Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.5, 2015

Evaluating Some Growth Media for the Cultivation of Fungal Cultures

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Abstract
An evaluation was carried out on some mineral and vegetable oils and growth media for the preservation of fungal cultures. Fungi such as *Aspergillus niger*, *Aspergillus flavus, Penicillium chrysogenum, Aspergillus terreus, Aspergillus glaucus, Fusarium oxysporium,* and *Rhizopus stolonifer* were isolated from food materials using Standard Blotter Method. Pure cultures were obtained and transferred into Potato Dextrose, Soyabean Dextrose, Sawdust Sucrose, Ofor Sucrose and Groundnut Dextrose Broths respectively, to screen their suitability for culturing fungi. After incubation at 27±1OC for 7 days, the organisms were harvested, weighed and growth rate measured. The mean values for all the organisms in Soyabean broth except *Fusarium oxysporium*, were significantly ($P \leq 0.05$) higher than those of Groundnut Dextrose, Ofor Sucrose Broth, Sawdust Sucrose Broth and Potato Dextrose Broth. Soyabean Dextrose Broth, performed better than other Broths probably because it contains more vitamins and minerals vital to fungal growth.
Keywords: Growth Media, Fungal Cultures

INTRODUCTION

Fungi are members of the kingdom Fungi and are eukaryotes (i. e. Organisms whose cells contain complex structures enclosed within membranes). It can also be referred to as organisms that have nuclei in their cells. This characteristic separates them from bacteria, which are prokaryotes, i.e. they lack nuclei in their cells. The Fungi are classified as a kingdom that is separate from bacteria, plants and animals. (The Free Encyclopedia, Fungi. 2009)

Fungi are heterotrophic organisms (meaning that they require external sources of organic compounds for food). Fungi grow as multicellular filaments called hyphae forming a mycelium; some fungal species also grow as single cells. They reproduce sexually and asexually and it is commonly via spores, produced on specialized structures or in fruiting bodies. Some species have lost the ability to form specialized reproductive structures, and propagate solely by vegetative growth. Examples of fungi are yeasts, molds and mushrooms. The fungi are more closely related to animals than plants, yet the discipline of biology devoted to the study of fungi, known as Mycology, often falls under a branch of botany. (Alexopoulos et al. 1996).

Occurring worldwide, most fungi are largely invisible to the naked eye, they grow in a wide range of habitats, including deserts or areas with high salt concentration or ionizing radiation, water, soil, human, plants and animals as well as in deep sea sediments. Some can survive the intense Ultra Violet Radiation encountered during space travel. Fungi perform an essential role in all ecosystems in decomposing organic matter and are indispensable in nutrient cycling and exchange. Some fungi become noticeable when fruiting, either as mushrooms or molds.

Many fungi are used as a direct source of food, such as mushrooms and truffles and in fermentation of various food products, such as wine, beer, and soy sauce. More recently, fungi are being used as sources of antibiotics in medicine and various enzymes, such as cellulases, pectinases, and proteases, important for industrial use or as active ingredients of detergents. Many fungi produce bioactive compounds called mycotoxins, such as alkaloids and polyketides that are toxic to animals including humans. Some fungi are used recreationally or in traditional ceremonies as a source of psychotropic compounds. Several species of the fungi are significant pathogens of humans and other animals. Losses due to fungi diseases of crops and food spoilage caused by fungi can have a large impact on human food supply and local economies.

Fungi are important experimental organisms. (Thomas, 2000).

- They are easily cultured
- Occupy little space
- Multiply rapidly
- Have short life cycle
- Used to study mycrobial assays of vitamins and amino acids.

Media

Whatever a particular mould needs, it must always be supplied with some form of organic carbon for energy, a source of nitrogen for protein and vitamin synthesis, and several minerals. The substance on which a mould is grown in the laboratory is called a *medium* and the mould growing on it, a *culture*. Culture media can be solid or liquid, depending on the sort of information one wishes to obtain. For the purposes of identification, solid culture media are usually more useful, as they allow the mould to sporulate more easily. (Umechuruba and Elenwo,1997).

Solid media

Most culture media are prepared by dissolving the necessary nutrients in water, to obtain a balanced solution supplying everything the mould needs for growth. Preparation of solid media involves dissolving a solidifying agent in the solution that will harden to a gel upon cooling. In the past gelatin was used for this purpose, but was found that gelatin, a protein, itself could serve as a nutrient for some fungi. As they grew on the gelatin, these fungi would cause it to liquefy, thus destroying the solidity of the medium.

A substance called *agar-agar* (or, more commonly, just agar) has been the solidifying agent of choice. Agar has the property of dissolving at a fairly high temperature (nearly that of boiling water) but solidifying at about 45^{o}C. Thus, it can be poured over living fungi without killing them, yet can be used for organisms that grow at high temperature.

Agar is relatively stable and cannot be consumed by most organisms, aside from a few specialized bacteria. It is extracted from certain marine algae or kelp by a complex industrial process. It is fairly expensive these days, but extensively used in various food and industrial products, as an emulsifier, thickener, or jelling agent.

Most culture media fit into one of three categories: (1) synthetic, (2) semi-synthetic, and (3) natural.

Synthetic media are composed of ingredients of known chemical composition and concentration. These media are useful in physiological or descriptive studies when it is necessary to duplicate exactly a previous batch of medium or to record the effects of the deletion or addition of a particular substance. Semi-synthetic media resemble synthetic media in containing a known set of ingredients, but differ in that at least some of the ingredients are of unknown or variable composition. A synthetic medium, in which all ingredients are chemically defined, can be made semi-synthetic by adding a substance such as yeast extract. We know that the yeast extract contains thiamine and other vitamins, but we do not know the exact amounts or what else might be present.

Natural media are so called because they are partly or completely composed of natural materials, such as ground-up (or whole) plants or animals. A slice of potato is a natural culture medium, as is a piece of meat or bread. Natural media are often very good and allow sporulation in fungi that may otherwise remain sterile. Their major disadvantage is that they may differ considerably from batch to batch and thus not yield reliable experimental results. Nevertheless, natural media are widely used in laboratory work and cannot be replaced by any other kind.

Liquid media

Liquid media are employed in laboratory work when the entire colony must be recovered for weighing or chemical extraction. They are also useful when the culture medium itself is to be analyzed for chemical changes. For identification purposes, liquid media are seldom chosen because few moulds sporulate well on them. The exception is in work with yeasts, a group of fungi especially adapted to liquid environments.

Any medium containing agar is at best a semi-synthetic medium. Agar contains numerous mineral elements and cannot conveniently be purified, even by repeated washings. Thus, for physiological studies, liquid media should be used.

There has been need to culture, identify and preserve fungi such that they can be easily reached and propagated at very short notices. Fungi have numerous activities that are both beneficial and detrimental in the environment, and they interactions with human, animal, microbes and other plants.

To achieve this, a special herbarium where fungi that had been collected, identified, characterized, preserved and kept for future work and reference is most essential. As plants are kept in the Herbarium to provide standard reference collections for verification and conformation of newly collected plants, as well as make available specimens and taxonomic literature for all levels of study etc, so are fungal cultures kept in a mycological Herbarium called a Mycological Morgue.

The objectives of the study:

1. To establish a standard mycological morgue in the University of Port Harcourt for easy identification, collection and proper maintenance of fungal cultures.
2. To determine the best medium most suitable for the cultivation of these fungi.

MATERIALS AND METHODS

Materials

Food items: Bread, raw groundnut seed (*Arachis hypogaea*), healthy *Detarium macrocarpum (*ground ofor), oranges (*Citrus sinensis*), whole water melon (*Citrullus lanatus*), paw paw fruit (*Carica papaya*), corn (*Zea mays*) and common bean seeds (*Phaseolus vulgaris*).

Materials used for the preparation of media are; raw groundnut, ground Ofor and Soyabean seeds, Potato and sawdust. The ground Ofor, groundnut and Soyabean seeds and Potato were bought from the market while the sawdust was got from a saw mill at Rumuodomaya in Port Harcourt, Rivers state, Nigeria.

Culture media: Potato Dextrose Broth, Soyabean Dextrose Broth, Sawdust Sucrose Broth, (Ofor) Sucrose Broth, Groundnut Dextrose Broth.

Glass ware and other laboratory equipment: Filter papers, Plastic trays for carry of Petri dishes, Cotton wool for wiping and plugging of glass wares, Aluminum foil for wrapping of materials to keep them sterile, Sieve for filtering and squeezing out pulps, Knife for cutting, Plastic bowls for washing, Pot for boiling, Microscope, Plastic mortar and pestle for mashing, Forceps for picking, Camera for photographs, Bunsen burner for boiling and flaming, Incubator, cork borer used to bore media to pick up fungal culture for inoculation, Inoculating loop for inoculation, Auto clave for sterilizing, Petri dishes for culturing, Conical flasks, 1000ml Measuring cylinder, 5ml Syringe, Stirring rod, Beakers, Funnel, Cover slip and slides, Mc Cartney bottles, Pipette, Lactic acid, 70% Ethanol, Bleach (*Sodium hypochlorite*), recording materials like; notebooks, markers and pens.

METHODS

Isolation

Fungi were isolated from food materials using Standard Blotter Method. In this method, Petri dishes were lined with 3 layers of sterilized 9cm filter paper. Sterilized distilled water was used to wet them and excess water poured out. The food materials used were sorted to remove diseased ones, then soaked in 70% ethanol for 5minutes and rinsed twice in sterilized distilled water; after which they were placed in Petri dishes equidistantly and incubated at 25^{o}C in the laboratory for 3-7 days. The following fungi such as; *Aspergillus niger,* Van Tieghem; *Aspergillus flavus,* Johann Heinrich Friedrich Link; *Penicillium chrysogenum,* Thom; *(*previously known as *Penicillium notatum); Aspergillus terreus*, Thom; *Aspergillus glaucus*, Link; *Fusarium oxysporium*, Schltdl; and *Rhizopus stolonifer* (Ehrenb.: Fr.) Vuill; were found growing on the food materials. They were isolated and sub-cultured on Potato (*Solanum tuberosum*) Dextrose Broth, Soyabeans (*Glycine max*) Dextrose Broth, Sawdust Sucrose Broth, Ofor (*Detarium macrocarpum*) Sucrose Broth and Groundnut (*Arachis hypogaea*) Dextrose Broth from which pure cultures were made and maintained on these media at 27 ±1^{o}C and preserved in the refrigerator.

Preparation of Media

Broth /liquid media: liquid media are employed in laboratory work when the entire colony must be recovered for weighing or chemical extraction and it does not require Agar.

Soyabean (*glycine max*) Dextrose Broth

Composition: Soyabean 200g, Dextrose 20g, Water I liter.

Method of preparation

The required quantity (200g) of soyabean (*Glycine max*) was sorted to remove stones and dirt, then weighed and washed, transferred into a pot containing one liter of water and placed on a Bunsen burner to boil until soft and strained through a sieve. The liquid obtained was transferred into 1 liter/ 1000ml measuring cylinder and 20g of dextrose was dissolved and added. The medium was made up to one liter, dispensed into 250ml flasks, plugged with cotton wool and foil and sterilized with an autoclave at 126^{o}C and 15psi for 20 minutes. It was allowed to cool and 3 drops of 25% lactic acid was added.

Potato (Solanum tuberosum) Dextrose Broth

Composition: Potatoes 200g, Dextrose 20g, Water I liter.

Method of preparation

Irish Potato (*Solanum tuberosum*) was peeled; required quantity (200g) weighed, washed and cut in tiny cubes. It was then transferred into a pot containing one liter of water and placed on a Bunsen burner to boil until soft enough to mash. After mashing, it was squeezed through a sieve to obtain the pulp. Which was transferred into a 1 liter/ 1000ml measuring cylinder, 20g of dextrose was dissolved and added. The medium was made up to one liter, dispensed into 250ml flasks, plugged with cotton wool and foil and sterilized with an autoclave at 126^{o}C and 15psi for 20 minutes. It was allowed to cool and 3 drops of 25% lactic acid was added. (Ataga, Elenwo and Nwachukwu, 2010).

Sawdust Sucrose Broth
Composition: Sawdust 200g, Dextrose 20g, Water I liter.
Method of preparation
The required quantity (200g) of saw dust was weighed, boiled until the water colour changed from clear white to dark brown after which, it was strained through a sieve. The liquid obtained was transferred into 1 liter/ 1000ml measuring cylinder and 20g of sucrose was dissolved and added. The medium was made up to one liter, dispensed into 250ml flasks, plugged with cotton wool and foil and sterilized with an autoclave at 126^{o}C and 15psi for 20 minutes. It was allowed to cool and 3 drops of 25% lactic acid was added.

Groundnut (Arachis hypogaea) Dextrose Broth
Composition: Groundnut 200g, Dextrose 20g, Water I liter.
Method of preparation
The required quantity (200g) of Groundnut (*Arachis hypogaea*) was sorted to remove stones and dirt, then weighed and washed, transferred into a pot containing one liter of water and placed on a Bunsen burner to boil until soft and strained through a sieve. The liquid obtained was transferred into 1 liter/ 1000ml measuring cylinder and 20g of dextrose was dissolved and added. The medium was made up to one liters, dispensed into 250ml flasks, plugged with cotton wool and foil and sterilized with an autoclave at 126^{o}C and 15psi for 20 minutes. It was allowed to cool and 3 drops of 25% lactic acid was added.

Ofor (Detarium macrocarpum) Sucrose Broth
Composition: Ofor 200g, Dextrose 20g, Water I liter.
Method of preparation
The required quantity (200g) of ground Ofor (*Detarium macrocarpum*) seed were weighed, dissolved in hot water then transferred into 1 liter/ 1000ml measuring cylinder and 20g of sucrose was also dissolved and added. The medium was made up to one liter, dispensed into 250ml flasks, plugged with cotton wool and foil and sterilized with an autoclave at 126^{o}C and 15psi for 20 minutes. It was allowed to cool and 3 drops of 25% lactic acid was added.

Preparation of Agar Slants: About 40mls of the already prepared Potatoes Dextrose Agar was poured into Mc Cartney bottle which had been sterilized at 15psi and placed in a slanting position on the bench to solidify. The different fungi were removed from the edge of the growing cultural using a 3mm cork borer and placed faced down at the centre of the agar slant. Inoculated slants were incubated at 27±1^{0}C for 4-7 days.

Inoculation
The already prepared media were allowed to cool, lactic acid added to inhibit the growth of unwanted microorganisms. The lactic acid was not added before autoclaving to avoid denaturization. The media were dispensed into Petri dishes (for solid media), flasks (for broth) and Mc Cartney bottles (for slants) and sealed.
The culture was allowed to grow in a protected place that has as little air movement as possible.

RESULTS
The following results were obtained after screening the growth media for their suitability for culturing different fungi species:
Evaluating the organisms: Table 1: The Soybean Dextrose Broth, showed growth in which *Aspergillus niger* had the highest growth followed by *Rhizopus stolonifer*, *Aspergillus flavus, Aspergillus terreus*, *Penicillium chrysogenum, Aspergillus glaucus* and *Fusarium oxysporium* in that order. While in Groundnut Dextrose Broth, *Rhizopus stolonifer* had the best growth followed by *Aspergillus niger, Aspergillus flavus, Aspergillus terreus*, *Aspergillus glaucus, Penicillium chrysogenum* and *Fusarium oxysporium*. Also in Potato Dextrose Broth, *Aspergillus niger* had the best growth followed by *Aspergillus flavus, Aspergillus glaucus, Penicillium chrysogenum, Aspergillus terreus, Fusarium oxysporium* and *Rhizopus stolonifer*.

The organisms in Sawdust Sucrose and Ofor Sucrose Broths had the poorest growth. The poor growths were evident in *Rhizopus stolonifer* and *Aspergillus flavus.* Ofor did not encourage much fungal growth but it had more growth than sawdust.

Looking at the overall best organism, *Aspergillus niger* is considered because, it performed better than others. Comparatively, Aspergillus niger was best followed by *Aspergillus flavus* and *Aspergillus glaucus* which had equal growth followed by *Aspergillus terreus*, *Penicillium chrysogenum, Rhizopus stolonifer* and *Fusarium oxysporium*

Evaluating the media: From the result obtained in Figure 1, it is evident that the organism performed better in Soybean Dextrose Broth, followed by Groundnut Dextrose Broth, Potato Dextrose Broth, Sawdust

Sucrose Broth and Ofor Sucrose Broth, while in Figure 2, the organisms had the best growth in Soybean Dextrose Broth, followed by Groundnut Dextrose Broth, Potato Dextrose Broth, Sawdust Sucrose Broth and Ofor Sucrose Broth.

In Figures 3-6, the same growth pattern was also observed that is; Soybean Dextrose, Groundnut Dextrose, Potato Dextrose, Sawdust Sucrose and Ofor Sucrose Broths respectively.

Interpreting the result in figure 7 the mean value of fungi in different growth media, *Aspergillus niger* grew best in soybean broth compare to other organisms. *Rhizopus stolonifer* was the second best followed by *A flavus, A terreus*, while *Fusarium oxysporium* had equal growth in soybean and groundnut broth. In groundnut broth, *Rhizopus stolonifer* had the best growth followed by *Aspergillus niger*, *A flavus, A glaucus, A terreus* and *Penicillium chrysogenum* while in potato dextrose broth, *Aspergillus niger* was the best followed by *A flavus, A glaucus, Penicillium chrysogenum, A terreus, Fusarium oxysporium and Rhizopus stolonifer.*

The significant difference of the performance of the organisms were examined and it was noticed that in soybeans broth, there is no significant ($P \leq 0.05$) difference between *Aspergillus niger, Rhizopus stolonifer, A flavus, A terreus, , A glaucus* and *Penicillium chrysogenum.* But they are significantly ($P \leq 0.05$) higher than *Fusarium oxysporium*. In groundnut broth, *Rhizopus stolonifer,* is not significantly ($P \leq 0.05$) different from *Aspergillus niger, A flavus, A terreus* and *A glaucus* but it is significantly ($P \leq 0.05$) higher than *Penicillium chrysogenum* and *Fusarium oxysporium*. And there is also no significant ($P \leq 0.05$) difference between *Penicillium chrysogenum* and *Fusarium oxysporium*. There is no difference between *Aspergillus niger, A flavus, A terreus, A glaucus and Fusarium oxysporium*. In Ofor broth, there is no significant ($P \leq 0.05$) difference between *Aspergillus niger, A terreus, Fusarium oxysporium* and *A glaucus.* But they are significantly ($P \leq 0.05$) higher than *Penicillium chrysogenum, Aspergillus flavus* and *Rhizopus stolonifer.* But *Aspergillus flavus* and *Rhizopus stolonifer* are significantly ($P \leq 0.05$) lower than *Penicillium chrysogenum.* In sawdust broth, *Aspergillus niger* and *A glaucus* are significantly ($P \leq 0.05$) higher than *Penicillium chrysogenum* and *Fusarium oxysporium* which are also significantly ($P \leq 0.05$) higher than *A flavus, A terreus* and *Rhizopus stolonifer.* In potatoe broth, there is no significant ($P \leq 0.05$) difference between *Aspergillus niger* and *A flavus* but they are significantly ($P \leq 0.05$) higher than others.

The mean values in Soybeans Dextrose Broth, Groundnut Dextrose and Potato Dextrose Broth, are significantly ($P \leq 0.05$) higher than those in Sawdust and Ofor Sucrose Broth. The mean value obtained from all the organisms in the different broth are as follows; For *Aspergillus flavus*: Soybeans Dextrose Broth (2.79), Groundnut Dextrose (2.39), Ofor Sucrose Broth (0.26), Sawdust Sucrose Broth (0.20) and Potato Dextrose Broth (2.09). For *Aspergillus glaucus*: Soyabean Dextrose Broth (2.42), Groundnut Dextrose (2.42), Ofor Sucrose Broth (0.86), Sawdust Sucrose Broth (0.58) and Potato Dextrose Broth (1.66). The mean values in Soyabean Dextrose Broth, Groundnut Dextrose and Ofor Sucrose Broth, are significantly ($P \leq 0.05$) higher than Sawdust Sucrose Broth and Potato Dextrose Broth. For *Aspergillus niger*: Soyabean Dextrose Broth (3.15), Groundnut Dextrose (2.52), Ofor Sucrose Broth (0.81), Sawdust Sucrose Broth (0.73) and Potato Dextrose Broth (2.24). There is no significant difference ($P \leq 0.05$) between the mean values in all the broths. For *Aspergillus terreus*: The mean values in Soyabean Dextrose Broth, Groundnut Dextrose and Ofor Sucrose Broth, are significantly ($P \leq 0.05$) higher than Potato Dextrose and Sawdust Sucrose Broth. For Penicillium *chrysogenum*: The mean values in Soyabean Dextrose Broth, is significantly ($P \leq 0.05$) higher than those in other broths.. And Groundnut Dextrose broth, Ofor Sucrose Broth and Sawdust Sucrose Broth values are significantly ($P \leq 0.05$) higher than that of Potato Dextrose Broth. For *Rhizopus stolonifer* and *Fusarium oxysporium*: The mean values in Potato Dextrose Broth are significantly ($P \leq 0.05$) lower than those in other broths. The mean values in Ofor Sucrose Broth is significantly ($P \leq 0.05$) higher than those in Soyabean Dextrose Broth, Groundnut Dextrose and Sawdust Sucrose broth respectively.

DISCUSSION

From the results obtained, Soybean Dextrose Broth performed better than other media. The difference in the performance is probably due to the fact that soybean contains more vitamins and minerals that have been identified as vital to fungal growth. Nutritionally, soybean is best known for its high carbohydrate, protein, sugar fiber, fat and other nutrients. The second best medium was Groundnut Dextrose Broth. Organisms in this broth grew well probably due to its nutritional content. It has higher calcium, potassium etc and contains Cystine, Thiamine (Vit. B_1), Riboflavin (Vit. B_2), Niacin (Vit. B_3), Pantothenic acid (B_5), Folate (Vit. B_9), which others do not have.

The cooked whole Ofor, when plated using standard blotter also had good fungal growth but the broth did not support so much growth. *Detarium macrocarpum* (Ofor) *was* assessed chemically for the presence of some antinutritional factors such as; oxalate, phytate, saponin and tannin. And it was discovered that it contains these chemicals in different proportions as shown below.

Levels of antinutritional factors in *detarium macrocarpum in* percentage (%). (Umaru, H. A., et al., 2006).

Oxalate 13.50 ± 2.16
Phytate 2.13 ± 0.97
Saponin 12.10 ± 0.05
Tannin 3.54 ± 0.28

Considerable interest has been generated by recent studies on the chemical composition of some wild fruits in Nigeria. Some of these wild fruits have higher nutritional values compared with levels found in cultivated fruits. However, some of these fruits contain antinutritional factors that can affect the availability of nutrients required by the body. The antinutritional factors interfere with metabolic process so that growth and bioavailability of nutrients are negatively influenced.

These chemicals found in Ofor contain antinutritional factors that affected the availability of nutrients required by the body of the fungi so their growth rates were inhibited.

With the evidences shown above, Soybean Dextrose Broth should be used as a medium for fungal growth

REFERENCES

Alexopoulos, C. J., Mims, C. W. and Blackwell, M. (1996). *Introductory Mycology.* John Wiley and Sons, New York. 868p.

Ataga, A. E., Elenwo, E. N. and Nwachukwu, E.O. (2010). *Laboratory Exercises and Series in Mycology*. ACOTEC Technology, P.H., Nigeria. Pp 13-21, 97- 183.

Felter, W.H. and Lloyd, U.J. (1995). *Kings' American Dispensatory Olea* pp. 1-9.

Hawksworth, D.L. (1974). *Mycologists Handbook Commonwealth.* Commonwealth Mycological Institute Publication. Slough, England. pp. 231.

The Free Encyclopedia. (2009) [Online] Available: *http://en.wikipedia.org/wiki/Fungus.* Retrieved on 2009- 12- 12.

Thomas, J. V. (2000). *The Kingdom* Fungi. Department of Biology. University of Wisconsin-La Crosse,USA. [Online] Available: http://www.uwlax.edu/biology/volk/fungi3/index.htm. Retrieved 2010- 03 - 26.

Umaru, H. A., Adamu, R., Dahiru, D. and Nadro, M. S. (2006). Levels of Antinutritional Factors in Some Wild Edible Fruits of Northern Nigeria. *African Journal of Biotechnology.* Vol. 6 (16), pp. 1935-1938, 20 August. 2007. Available online at http://www.academicjournals.org/AJB.

Umechuruba, C.I and Elenwo, E.N. (1996). *Introductory Mycology Question and Answer Approach*. Pen Paper Publication, Owerri Nigeria. pp. 1-27.

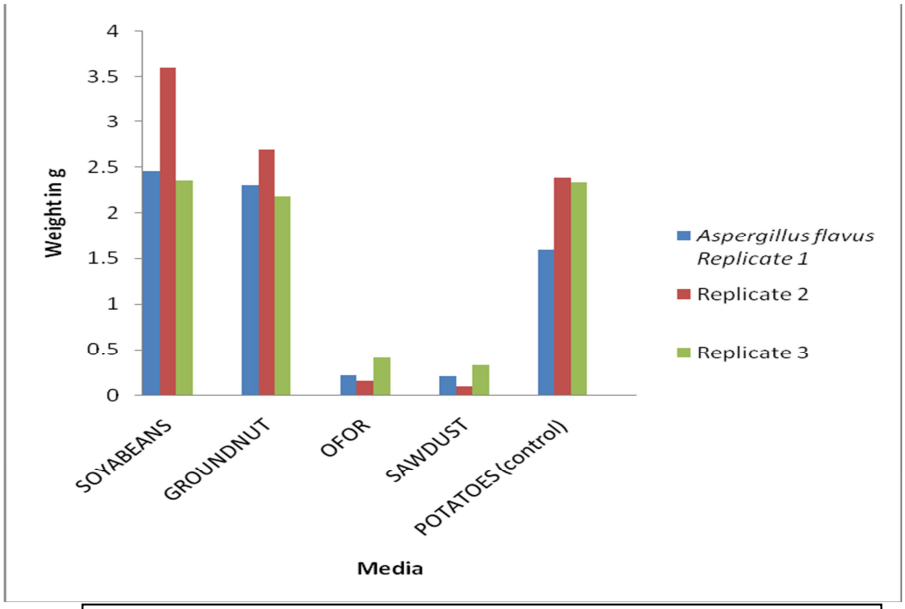

Figure 1: Graph showing the growth of *Aspergillus flavus* in different media

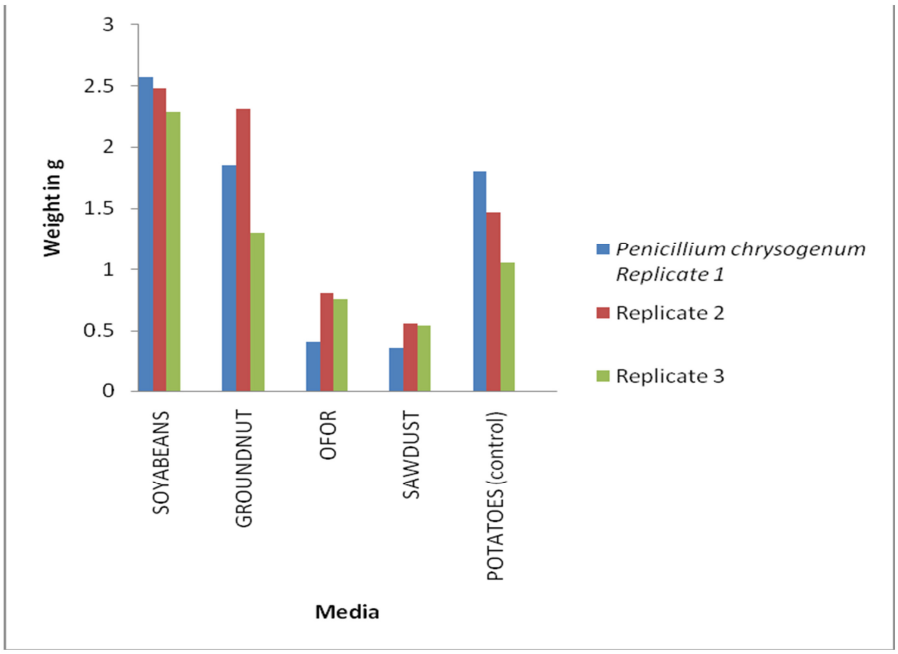

Figure 2: Graph showing the growth of *Penicillium chrysogenum* in different media

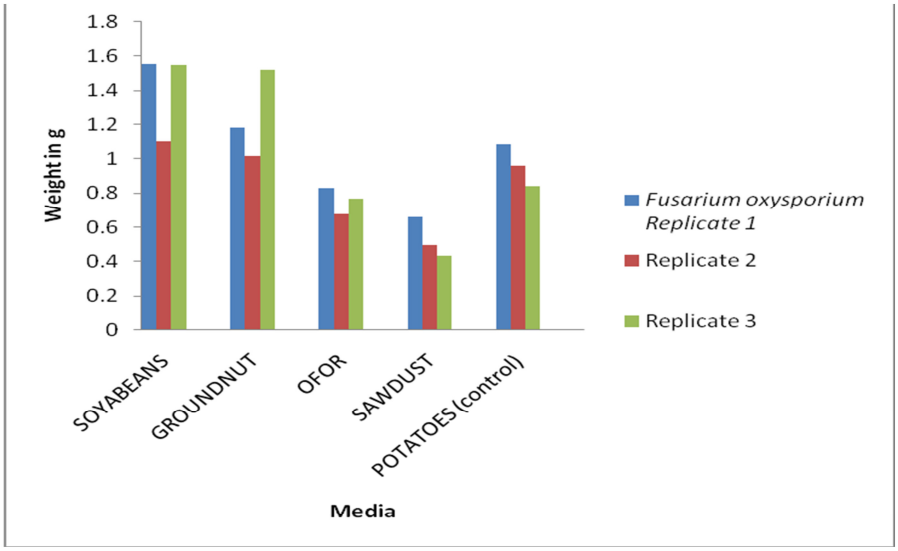

Figure 3: Graph showing the growth of *Fusarium oxysporium* in different media

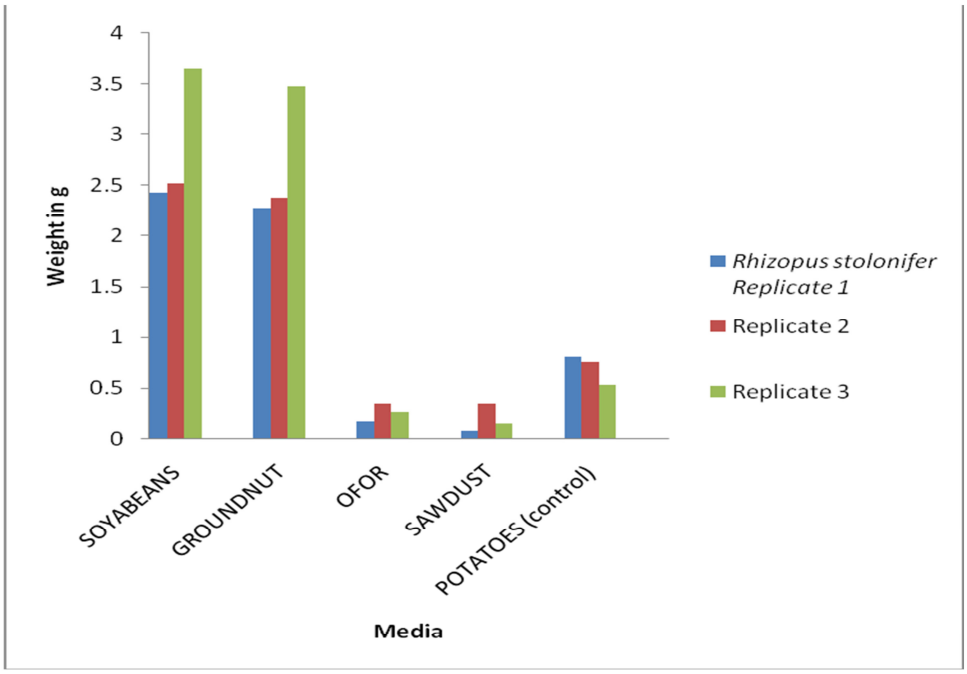

Figure 4: Graph showing the growth of *Rhizopus stolonifer* in different media

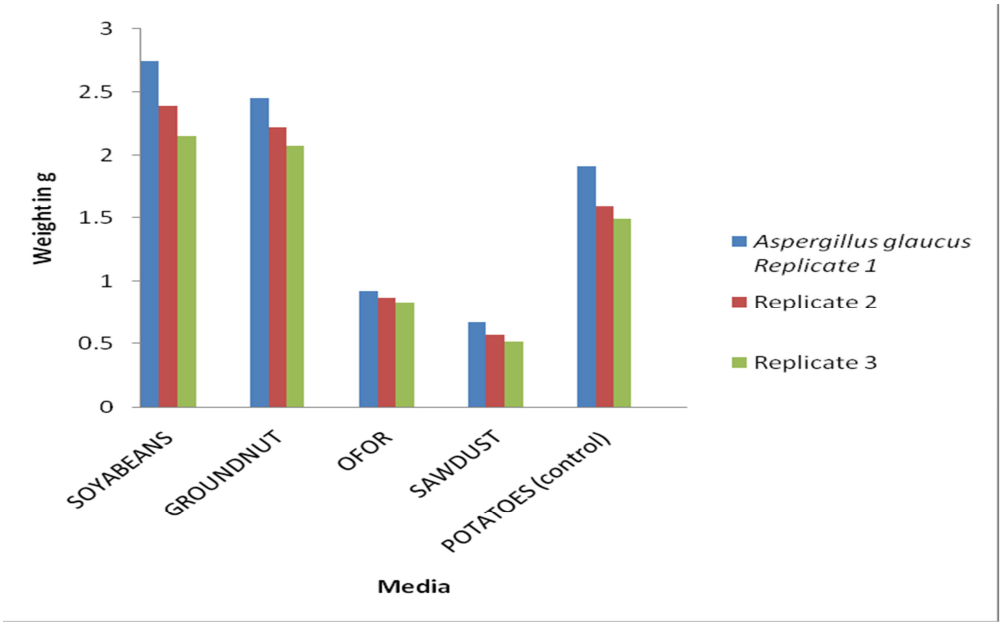

Figure 5: Graph showing the growth of *Aspergillus glaucus* in different media

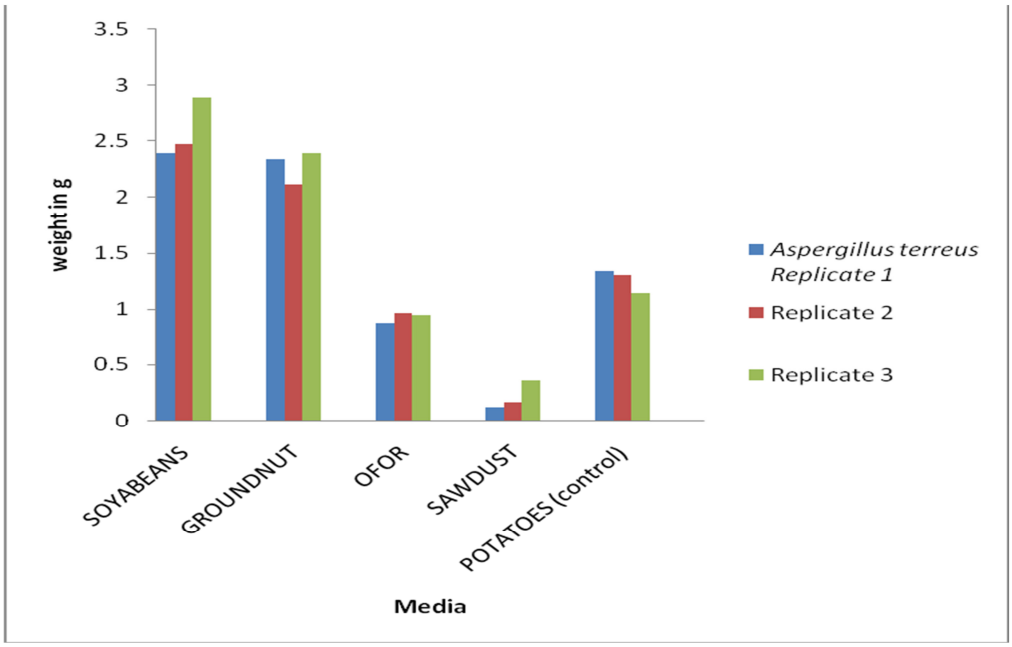

Figure 6: Graph showing the growth of *Aspergillus terreus* in different media

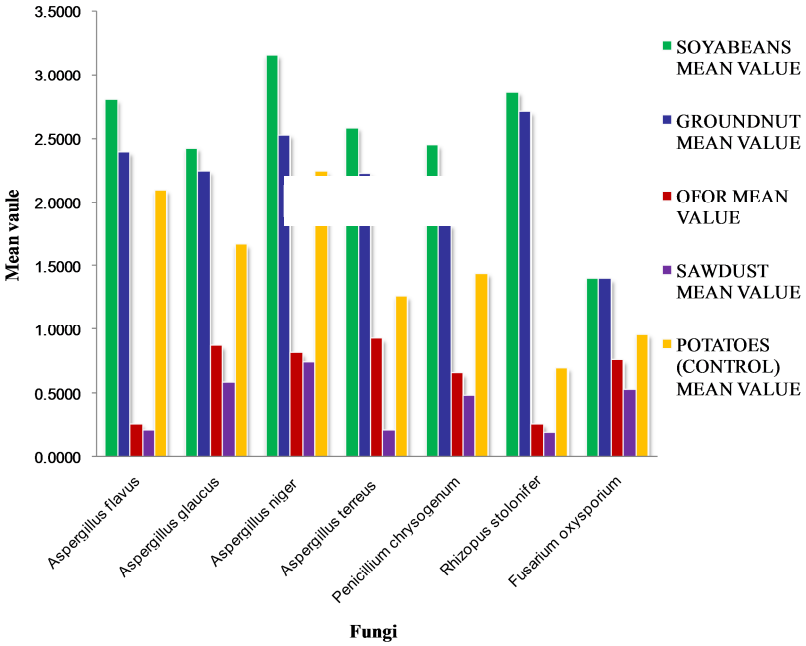

Figure 7: Graph showing the mean value of fungi in different growth media

TABLE 1. GROWTH MEASUREMENT OF DIFFERENT ORGANISMS IN DIFFERENT GROWTH MEDIA

ORGANISMS	REPLICATES OF 3	SOYABEAN	GROUNDNUT	OFOR	SAWDUST	POTATOES (control)
		DRY WEIGHT OF ORGANISMS				
Aspergillus niger	1	3.815	2.607	0.709	0.769	2.299
	2	2.233	2.061	0.901	0.708	2.045
	3	3.411	2.909	0.821	0.732	2.379
Aspergillus flavus	1	2.454	2.304	0.213	0.204	1.583
	2	3.589	2.692	0.156	0.096	2.377
	3	2.347	2.178	0.412	0.323	2.326
Penicillium chrysogenum	1	2.566	1.846	0.405	0.358	1.801
	2	2.478	2.313	0.804	0.554	1.465
	3	2.286	1.299	0.752	0.537	1.054
Fusarium oxysporium	1	1.551	1.175	0.828	0.659	1.083
	2	1.096	1.015	0.675	0.491	0.954
	3	1.543	1.515	0.763	0.429	0.837
Rhizopus stolonifer	1	2.418	2.274	0.172	0.074	0.806
	2	2.512	2.368	0.348	0.342	0.756
	3	3.639	3.471	0.266	0.154	0.525
Aspergillus glaucus	1	2.744	2.451	0.916	0.664	1.906
	2	2.378	2.213	0.863	0.568	1.594
	3	2.148	2.066	0.826	0.514	1.491
Aspergillus terreus	1	2.389	2.332	0.86	0.115	1.332
	2	2.469	2.114	0.965	0.156	1.304
	3	2.882	2.391	0.942	0.356	1.141

TABLE 2

TREATMENTS	SOYABEANS MEAN VALUE	GROUNDNUT MEAN VALUE	OFOR MEAN VALUE	SAWDUST MEAN VALUE	POTATOES (CONTROL) MEAN VALUE
Aspergillus flavus	2.7967 ^{a}	2.3913 ^{ab}	0.2603 ^{c}	0.2077 ^{c}	2.0953 ^{ab}
Aspergillus glaucus	2.4233 ^{a}	2.2433 ^{ab}	0.8683 ^{a}	0.5820 ^{ab}	1.6637 ^{bc}
Aspergillus niger	3.1530 ^{a}	2.5257 ^{ab}	0.8103 ^{ab}	0.7363 ^{a}	2.2410 ^{a}
Aspergillus terreus	2.5800 ^{a}	2.2253 ^{ab}	0.9233 ^{a}	0.2090 ^{c}	1.2590 ^{cd}
Penicillium chrysogenum	2.4433 ^{a}	1.8193 ^{bc}	0.6537 ^{b}	0.4830 ^{b}	1.4400 ^{c}
Rhizopus stolonifer	2.8563 ^{a}	2.7043 ^{a}	0.2620 ^{c}	0.1900 ^{c}	0.6957 ^{e}
Fusarium oxysporium	1.3967 ^{b}	1.3967 ^{c}	0.7553 ^{ab}	0.5263 ^{b}	0.9580 ^{de}
Least Significant Mean	0.9663	0.7404	0.1965	0.2049	0.4711

The values above are means of three replicates. Means with the same letters are not significantly ($P \leq 0.05$) different.
→ If F calculated > F tabulated, then the value is significant but F calculated < F tabulated, the value is insignificant

Table showing the mean value of fungi in different growth Media

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