

Checklist of Ascomycetous Fungi Isolated from Soil Samples in Gwagwalada Area Council, Abuja

Oyedeki, Funmilayo Nike

Department of Biology, Federal Capital Territory College of Education, P.M.B. 61, Abuja, Nigeria
Email: deleijgbade@yahoo.com

Abstract: Twenty-five soil samples were collected from five areas in Gwagwalada FCT-Abuja and screened for the presence of ascomycetous fungi using spread plate method. A total of 8 isolates belonged to six genera and eight species of ascomycetous fungi were isolated. The predominant *Ascomycetous* fungi isolated include; *Aspergillus niger*, *Fusarium solani*, *Penicillium chrysogenum*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Cladosporium resinae*, *Mucor mucedo*, *Rhizopus stolonifer*. Maximum number (42/55, 76.36 %) of ascomycetous fungi was recovered from refuse dump, farm land and animal shed soils, barber's shop and drainage site' having 23.64 %. *Aspergillus niger* was the most prevalent species and represented 10 (18.18 %) of the total number of isolated fungi. *Rhizopus stolonifer* was next with 9 (16.36 %) *Penicillium Chrysogenum* (Thom) and *Mucor mucedo* have the same number of occurrence 7 (12.73 %), *Aspergillus flavus* (Link ex Fr.) and *Aspergillus fumigates* also have equal isolation rate of 6 (10.91 %), while *Cladosporium resinae* have 4 (7.27 %) being the least prevalent. The physicochemical characteristics of soil samples were found to affect the distribution and population of the isolated fungi. The rate of isolation of the isolated ascomycetous fungi test were tested at $p = 0.05$ level of significant.

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1. Introduction

Soil contains a vast array of microorganisms such as bacteria, viruses, fungi, actinomycetes, protozoa and algae (Alexander, 1997; Beare, 1997; Olowonibi, 2003). Soil organism participates in the genesis of the habitat, which they live. They, together with the total biota and especially the higher vegetation, constitute one of the five interactive factors in soil formation; the other four are climate, topography, parent material, and time (Beare, 1997). The physical and chemical breakdown of rocks to fine particles with large surface areas and the accompanying release of plant materials initiate the soil forming process (Alexander, 1977; Beare, 1997; Olowonibi, 2003; Paul and Clerk, 1996). Two major nutrients that are deficient in the early stages of the process are carbon and nitrogen therefore, the initial colonizer of soil parent material are often organisms capable of enhancing photosynthesis and nitrogen fixation. These are predominantly the cyanobacteria, also known as the blue green algae (Sylvia *et al.*, 1997). After higher vegetation has become established, a continuum of soil processes produces the dynamic mixture of living and dead cells, soil organic matter (SOM), and mineral particles in sufficiently small sizes to permit the intimate colloidal interaction characteristic of soil (Lambart *et al.*, 1979; Andrew *et al.*, 2008). The Ascomycetes (Sub-division *Ascomycotina*) constitute the largest class of fungi, the number of known species being approximately 32,000. There is considerable diversity of form and

structure among the *Ascomycetes*. At one end of the scale are the truffles and morels (Adams *et al.*, 1999). The ascus is a walled receptacle enclosing the spores and usually rupturing at the physical and nutritional factors where a pronounced affect on sporulation of fungi occur. Temperature, light, hydrogen ion concentration, aeration and humidity are some of the important physical factors. Factors such as source of Carbon, Nitrogen, Vitamins and trace elements also determine the rate of spore development under natural (soil) conditions (Ivan *et al.*, 2008; Michael and Donald, 1996). The aim of this study was to checklist the ascomycetous fungi from soil samples in Gwagwalada Area Council.

2. Materials And Methods

2.1 Study Area

This research work was carried out at the Laboratory of the department of Biology, School of Sciences, Federal Capital Territory College of Education, Zuba-Gwagwalada, Abuja, Nigeria.

2.2 Samples Collection

A total of twenty-five (25) soil samples were collected randomly from five (5) different sites in Gwagwalada FCT-Abuja. Five samples each were collected from each location. Samples were collected from fertile land, animal shed, refuse arena, sewage arena and Barber's shop (Alexander, 1997; Beare, 1997; Olowonibi, 2003; Paul and Clerk, 1996). At each location, 20 g of soil were collected from the superficial layer, at a depth of 10 cm. Soil samples

were collected in the sterile polythene bags and brought to the Laboratory of the department of Biology School of Sciences Federal Capital Territory College of Education, Zuba-Gwagwalada, Abuja, Nigeria, for the isolation and identification of ascomycetous fungi from the soil samples using the method of Olowonihi (2003) with some modifications.

2.3 Physico-Chemical Analysis

2.3.1 Soil Water Holding Capacity Determination

Soil sample which has been dried in the oven at 105 °C for 24 hours were used for the water holding capacity determination according to the method of Pramer and Schmidt (1964) thus, about 5 gm of the dried soil was placed on Whitman filter paper which was placed on a 250 Erlenmeyer flask and 20 ml of water was added, then the time taken for all the water to move down to the flask was taken and used to determined the water holding capacity.

2.3.2 Soil Moisture Content Determination

The method used for this determination was that of Pramer and Schmidt (1964). % organic matter (humus) in sample = weight of humus x 100/Weight of dry soil taken.

2.3.3 Soil pH Determination

About 20g of air-dried sieved soil into a 100ml beaker and 20ml of sterile distilled water were added. The suspensions were left to stand for 30 minutes with occasional stirring to enhance equilibrium reaction. The pH of the suspension were taken by inserting the glass hydrogen (H⁺) electrode of the pH meter (Pye Unicam, model 292mk² pH meter) into the partly settled suspension (Alexander, 1997).

2.3.4 Preparation and sterilization of media

Potato Dextrose Agar was use in this study and prepared according to the manufacturer's instructions thus, 39g of PDA were dissolved in 1000ml of sterile water and then sterilized (autoclaved) at 121°C and pressure of 15Pa for 15 minutes. Potato Dextrose agar were use for the isolation and maintenance of pure cultures of the ascomycetous fungi (Olowonihi, 2003; Pramer and Schmidt, 1964; Sylvia *et al.*, 1994).

2.3.5 Isolation of Ascomycetous fungi

The fungi were isolated from soil using the spread plate technique (Olowonihi, 2003). One gram (1 g) of soil samples were dissolved in 10 ml sterilized distilled water. The soil suspensions were diluted up to 10⁵. The samples were inoculated on already prepared Potato dextrose agar plates. The inoculated plates were incubated at ambient temperature (25 ± 2°C) for 5 days. Colony developments were observed after incubation period.

2.3.6 Preparation of pure cultures of fungal isolates

The young fungal colonies were aseptically picked up and transferred to fresh sterile PDA plates to obtain pure cultures.

2.3.7 Identification of Ascomycetous fungal isolates

Isolates obtained were characterized and identified on the basis of their colonial and morphological characteristics which include macroscopic and microscopic examinations. Among the characteristics used were colonial characteristics such as size, surface appearance, texture, reverse and pigmentation of the colonies (Sharma and Rajak 2003). In addition, microscopy revealed vegetative mycelium including presence or absence of cross-walls, diameter of hyphae, and types of asexual and sexual reproductive structures (Alexander, 1997; Beare, 1997; Olowonihi, 2003; Paul and Clerk, 1996). Slide culture method that minimized serious distortion of sporing structures was used. Appropriate references were then made using mycological identification keys and taxonomic description (Samson and Reenen-Hoekstra, 1988).

2.3.8 Statistical Analysis

Isolated fungi were statistically analyzed and the test applied was F-test statistic at p= 0.05 level of significant.

3. Results

3.1 Physico-Chemical Characteristics of Experimental Soil Samples

The results of the physico-chemical characteristics of the soil samples which include; water holding capacities, moisture contents, organic matter contents, and pH values revealed that drainage site soil had the highest water holding capacity of 0.43ml/g, while animal shed soil had the lowest with 0.3ml/g. The range value was 0.13ml/g. This finding could possibly be correlated to the sandy content in the soil sample from animal shed and the clay content in the soil sample in drainage site. Refuse dump soil had the highest moisture content of 1.56%, while the least value of moisture content obtained goes to animal shed soil with 0.12%. In the case of organic matter contents, refuse dump soil had the highest with 4.30% and the lowest value goes to barber's shop soil with 2.63%. Based on the pH values of the sampled soil, it was found that refuse dump soil was acidic with a pH value of 5.7 while farm land soil recorded a high pH value of 7.4 indicating that the soil was alkaline. This range of pH values affected the type of fungi found in the different soil samples as shown in Figure 1.

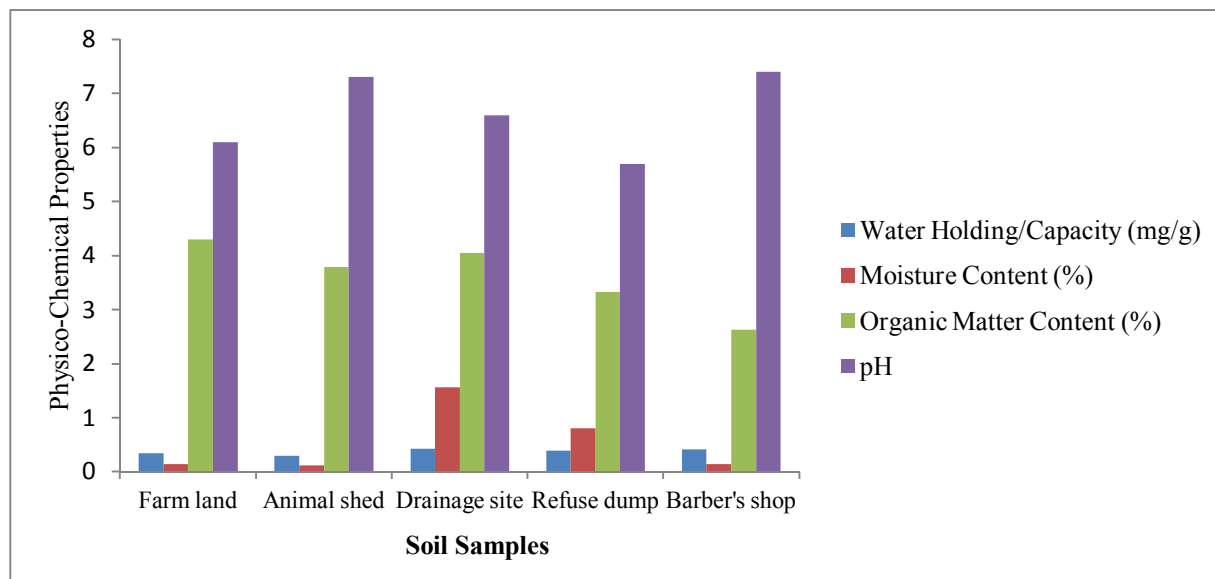


Figure 1: Physico-chemical characteristics of experimental soil samples

3.2 Checklist of Ascomycetous Fungi

Isolation rate of ascomycetous fungi from five soil samples in Gwagwalada FCT-Abuja shows that *Aspergillus niger* was the highest and higher in soil samples collected from the refuse dump and farm lands as shown in Table 1. Among the filamentous fungi isolated from soil samples at Gwagwalada, eight (8) species belonging to six (6) genera (*Aspergillus*, *Penicillium*, *Cladosporium*, *Fusarium*, *Rhizopus*, and *Mucor*) of ascomycetes were identified

on the basis of their colonial and morphological characteristics which include macroscopic and microscopic examinations. Among the characteristics used were colonial characteristics such as size, surface appearance, texture, reverse and pigmentation of the colonies. In addition, microscopy revealed vegetative mycelium including presence or absence of cross-walls, diameter of hyphae, and types of asexual and sexual reproductive structures.

Table 1: Checklist of ascomycetous fungi isolated from soil sample in Gwagwalada FCT-Abuja

Ascomycetous fungi	Isolation rate, Number (%)					
	F.L (n=5)	A.S (n=5)	B.S (n=5)	D.S (n=5)	R.D (n=5)	Total (n=25)
<i>Aspergillus fumigates</i>	2(40)	1(20)	0(0)	1(20)	2(40)	6(10.91)
<i>Aspergillus niger</i>	3(60)	1(20)	2(40)	1(20)	3(60)	10(18.18)
<i>Aspergillus flavus</i>	2(40)	1(20)	0(0)	1(20)	2(40)	6(10.91)
<i>Penicillium chrysogenum</i>	3(60)	0(0)	0(0)	2(40)	2(40)	7(12.73)
<i>Cladosporium resinae</i>	0(0)	2(40)	0(0)	0(0)	2(20)	4(7.27)
<i>Rhizopus stolonifer</i>	2(40)	3(60)	1(20)	0(0)	3(60)	9(16.36)
<i>Mucor mucedo</i>	1(20)	1(20)	3(60)	0(0)	2(40)	7(12.73)
<i>Fusarium solanii</i>	0(0)	2(40)	1(20)	1(20)	2(40)	6(10.91)
Total	13(23.64)	11(20.00)	7(12.73)	6(10.90)	18(32.73)	55(100)

Keys: F.L=Farm land, A.S=Animal shed, B.S=Barber’s shop, D.S=Drainage site, R.D=Refuse dump and n=number of soil sample. Isolation Rate, Number (%)

4. Discussions

Among the filamentous fungi isolated from soil samples in Gwagwalada, *Aspergillus niger* is the most prevalent ascomycetous fungus and also dominant species that was isolated from 10 (18.18%) soil samples of the five different regions, followed by *Rhizopus stolonifer* 9(16.36%), *Penicillium Chrysogenum* and *Mucor mucedo* have the same number of occurrence 7 (12.73 %), *Aspergillus flavus* and *Aspergillus fumigates* also have equal isolation rate of 6 (10.91 %), while *Cladosporium resinae* have 4 (7.27 %) being the least prevalent. This also agrees with Olowonibi (2003) who reported similar result in the study of distribution of fungi in the five soil series. It is of interest to note that most of the ascomycetous fungi obtained in this study correlated with the physico-chemical characteristics of the soil from where they were isolated. Domesch *et al.* (1980) reported the compendium of soil fungi from various soils which show that *Aspergillus niger* was the most frequently isolated. The soil moisture has a direct effect on the population of fungi positively hence, at higher moisture, the tolerance and colonization by fungi is badly affected (Sylvia *et al.*, 1997). Excessive moisture leads to inadequate oxygen diffusion. In this study, refuse dump soil has relatively high moisture content and consequently the fungal was high which also agree with the reported made by Michael and Donald (1996) on soil analysis. However, drainage site soil (10.90%) had the highest moisture content of 1.56% but the fungal plate count was lower compared with refuse dump soil (32.73). This finding could possibly be correlated with moisture excessiveness leading to inadequate oxygen diffusion thereby affecting fungal colonization. Fungi as a group will tolerate a wide pH range, but some fungi are more tolerant to acidic soils. As compared to bacteria they can tolerate a wide range of pH 4-8 (Ketchum, 1988) which also correlates with the findings in this study. As indicated in this study, refuse dump soil which was acidic (pH 6.1) has the highest fungal isolates (Figure 1). The high alkaline condition existing in animal shed soil and barber's shop soil could possibly be responsible for the low occurrence of *Penicillium spp* which is in consonance with the work done by Ketchum, (1988) who reported that any unfavourable alkaline soil often inhibits the development of *Penicillium spp*. The results presented in this study indicated that refuse dump had the highest organic matter content of 4.30%, hence has very high fungal isolates. Alexander (1997) reported that humus (organic matter) rich soils have large fungal population than soil poor in humus. It can also be deduced from this study that the organic matter contents of the soil which is the main source of

utilisable substrates for the fungi plays a significant role as high number of the fungal species were recovered from refuse dump, farm land and animal shed respectively as shown in Table 1. This finding is in consonance with the work done by Andrew *et al.* (2008). There are basic groups of fungi encountered in this study which have been obtained by previous workers, in other parts of the world.

5. Conclusion

Aspergillus spp. (especially *Aspergillus niger*) was found to be frequently isolated. This could possibly be due to the fact that *Aspergillus niger* is a common contaminant on various substrates while others include *Fusarium spp*, *Penicillium spp*, *Mucor spp* *Cladosporium* and *Rhizopus spp*. Their common occurrence could also be due to their high sporulating nature and this is also coupled with their ability to grow well on laboratory media.

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