Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

Vol. 9	No. 3	pp. 597-600	2010

Original Research Paper

Edible Potential of Wild Mushroom *Astraeus hygromatricus* (Pers.) Morg.

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Nat. Env. Poll. Tech.
ISSN: 0972-6268
Website: neptjournal.com

Key Words:
Wild edible mushroom
Astraeus hygromatricus
Nutritional content

ABSTRACT

Wild edible fungus, *Astraeus hygromatricus* was analysed for its nutritional and anti nutritional contents. 11.71% and 4.66% protein content was recorded in outer part and inner part of the fruit bodies, respectively which is comparable with other edible mushrooms. Fruit bodies contain high carbohydrate content i.e., 29.48% and 35.41% in outer and inner parts respectively. The ash content of *A. hygrometricus* is low (2.5%). Fungus samples are good source of minerals such as P, K, Ca, Mg, Fe, Zn and Mn. Two major vitamins i.e., water soluble vitamins, ascorbic acid and thiamine, were also found to be present in both inner and outer parts (3.26 and 0.26 mg/100g).

INTRODUCTION

Wild mushrooms are one of the most important non-wood forest products (NWFP) and play an important role in the subsistence pattern of forest fringe dwellers. In many parts of India, wild edible mushrooms have been part of the human diet for a long time. More than 200 species of fungi are reported to be edible throughout the world and about 283 of these are reported to be available in India (Purkayastha & Chandra 1985). Mycorrhizal fungi confer many attributes to plants such as growth stimulation due to increased nutrient uptake, tolerance of plants to odd conditions, and biocontrol of root diseases. In return, mycorrhizal fungi, which are highly specific in their nutritional requirement, get simple sugars, amino acids and other substances from the host plant for their growth and development.

Astraeus hygrometricus (Pers.) Morg., commonly known as putpura, pottu, is considered a mycorrhiza forming fungus, growing in association with the roots of sal (*Shorea robusta*) during the rainy season. It helps the plants in extracting nutrients, especially phosphorus, from very slightly soluble soil minerals and organic substances. At the beginning of the rainy season (first or second week of June) the fruit body of the ectomycorrhiza develops along the roots of sal plants just beneath the soil layer in the forest soil of Mandla region of Madhya Pradesh. Its sporophore is subglobose to tuberiform, hard, and 1.5-2.5 cm in diameter (Figs. 1, 2). Spores yellowish brown to brown, globose to subglobose, inamyloid, slightly thick-walled, prominently echinulate and 9-11 µ in diameter. It is an important non-wood forest product of sal forest and provides income to tribal population and NWFP traders.

MATERIALS AND METHODS

The fruit bodies of wild edible mushroom were collected from Sal forest areas of Bichiya, Mandla (Madhya Pradesh)and Chilpi, Kawerdha (Chhattisgarh) in the month of June. Moisture content was determined by oven dehydration at 98°C for 5h.

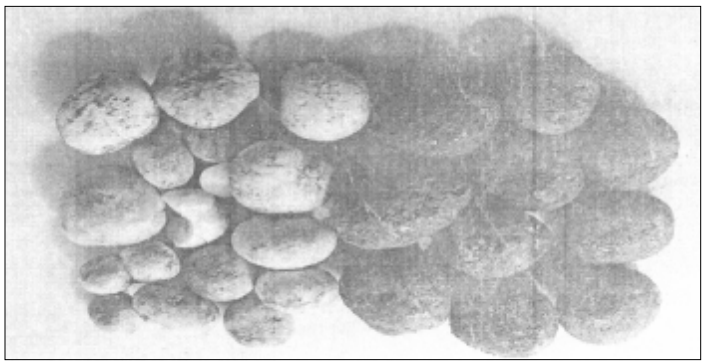

Fig. 1: Fruiting bodies of Astraeus hygrometricus

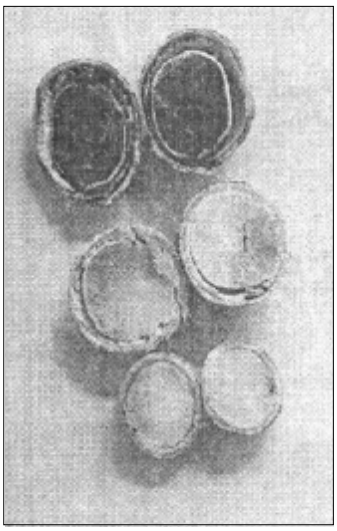

Fig. 2: T. S. fruiting bodies of *Astraeus hygrometricus*

Total carbohydrate content was estimated by Anthrone method (Hedge & Hofreiter 1962). The ash content of the sample was determined by weighing the incinerated residue obtained at 600°C according to AOAC method (AOAC 1970). Calcium and magnesium were estimated by titrimetric method, potassium by flame photometry, and phosphorus spectrophotometrically. The total nitrogen was estimated by micro-Kjeldahl method (AOAC 1970). The crude protein content of the samples was calculated by multiplying the total nitrogen content by the factor 6.25 (Sadasivam & Manickam 1992).

Ascorbic acid content was estimated by the titrimetric method of Aberg (1958). Thiamine was estimated by the method of Sadasivam & Manickam (1992). Crude fat or oil was extracted by Soxhlet extraction method. The phenolic acids were extracted from the plant parts by the procedure of Charpentier & Cowles (1981) with the help of HPLC. The following known phenolics were used as standards: anthralinic acid, salicylic acid, protocatechuic acid, chlorogenic acid, p-hydroxybenzoic acid, vanillic acid, caffeic acid, syringic acid, p-coumaric acid and ferullic acid. Tannin content in the sample was estimated according to the method of Schanderi (1970). Total phenol content in the sample was estimated by folin-ciocalteau reagent (Malick & Singh 1980). Saponin content was determined by the modified method of Fenwick & Oakenfull (1981). The gross food energy was estimated according to the method of Osborne & Voogt (1978) using equation:

FE = (% CPX4) + (% lipids X 9) + (% COH X4)
FE = Food energy (in g calories)
CP = Crude Protein
CHO = Carbohydrate

RESULTS AND DISCUSSION

The forest areas of Mandla (Kalpi, Narayanganj, Bichiya, Anjanai, Mangli), Amarkantak, Dindori of Madhya Pradesh, and Dhamtari, Bilaspur, Kanker and Durg of Chhattisgarh were surveyed and fruit bodies of edible fungi, Putpura (*Astraeus hygromatricus*) were collected during the month of June.

The proximate composition of the wild edible mushroom is given in Tables 1 and 2. The moisture content in this mushroom was 83.87%; this range falls into 80-95%, which is normal percent of moisture in fresh mushrooms (Breene 1990).

Table 1: Nutritional composition of *A. hygromatricus*.

Parameters analysed	Outer part	Inner part
Moisture (%)	83.87 (Full body)	
Ash (%)	2.5 (Full body)	
Carbohydrate (%)	29.48	35.41
Starch (%)	0.11	-
Oil (%)	1.05	0.24
Protein (%)	11.71	4.66
Fibre) %	0.02	0.13
Ascorbic acid (mg/100g)	3.26	0.26
Thiamine (µg/100g)	5.23	3.54

Values are the mean of three replicates.

Table 2: Minerals in *A. hygromatricus*.

Parameters analysed	Outer part	Inner part
Phosphorus (mg/100g)	935	405
Potassium (mg/100g)	2132	1241
Ca (mg/100gm)	29.5	25.8
Magnesium (mg/100g)	242	11
Iron (ppm)	2.787	2.35
Zinc (ppm)	0.897	0.448
Manganese (ppm)	0.74	0.17

Values are the mean of three replicates.

Table 3: Phenolic acid composition of *A. hygromatricus*.

S.No.	Phenolics	*A. hygromatricus* Retention time (min)	Amount (µg/g)
1.	Protocatechuic acid	4.68	3.62
2.	Vannilic acid	-	-
3.	Ferulic acid	8.48	4.54
4.	Salicylic acid	21.61	-
5.	Caffic acid	-	-
6.	p-hyodroxy benzoic acid	-	-
7.	Anthralinic acid	12.54	7.21
8.	Syringic acid	9.95	4.37

A. hygromatricus is the good source of protein. 11.71% protein content was recorded in outer part and 4.66% in inner part of the fruit bodies which is comparable with other edible mushrooms. Fruit bodies contain high carbohydrate content i.e., 29.48% and 35.41% in outer and inner parts respectively.

The ash content of *A. hygromatricus* is low (2.5%) compared to *Agaricus bisporus* (9.1%) and *Ustilago maydis* (5.5%) reported by Beuchat et al. (1992) and Valverde & Paredes-Lopez (1993) respectively. The fat content was 1.04 and 0.24% in outer and inner part of *A. Hygromatricus*, which is lower than the other edible mushrooms.

Mushrooms contribute vitamins such as C and B (B_1, B_2, B_{12} and niacin). Two major vitamins i.e., water soluble vitamins, ascorbic acid and thiamine were also found to be present in both inner and outer parts (3.26 & 0.26 mg/100g).

A. hygromatricus is a rich dietary source of various minerals (Table 2) and its outer and inner parts contain appreciable amount of iron, magnesium, phosphorus, potassium and zinc. The levels of trace mineral elements i.e., iron and zinc among others were fairly significant. It was reported that trace elements comprise less than 0.0001% of the total body fraction. It is necessary component of haemoglobin, myoglobin and in the transport of oxygen. Similarly, zinc functions as co-factor of several enzymes in energy metabolism and immune factor (William & Devlin 1991).

The phenolic fraction of plants has been linked to their antioxidant capacity and antimicrobial activity. RP-HPLC with PDA detection was employed to distinguish and quantify phenolic acids. The number of phenolic acids varied from 3 to 4 in *A. hygromatricus* (Table 3). Anthralinic acid was present as a major component in fruit bodies with 7.21 µg/g. There were number of major and minor peaks in HPLC chromatograms, which could not be identified.

Total phenolic content and tannins were determined spectrometrically and were 1.4 and 4.25% in outer and inner part respectively. Toxic contents, cyanogens and saponins were not detected. Tannin contents were 1.1 and 1.14% in inner and outer parts respectively. The essence of estimating the concentrations of these secondary plant metabolites is to establish and advice on the quantity one can consume at a time.

Table 4: Anti-nutrient contents in *A. hygromatricus*.

Bio-chemicals	Outer part	Inner part
Tannins (%)	1.10	1.14
Phenols (%)	1.4	4.25
Cyanogens (%)	Nil	Nil
Saponins (%)	Nil	Nil

Values are the mean of three replicates.

Table 5: Food energy of *A. hygromatricus*.

Species	Food energy (g calories)
Astraeus hygromatricus	336.74

It was observed that the study sites were dominated by the tribal communities. They were mostly poor, underdeveloped, neglected and fully dependent on plants for food and collecting wild plants parts like leaves, fruits, seeds, tubers, mushrooms, etc. for their sustenance. These are utilized in different areas of central region according to their availability during the season. These contained high amount of nutritional contents. The results of the study showed that relatively high polysaccharide/carbohydrates, protein and minerals were available which provide numerous health benefits. At present, only a fraction of total potential is being tapped by the tribal communities. It is urgently needed to explore the possibility of its utilization or domestication for further processing and their utilization in neutraceutical preparations.

ACKNOWLEDGEMENT

The author is thankful to the Dr. R. K. Verma, Scientist and Dr. V. S. Dadwal for identification of the edible fungi.

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