

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH



FOOD RESEARCH INSTITUTE

COLLABORATIVE RESEARCH PROJECT REPORT

By

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September, 2014

**COLLECTION AND CHARACTERIZATION OF MUSHROOM SPECIES IN GHANA
FOR HIGH-YIELD, SUB-YIELD COMPONENTS AND HIGH ANTIOXIDANT
ACTIVITIES**

**A COLLABORATIVE RESEARCH PROJECT WITH DEPARTMENT OF BOTANY,
UNIVERSITY OF GHANA**

SPONSORS: UNIVERSITY OF GHANA RESEARCH FUND
PROJECT REF. NUMBER: URF/5/ILO-008/2011-2012

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DURATION OF PROJECT: Two years (2012-2014)

BACKGROUND INFORMATION and JUSTIFICATION:

Mushrooms are a good source of proteins, vitamins and minerals. They are low in fat and sugars. Most importantly they are known to be the only vegetable that contains all the nine essential amino acids needed for good health.¹ In Ghana mushrooms are a common food item when available. They are used largely in the preparation of soups, stews and as food thickeners and also sold for additional income. With the introduction of the plastic bag method in Ghana in 1990, various types of mushrooms have been propagated of which the oyster mushroom is the most widely accepted.² They can be cultivated all year round as compared to the seasonal ones which are available in March-April and September-October.

Oyster mushrooms (*Pleurotus* species), the third largest commercially produced mushroom in the world,³ are found growing naturally on certain rotten woody material⁴. They have a wide range of temperature adaptability,⁵ substrate utilization,⁶ nutritional and medicinal properties.⁷ Nutritionally, the mushroom has been found to contain vitamins B1 (thiamin), B2 (riboflavin), B5 (niacin), B6 (pyridoxine) and B7 (biotin)⁸. Medically, the species *P. ostreatus* have been reported to decrease cholesterol levels⁹. The carpophore of the mushroom is also a potential source of lignin and phenol degrading enzymes¹⁰. It is also used industrially as a bioremediator^{11,12}.

In recent times edible mushrooms have not only attracted interest as food but as functional foods. Mushrooms have also attracted great attention as a source of bioactive metabolites for the development of drugs and nutraceuticals^{13,14}. Some of them have also been found to be a source of secondary metabolites such as phenolic compounds,¹⁵ flavonoids, terpenoids, sterols, ascorbic acid, ergothioneine and carotenoids¹⁶. They exhibit high antioxidant properties and they therefore ward off cancers, HIV-1 AIDS and other viral ailments; they are antimutagenic, anti-tumoral and can be used to manage cardiovascular disorders¹⁶.

With the medicinal properties of mushrooms, promotion of their consumption will not only ensure nutritional adequacy in the diets of consumers but will also improve their health needs. The current annual production of fresh and dried oyster mushrooms in Ghana is 240 metric tons

and this is all consumed locally.¹⁷ There is therefore the need to look for high-yielding hybrids that have also high nutritional and medicinal properties to meet the increasing demands on the market. Research activities on mushroom breeding and production are very limited as compared to other crops which may be partly due to lack of previous knowledge of the genetics and breeding system in mushrooms. Mushrooms have predominantly secondarily homothallic lifecycle therefore making classical breeding of the crop difficult.

This study is the first of its kind in Ghana and will aim at breeding oyster mushrooms for high-yield and sub-yield components, high polyphenols and high antioxidant properties through marker assisted selection breeding.

OBJECTIVES:

- To collect Ghanaian mushrooms from Kakum forest reserve (In the second year of the project, number of collection sites as indicated earlier was changed and expanded to include University of Ghana Botanical Gardens and its environs, Shai Hills Resource Reserve, Achimota Forest Reserve and Kade Research Station)
- To carry out morphological characterization on the Ghanaian mushrooms and oyster strains in the genebank
- To characterize the mushrooms phytochemically to identify and select potential strains for future breeding work
- To characterize the mushrooms using proximate and elemental analysis to identify and select potential strains for breeding

FIRST YEAR REPORT (2012-2013)

ACTIVITIES CARRIED OUT DURING THE PERIOD

- Twenty one (21) strains of eight *Pleurotus* species from the National Mycelium bank (CSIR-FRI) were cultivated on composted sawdust in accordance to Obodai et. al., (2007). This study was conducted between December, 2012 and February, 2013.
- Of the 21 strains of oyster mushrooms studied only 12 species produced fruit bodies within the cropping period of 8 weeks (Figure1). Morphological characteristics recorded on these mushrooms were: stipe and pileus length, diameter and weight of first flush.
- Total phenols and flavonoids, Antioxidant activity assays and mineral determinations were carried out on the mushrooms. A paper of these results was published- M. Obodai, E. Owusu, G.O. Schiwenger, I.K. Asante & M. Dzomeku (2014). Phytochemical and mineral analysis of 12 cultivated oyster mushrooms (*Pleurotus* species). *Advances in Life Sciences and Technology* 26:35-42, ISSN: 2225-062x.

Figure 1: Pictures of the mushrooms that flushed during the study period



P. ostreatus strain POA-9



P. ostreatus strain EM-1



P. ostreatus strain POA-10



P. ostreatus strain POA-7



P. ostreatus strain POA-6



P. ostreatus strain POA-13



P. ostreatus strain POA-5



P. ostreatus strain POA-11



P. pulmonarius strain PPA-2



P. pulmonarius strain PPA-2



P. citrinopileatus strain PCC-1



P. sapidus strain PSC-1

SECOND YEAR REPORT (2013-2014)

ACTIVITIES CARRIED OUT DURING THE PERIOD

- Three forest reserves were visited:
 - ✚ Achimota Forest Reserve
 - ✚ Shai Hills Resource Reserve
 - ✚ University of Ghana Botanical Gardens and its environs
- A total of 28 mushrooms were collected and some identified (Figure 2), out of which 3 were unidentified. The identified ones were made of 17 in the order Agaricales, 7 polyporales and one (1) auriculariales. These belonged to 11 different families.
- Studies on the total phenols and flavonoids, antioxidant activity assays and mineral determinations were carried out on the mushrooms.
- Manuscripts are in preparation : Phytochemical, free radical scavenging activity and thin layer chromatography analysis of methanolic extract of wild mushroom species collected from the Shai hills reserve of Ghana.

LESSONS LEARNT:

Studies involving field collection of mushrooms can be delayed by seasons since mushrooms in the wild are scarce during the dry season.

In the Shai Hills Resource Reserve, edible mushrooms were not found, presumably they might have been consumed by the baboons.



Auricularia spp.



Lepiota sp



Termitomyces sp.



Agrocybe dura



Tricholoma gambosum



Schizophyllum commune

Figure 2: Some collected mushrooms

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