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Studies on Collection and Proximate Compositions of Phallus Indusiatus (Vent. Ex. pers), A Nigerian Higher Fungus

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Abstract: Studies were carried out on collection and proximate composition of *Phallus indusiatus* (Vent. Ex-Pers.), a Nigerian higher fungus. This beautiful higher fungus, which has foetid smell and well developed induasium was found growing on decaying wood of *Astoon boon* buried within the soil. The collection was done from undisturbed vegetation on top of Eruwakun hill, Ikun-Akoko, Ondo States Nigeria. Different parts of this fungus (veil, pileus, stipe, volva and egg stage were analyzed for food and mineral element compositions. *Phallus indusiatus* was rich in protein, sugars, crude fibre and dry matter. The highest crude protein level (42.63 mg g^{-1}) was found in veil while the egg stage and pileus had 33.6 and 25.56 mg g^{-1} respectively. The egg stage of this, fungus contained richest amount of lipid (1.66mg g^{-1}) while the stipe had the highest sugar level (6.50mg g^{-1}). Likewise, mineral elements (Ca, Mg, Fe, K, Mn, Zn and Cu) were found in appreciable concentrations at different parts of this fungus.

Key words: *Phsallus indusiatus* · proximate composition · mineral elements · fruitbodies

INTRODUCTION

Phallus indusiatus (*Vent* Ex.Pers.) is a very rare and distinct type of tropical macro fungus. It is a white beautiful species which can be easily identified by its characteristics foetid small and it veil or net-like covered stipe [16]. It belongs to the phylum basidiomycota, order *Phalliales* and family Phallaceae [1]. The stipe is attached to a short pileus and, indusium is a well pronounced structure which hangs down around the stalk like a veil of white delicate network.

The fruit body is egg-shaped and 3-5cm diameter when young and on maturity, it split opened at its apical region to attain the height of 12.15cm egg which remain attached to the stalk. The bell shaped conical pileus with a perforated apex is a strong fold which forms network on the surface. This fungus is seasonal in its occurrence. It is common during the raining season Zoberi [16], collected *Phallus indusiatus* from Idanire hill (1700 feet) in Nigeria. This fungus had also been reported from different part of South-Western Nigeria most especially Ogun State. It is recognized locally, as Olu Afenikeni by the Yoruba tribe of Nigeria because of its short life span of 12 hours. The traditionists in southern Nigeria believed that this mushroom could be used in casting a spell of death on someone when it is ground with some other ingredients. Incantations are made while calling the name of the victim. Because of this belief, people in Nigeria usually avoid the eating of this mushroom.

Up till now, there is little or no independent scientific report on collection and proximate evaluation of *Phallus indusiatus*. The study was therefore undertaken to study collection and nutritional compositions of this important species.

MATERIALS AND METHODS

Collection of *Phallus indusiatus*: The fruitbodies of the test fungus with many carpophores in their egg stage were collected from decomposing litters and wood of *Astoon boon* (locally known to Ahun) partially buried within the richly humus soil. This mushroom was found growing wildly in damped undisturbed vegetation on top of Eruwakun hill in Ikun-Akoko, Ondo State Nigeria.The eggs and the sporophores were carefully removed with hand shovel and placed inside aerated basket lined with soft tissue paper to prevent them from mechanical damaged. The soil sample at the site of collection of this fungus was also collected for analysis.

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The fungus was identified by comparing its morphological, anatomical and physiological characteristics with the standard descriptions of Zoberi [16, 17] and that of Alexopolous *et al.* [1]. This identification was authenticated by Professor B.A. Oso,a world renown mycologist in the Department of Botany and Microbiology, University of Ibadan, Nigeria.

Sample preparation and proximate analysis: The sporophores of *P. indusiatus* were rinsed with de-mineralized water to remove adhering plants and soil particles. The sample was sorted out into veil, pileus, stipe, volva and egg and the different parts were separately dried at 55°C to a constant weight using an air circulating oven. The dried samples were milled into powder using Moulinex blender.

The moisture content was determined by oven drying the sample at 100-105°C. The loss in weight obtained after drying the fresh sample for 72 hours was taken as the moisture content[7]. For protein analysis, 2.5g of each sample was separately digested in a mixture of pure HNO_3 and $HClO_4$ in ratio of 4:1 (V: V) and diluted with de-mineralized water to make 25ml. Total nitrogen within each sample was then determined by spectrophotometric method described by Daniel and Eaker [4]. Crude protein content was obtained by multiplying nitrogen content with coefficient of 6.25 [4]. Ash content was determined by adding 3g of powdered samples inside the crucible of known weight and ashed in a Gallenkamp furnace at 550°C for 6 hours after which it was cooled and weighed [7]. Total lipids were assay for by extracting the sample using hexane as a solvent 8 hours in a soxhlet apparatus [3]. Sugar and crude fibre contents were also determine using AOAC method [3]. Mineral elements were analyzed using automated atomic absorption spectrophotometry and flame photometry method Senatore *et al.* [15].

RESULTS AND DISCUSSION

Study carried out on collection of *Phallus indusiatus* (Vent. Ex.Pers) shows that this fungus is a beautiful white and rare tropical species of mushroom. It has a characteristic foetid smell and life span of about 8-10 hours. Plate 1 shows the egg stage of this fungus. It is light brown in colour, rough, ball-like and has diameter of 3-5cm. After 48 hours, the egg stage of this fungus split open at its apical region to attain a net covered structure of about 8-12 cm in diameter (Plate 2- 4). The Volva (Plate 3 and 4) is formed from an outer covering of the egg (Plate 1) which remains attached to the stipe. The perforated apex is attached to the top of the stipe which develops into a strong fold which forms network of net or veil at the surface (Plate 2).

Gleba is formed on the folded surface of the pileus and it is olivaceous, foetid and mucid. The gleba is a dark brown substance which contains spores enmeshed in the mucilage. The gleba stains any material it comes in contact with and is probably smeared on the visiting flies and green beetles which feed on it. These insects might be probably mode of various means by which spores of this fungus are dispersed. *Phallus indusiatus* was found from this study to be seasonal. The sporophores were collected mainly during the raining season (May to October, 2004). They were never found between January-April and November and December of the same year (Table 1). The location and the habitat of collection of this fungus could be compared with that of Zoberi [16]. In the present studies, *P. indusiatus* fruitbodies were collected on top of Eruwakun hill, Ondo State while Zoberi [16] collected the same fungus in 1969 on top of Idaranre hill. This suggests that this fungus prefers high attitude for its survival. The present investigation therefore gave full picture descriptions of this fungus which is not available in literatures.

The food analysis carried out on different parts of *P. indusiatus* showed variations in the food contents and mineral element compositions (Table 2 and 3). All the parts analyzed had appreciable amount of crude protein. The most abundance crude protein (42.63mg g^{-1}) was found in the veil while, the egg stage and pileus had 33.60 and 25.56mg g^{-1} respectively (Table 1). The protein contents of the veil and the egg stage of this mushroom

Table 1: The quantity collected and month of collection of *P. indusiatus* in the year 2004

Month	Quantity collected (Average dry weight in kg)
January	-
February	-
March	-
April	-
May	4.5
June	6.8
July	9.3
August	13.9
September	8.7
October	3.3
November	-
December	-

Plate 1: Phallus indusiatus showing egg stage

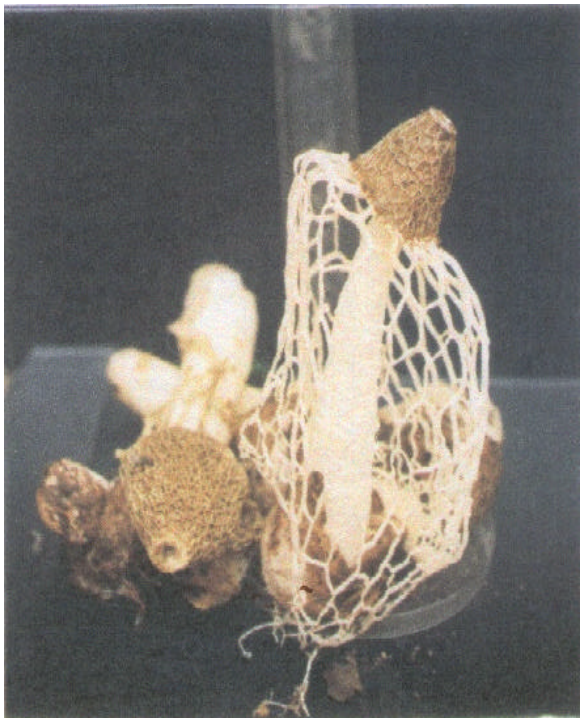

Plate 3: Fruitbodies of *P. indusiatus* showing pileus, veil, stipe and volva

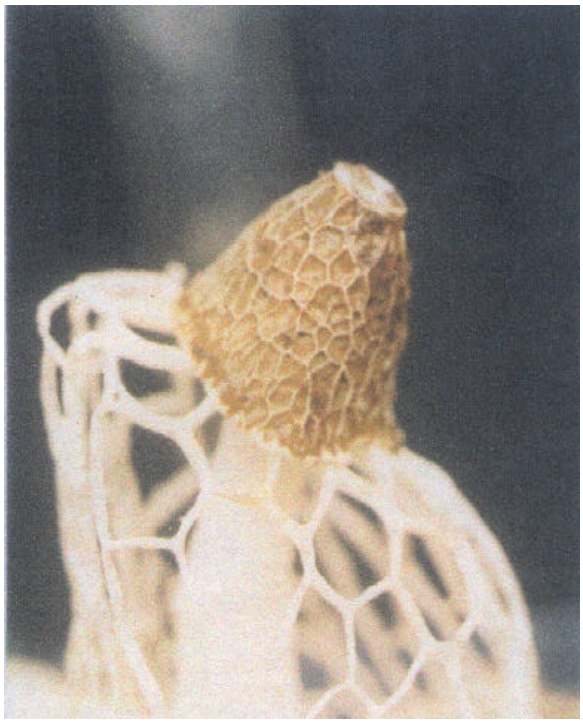

Plate 2: Fruitbodies of *P. indusiatus* showing the pileus, veil and stipe

Plate 4: Complete fruitbody of *P. indusiatus*

Table 2: Proximate composition of different parts of *Phallus indusiatus*

	Food contents	Veil	Pileus	Stipe	Volva	Egg stage
1	Sugar	0.83e	1.70d	6.50a	2.63c	3.98b
2	Crude protein	42.63a	25.56c	16.80d	17.90d	33.60b
3	Lipid	0.80c	1.36b	1.00c	1.25b	1.66a
4	Crude fibre	1.70e	13.56c	10.50d	17.16b	20.90a
5	Ash	25.75b	13.88c	21.51b	33.21a	4.74d
6	Moisture content	64.03d	72.90c	78.40b	87.90a	88.76a
7	Dry matter	45.96a	37.10b	21.93c	12.10d	11.20e

Table 3: Mineral element compositions of various parts of *Phallus indusiatus*. Values are means of 3 replicates calculated in mg g^{-1} dry weigh

Mineral elements	Veil	Pileus	Stipe	Volva	Egg stage
Calcium	0.40d	1.57a	0.46d	1.18b	0.61c
Magnessium	0.73d	0.70d	1.23c	2.25a	1.56b
Iron	1.13b	0.040d	0.043d	0.050c	0.366a
Potassium	1.68b	0.63e	2.25a	0.78d	1.53c
Sodium	0.011c	0.310a	0.050b	0.020c	0.051b
Manganese	0.016a	0.018a	0.015a	0.009a	0.051a
Zinc	0.200c	0.466c	0.750b	0.883b	1.330a
Copper	0.004b	0.001d	0.002c	0.007a	0.001d

Means followed by the save letter(s) along each verical row are not significantly different by Duncan's multiple range test ($P \leq 0.05$)

Table 4: Mineral element composition of soil where *P. indusiatus* was harvest

Element	Ca	Mg	Fe	K	Na	Mn	Zn	Cu
Amount present in soil sample (mg g^{-1})	0.39	0.20	0.07	0.04	0.097	0.067	0.037	0.03

is higher than that of cowpea (25.0 mg g^{-1}), groundnut (21.7 mg g^{-1}), cow and lamb meat (20-30 mg g^{-1}), chicken and turkey (30 mg g^{-1}) and fishes (15-23 mg g^{-1}). It is to be noted that the total protein content of the pileus and stipe of *P. indusiatus* is even higher than the powdered egg 49 % [14]. The significance of high protein content is that, the present use of mushroom in some Nigerian villages as substitute for meat is justified and need to be encouraged. Leon-Guzman *et al.* [12] suggested that edible mushrooms are highly proteinous.

The moisture content of the different parts of this mushroom ranged from 64.03 to 88.76% (Table 2). The egg stage of this fungus has the highest moisture content while veil has the lowest. This finding agrees with those of Ogundana and Fagade [13], Alofe [2], Fasidi [6] and Jonathan *et al.* [8] who worked on various types of Nigerian mushrooms. The total amount of crude fibre in the egg stage and volva (Table 2) was higher than that of the other parts. The highest crude fibre composition in the egg stage is not a surprise because 'egg' contains all parts embedded in it. The total crude fibre content of the volva, pileus, egg stage and that of stipe was very high (64.22 mg g^{-1}) (Table 2). The crude fibre content of this fungus could be compared with that of vegetables [5]. This suggests that *P. indusiatus* can be recommended for the obese people. The volva also contains fairly high fibre content. This may be as a result of the fact that this portion has contact with organic matter of the soil.

The ash content was highest in volva followed by that of the veil (Table 2). The total ash content for both the stipe and the pileus was (45.09 mg g^{-1}) and this value was comparably higher than what Alofe [2] and Kadiri [10] obtained for *L. subnudus, T. robustus* and *C. molybditis*. The reason for this is not known, but it might be due to the soil constituents of the habitat where *P. indusiatus* was collected (Table 4).

The quantity of lipid found in all the different parts of this fungus was generally low (Table 2). This makes it an excellent food for the obese people. Potassium was the dominant mineral element for the five parts analyzed followed by calcium while copper was the least (Table 3). Similar observation was made by Alofe [2] (for 7 Nigerian mushrooms).Jandalk and Thianga [9] obtained similar result for *M. procera*. The result of the present study is however, different from those of Kadiri [10] and Kuforiji *et al.* [11], who obtained Mg as the most

dominant mineral elements. This implies that nutrient composition of different mushrooms may differ

Pileus and volva had the highest and second highest Ca content while veil has the lowest. This could be attributed to the fact that *P. indusiatus* was found growing on Ca rich soil. (Table 4). This level of Potassium, Iron and Sodium contents in the fruitbodies of edible mushrooms are higher than those of fruits and vegetables [14]. Since the range of these minerals fall within comparative values obtained for *P. indusiat.* It is therefore recommended that this mushroom could be encouraged for consumption in order to enhance mineral nutrients intake by man.

Data are calculated as % dry weight except 6 and 7 that are calculated as % fresh weight. Means followed by the same letter(s) along each vertical row are not significantly different by Duncan's multiple range test ($P \leq 0.05$).

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