereal grains conditions, handling technique and handlers know-how.

Prevention of fungal invasion on stored cereal grains is by far the most effective method highly recommended for avoiding fungal problem in stored cereals. Integrated management program, focus on good agricultural practices, food quality from the field to the consumers, hygiene practices and safety of finished products should also be considered. In addition, strict application and implementation of quality control, quality assurance and good manufacturing practice principles will help to ensure that grains consumed by several millions of Nigerians are safe.

Table 1: Description of general mycogenera isolated in Ogbete main market

Grain	Slant	Microscopy	Organism
1. Rice	White colour	Spore head	*Aspergillus flavus*
2. White maize	Black	Non-septate	*Penicillium*
3. Brown bean	Black colour part	Non-septate and spore head	*Aspergillus niger*
4. White bean	Black part	Spore head/Non	*Mucor*
5. Red fio fio	White colour	Spore head nonseptate	*Rhyzopus*
6. Okpa (bambara nut)	Gray colour part	Non-septate Spore head	*Aspergillus niger*
7. Foreign rice	White colour Green colour	Spore head/non-septate	*Mucor*
8. Millet	Brown colour Black colour	Spore head/non-septate non-septate	*Aspergillus niger*
9. Akidi (black bean)	Brown part	Spore head	*Fusarium*
10. Wheat	Black part	Spore head/non-septate	*Aspergillus niger*
11. Yellow maize	Black part	Spore head/non-septate	*Penicillium*
12.White fio fio	Black part	Spore head/non-septate	*Sporotrichum*
13.Red sorghum	Brown part	Spore head and non-septate	*Rhyzopus*
14.White sorghum	Gray part	Spore head and non septate	*Rhyzoctonia*

Figure 1: Sporehead of *Aspergillus flavus* isolated from rice (Microscopic characteristics: Non-Branched condiospore with bulb end carries conidia. Macroscopic characteristics: pin like green growth).

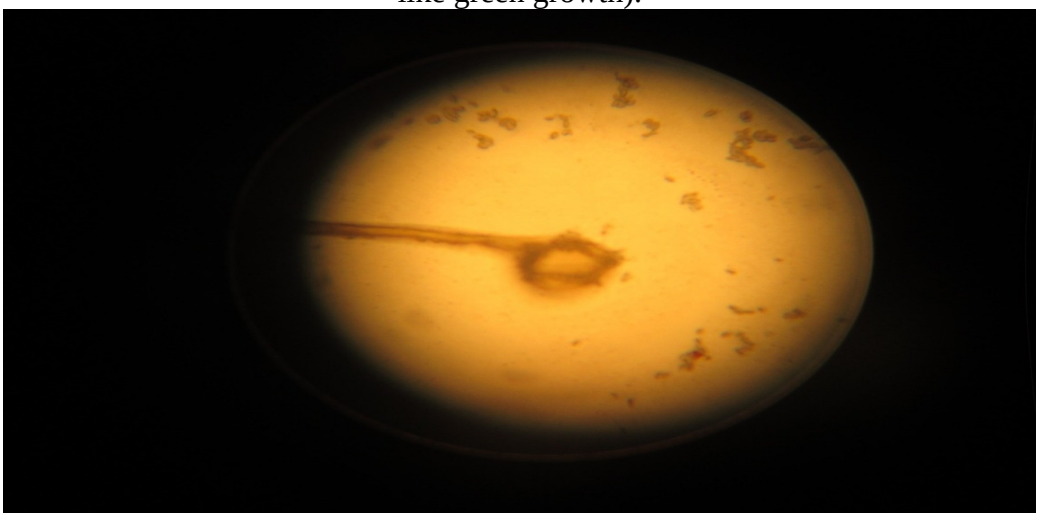


Figure 2: Sporehead of *Penicillium* spp. from white maize (Microscopic characteristics: Brush-like conidiospore carries conidia. Macroscopic characteristics: Colour-green or green-greyish colour and colonies grows over fruits especially citrus).

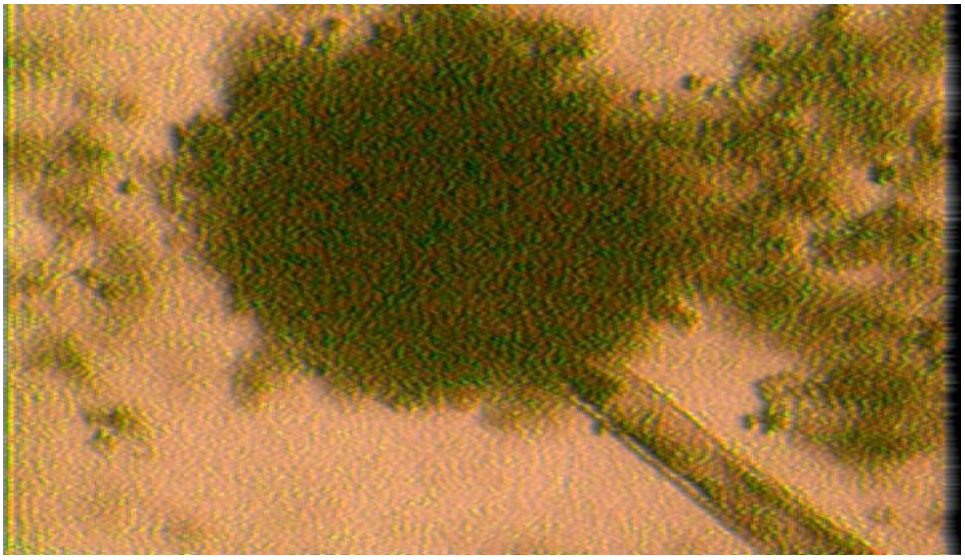


Figure 3: Sporehead of *Aspergillus niger* isolated from brown bean (Microscopic characteristic: Non-Branched conidiospore with bulb end carriesconidia like sun rays. Macroscopic characteristics: pin like black growth).

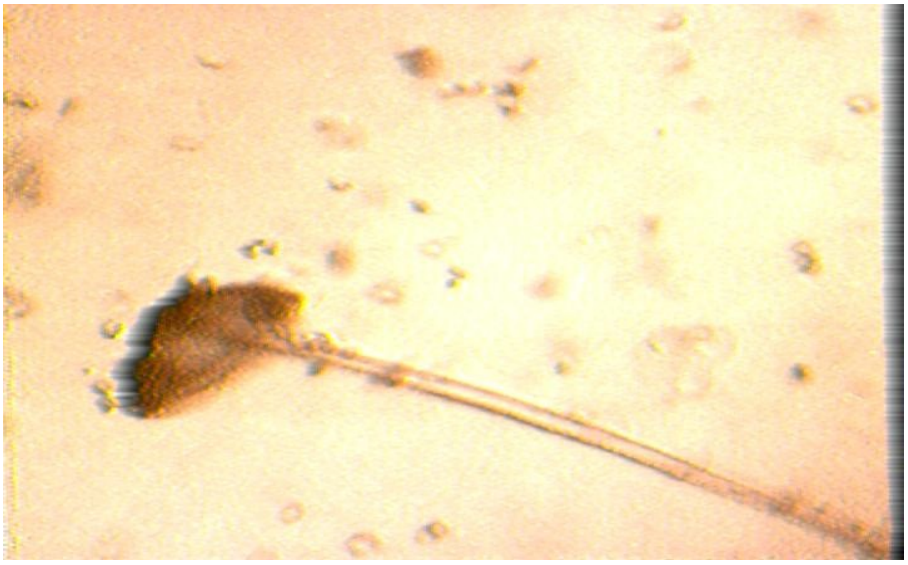


Figure 4: Sporehead and mycelia of *Rhyzopus* spp. isolated from fio-fio (Microscopic characteristic: contain spores and cotton like growth spotted with black colour)

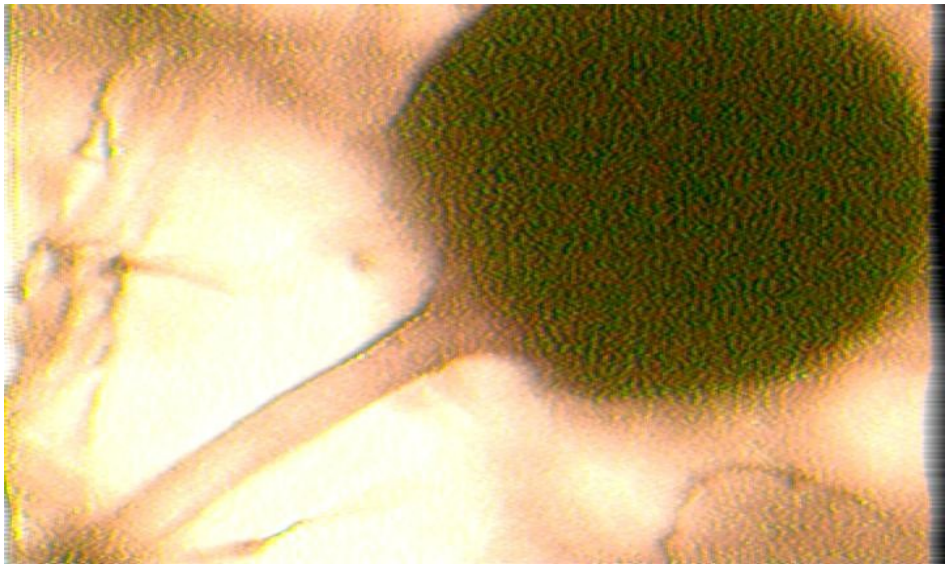


Figure 5: Sporehead and mycelia of *Aspergillus niger* isolated from Okpa (Microscopic characteristic: Non Branched with bulb end carries conidia like sun rays. Macroscopic characteristic: Pin like black growth).

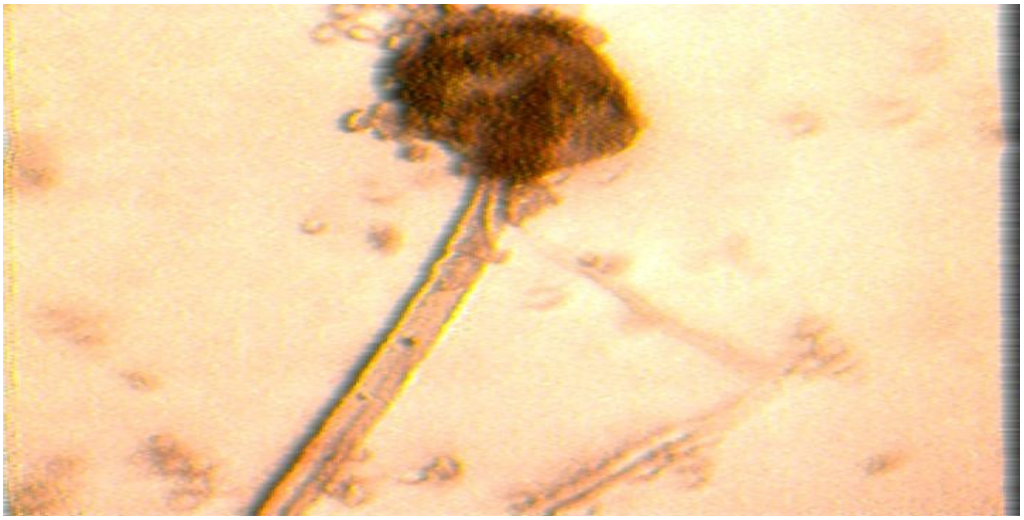


Figure 6: Sporehead and mycelia of *Mucor* spp. isolated from foreign rice (Microscopic characteristic: Contain spores, do not have rhizoids, cotton like white spotted with black colour).

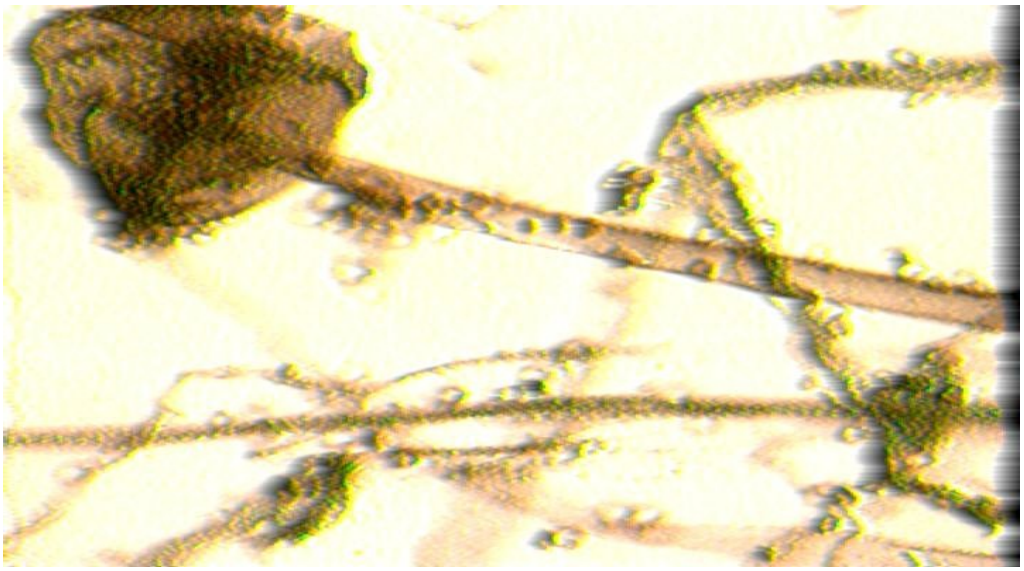


Figure 7: Sporehead and mycelia of *Fusarium* spp. isolated from Akidi (black bean). (Microscopic characteristic: spindle-like conidia, multi-cellular. Macroscopic characteristics: Colonies appear brown or pink in center and with white edges).

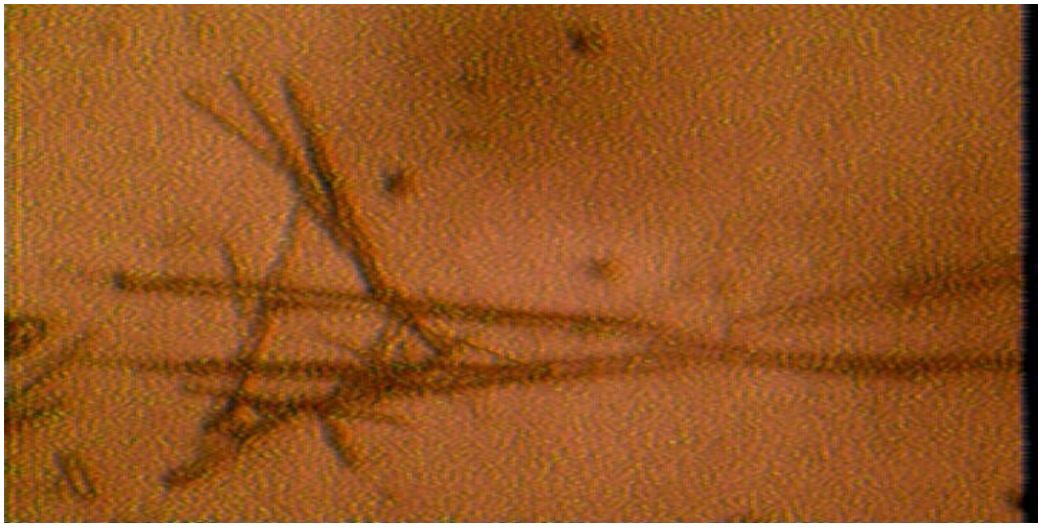


Figure 8: Sporehead of *Rhyzopus* spp. isolated from red sorghum (Microscopic characteristic: contain spores and cotton like growth spotted with black colour).

Figure 9: Mycelia of *Rhizoctonia* spp. isolated from white sorghum.

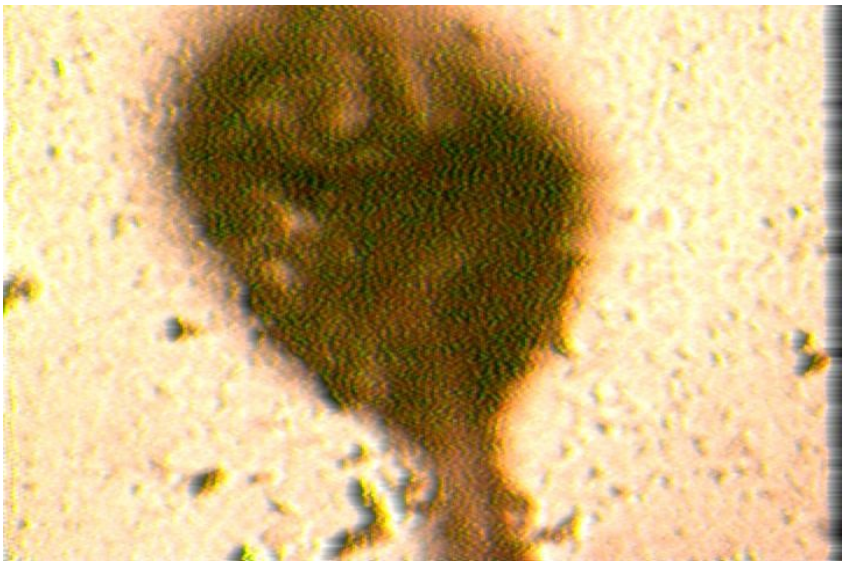
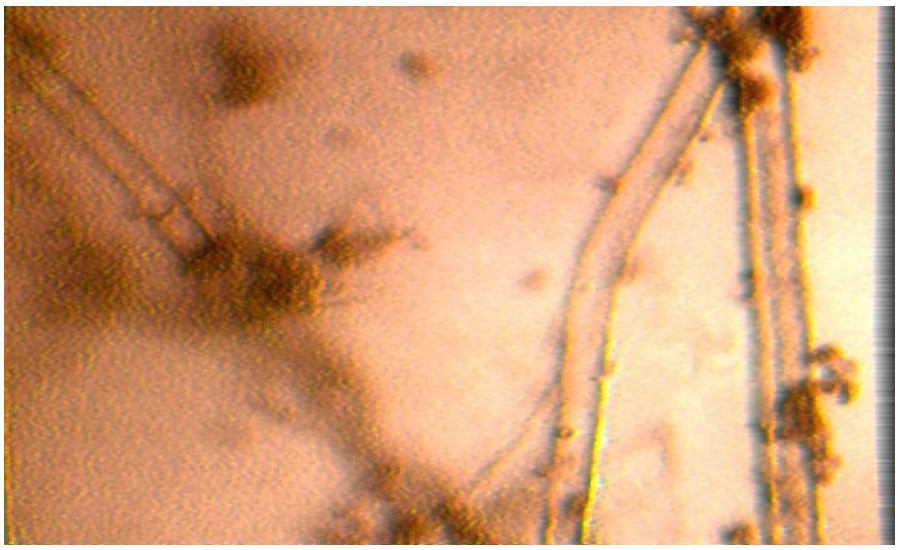


Figure 9: Mycelia of Rhizoctonia spp. isolated from white sorghum.



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