

Evaluation of Alkaloids of North Indian Wild Edible Termitophilous Mushrooms

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Abstract: Mushrooms have long been generate a lot interest. Nowadays however, increase interest in consumption of mushrooms consider them to be important from nutritionally and nutraceutically point of view. The objective of this study was to determine alkaloids in seven edible species of *Termitomyces* viz., *T. microcarpus*, *T. radicans*, *T. badius*, *T. medius*, *T. heimii*, *T. striatus* and *T. mammiformis* collected from different localities of North India during the monsoon season. Standard biochemical techniques were followed for evaluation. The various alkaloids evaluated which are ranged from 0.046 – 0.077 mg/g.

Key words: *Termitomyces* • Mushrooms • Edible fungi • Basidiomycetes • Alkaloids • Food composition • India

INTRODUCTION

For thousand of years the mushrooms have been known as source of food and are known to produce many kind of bioactive compounds, generally linked with mycelial cell wall, that help in enhancing the immune capacity to fight against carcinogens [1]. Among these termitophilous mushrooms represented by genus *Termitomyces* a basidiomycetous fungus belonging to the family *Lyophyllaceae* [2] is one of the most preferred genus in this regard. Species of this genus, namely *T. microcarpus*, *T. radicans*, *T. badius*, *T. medius*, *T. heimii*, *T. striatus* and *T. mammiformis* known for their edibility are traditionally consumed in Indian subcontinent [3, 4] There are several reports on mushrooms about the presence of bioactive compounds, which largely makes mushrooms important items of consumption and earning revenue [5, 6]. There are number of investigations covering alkaloids evaluation of mushrooms [7-10]. Alkaloids serve as therapeutic agents as well as important raw materials for the production of traditional and modern drugs. Alkaloids are also reported to have microbiocidal and anti-diarrhoeal effect due to their effect on transit time in the small intestine and their ability to intercalate with microbial deoxyribonucleic acid (DNA) [11, 12]. In view of above investigations for evaluation of alkaloid contents of termitophilous mushrooms collected from different localities of North West India was initiated following standard biochemical

procedures. The results of the investigation conducted for the evaluation of alkaloids have been presented in this paper.

MATERIALS AND METHODS

Samples: Fully mature samples of seven species of *Termitomyces* namely *T. microcarpus*, *T. radicans*, *T. badius*, *T. medius*, *T. heimii*, *T. striatus* and *T. mammiformis* were collected from North West India during monsoon season (Figs. 1-7). The morphological identification of these mushrooms was made on the basis of macro and microscopic characteristics of individual taxa which was noted down on the field key to mushroom collector. Identification of the samples was done by consulting Pegler [13]. The representative voucher specimens were deposited at the Herbarium of Botany Department, Punjabi University, Patiala (Punjab), India under PUN. These mushroom samples were dried at 45°C before analysis.

Extraction Procedure for Alkaloids Evaluation: The fruiting bodies were air-dried in a Lyophilizer (Ly-Christ Alpha1-2) and powdered before analysis. The dried samples (5 g) were extracted by stirring with 100 ml of methanol at 25 ± °C at 150 rpm for 24 hr. and filtered through Whatman No. 4 paper. The residue was then extracted with two additional 100 ml portions of methanol, as described earlier. The combined methanolic extracts



Fig. 1: *Termitomyces microcarpus*



Fig. 2: *Termitomyces badius*



Fig. 3: *Termitomyces heimii*



Fig. 4: *Termitomyces medius*

was evaporated at $40 \pm ^\circ\text{C}$ to dryness and re-dissolved in methanol at a concentration of 50 mg/ml and stored at $4 \pm ^\circ\text{C}$ for further use for extraction of different nutraceutical components.



Fig. 5: *Termitomyces mammiformis*



Fig. 6: *Termitomyces striatus*



Fig. 7: *Termitomyces radicans*

Alkaloids Estimation [14]: The alkaloids were extracted from 5 g of each of the dried powdered mushroom samples using 100 ml of 10 % acetic acid, which was left to stand for 4 hrs. The extract was filtered to remove cellular debris and then concentrated to a quarter of the original volume. To this concentrate, 1 % Ammonia solution was added drop-wise until the formation of precipitate. The alkaloids thus obtained were dried to a constant weight at 65°C in an oven. The percentage of alkaloids was calculated by using formula.

$$\text{Percentage alkaloids \%} = \frac{\text{Weight of residue}}{\text{Weight of the sample}} \times 100$$

Statistical Analysis: For each one of the mushroom species three samples were analyzed and also all the assays were carried out in triplicate. The results are expressed as mean values and standard deviation (SD).

Table 1: Alkaloids (mg/gm) in wild *Termitomyces* species On dry weight basis. (mean \pm SD; n = 3)

Sr. No.	Species	Alkaloids (mg/g)
1	<i>T. microcarpus</i>	0.056 \pm 0.03
2	<i>T. badius</i>	0.052 \pm 0.03
3	<i>T. medius</i>	0.053 \pm 0.09
4	<i>T. striatus</i>	0.050 \pm 0.16
5	<i>T. heimii</i>	0.046 \pm 0.04
6	<i>T. mammiformis</i>	0.077 \pm 0.05
7	<i>T. radicans</i>	0.046 \pm 0.08

RESULTS

Evaluation for Alkaloids: The present study indicated that the presence of alkaloids in the extracts of the wild edible termitophilous mushrooms. Maximum amount of Alkaloids was detected in *T. mammiformis* contained 0.077 mg/g followed by *T. microcarpus* (0.056), *T. medius* (0.053%), *T. badius* (0.052%), *T. striatus* (0.050%) of alkaloids and lowest in *T. heimii* (Table 1).

DISCUSSION

The analysis of alkaloids on termitophilous mushroom samples from North India showed indicated appreciable quantities of alkaloids. Alkaloids were also found in very small concentrations ranging from 0.046- 0.077 mg/g which is higher than reported earlier in *Schizophyllum* commune (0.015%) and *Polyporus* spp. (0.013%) [15]. Further these mushrooms compared with other mushrooms which are ranged 0.17-0.78 % [16]. Ayodele and Jokhuoya Asuquo and Etim screened phytochemical properties of the mushroom *Oxyporus populinus* and *Psathyrella atroumbonata* indicated presence of moderate amount of alkaloids [17, 18]. The presence of alkaloids in the extract is an indication that these mushrooms are of pharmacological importance [19]. In view of the results achieved during the present investigation it is apparent that these mushrooms are quite rich in alkaloids which make these suitable for the menu of modern calorie conscious society. The commercial production of termitophilous mushrooms not only promises a strong food alternative for mushroom lovers with a potential to provide equally potent culinary option as is provided by edible species of *Agaricus*, *Pleurotus*, *Volvariella*, *Lentinula*, etc. There is an urgent need to understand the diversity and potential of these mushrooms by undertaking further investigations for more effective utilization and their conservation.

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