Original Article

Bulletin of Environment, Pharmacology & Life Sciences
Volume 1, Issue 1, December 2011: 54 - 56
Journal's URL: www.bepls.com
[Accepted 18 December 2011]

Morphological Characterization and Yield Potential of *Termitomyces spp.* Mushroom in Gorakhpur forest Division

Bobby Srivastava, A. K. Dwivedi* and V. N. Pandey
Experimental Botany Lab, Department of Botany
DDU Gorakhpur University, Gorakhpur-273009
***E-mail:** anup_airgkp@rediffmail.com

ABSTRACT
Termitomyces is a wild mushroom growing in the symbiotic association of termite under or aboveground the termatorium, which is extensively used as human food and medicine from the time immortal. It has many more species throughout the country, but the study reveals in the Gorakhpur forest division confined that there are four species of Termitomyces are found. In order to determine the genetic diversity among these four species were studied by using morphological characterization, phenotypical appearance. Four species naming Termitomyces heimii, Termitomyces clypeatus, Termitomyces mammiformis and Termitomyces microcarpus characterized by different morphological traits i.e., shape of perforatorium, stipe length(cm), pileus length, margin of fruit body, colour of fruit body, gills, flesh, annulus, pseudorrhiza and spore print were recorded. Results indicate that all the four species of Termitomyces shows great diversity in their morphological characters.
Key words: *Morphological characterization, Symbiotic association, Genetic diversity, yield potential, Termitomyces.*

INTRODUCTION

Edible mushrooms are considered as healthy food because their mineral content is higher than that of meat or fish and most vegetables, apart from their nutritional value mushrooms have potential medicinal benefits [1, 2]. Recent studies confirm that they are an important source of food and income in both developing and developed countries [3, 4]. Indigenous peoples are utilizing mushroom for the treatment of different type of diseases and also as an aphrodisiac and tonic [5]. Different types of edible mushrooms are cultivated on large scale for commercial use and many more species of mushrooms grow wildly in nature which has much nutritional and medicinal value.

Termitomyces species is one of the choice edible mushrooms which grow wildly in symbiotic association of Termite. According to the systemic position, *Termitomyces* belongs to the class Basidiomycota, order Agaricales and family Agaricaceae; grow symbiotically in Termatorium. The *Termitomyces* is an important genus of fleshy fungi, which are locally consumed by forest dwellers and people of adjoining areas. *Termitomyces* mushroom is a wild fleshy mushroom growing symbiotically in association with termite especially in rainy season [6]. *Termitomyces* is affluent source of sugar, protein fibre, lipid, vitamin, mineral in addition to medicinal value which is used in lower blood pressure, rheumatism, kwashiorkor, obesity, diarrhoea and as purgative [7].

MATERIALS AND METHODS

Morphological characterization of four species of *Termitomyces* was done in the field as well as in the laboratory on the basis of shape, structure, appearance, colour, texture and spore print. The yield data for three flushes in a period of 30 days from first flush were recorded in terms of average number, average weight and average weight per fruit body.

RESULT AND DISCUSSION

Morphological characters: Macro morphological characters varied among the four *Termitomyces* species, and their hybrids also differ in their macro morphological characters as depicted in table -2.

A. Perforatorium: *Termitomyces clypeatus* shows strongly spiniform perforatorium, *T. heimii* with umbo, *T. mammiformis* shows sharply differentiated perforatorium and *T. microcarpus* show small spiniform perforatorium.

B. Stipe and stipe length: Stipe of *T. heimii* is cylindrical creamy stuffed with thick annulus, up to 5 cm long and up to 1.5 cm wide, *T. mammiformis* produced white, solid stipe with up to 9 cm long and 3.2-4.5 cm in diameter, *T. clypeatus* have long, central, solid, white to dirty brown fleshy and fibrous stipe

which may 3-7 cm long and T. microcarpus produced small, slender, long, uniformly thick stipe which are slightly enlarged below soil, length of stipe are 2-4 cm and 1-1.5 cm in diameter. Among the four *Termitomyces* species, *T. mammiformis* produces fruit bodies with significantly longer stipe (9.00cm) which was as par with *Termitomyces heimii* (5.00 cm), *T. clypeatus* produced fruit bodies having 3-7.00 cm long stipes, which were significantly longer than *T. microcarpus* (4.00 cm). (Table-2)

C. Pileus length*:* Pileus length was maximum in case of *Termitomyces heimii* (up to 8 cm) and this character was inherited to *T. mammiformis* (6.00 cm), *T. clypeatus* (5.5-8 cm) and *T. microcarpus* (.5-1.5 cm), data showed in Table- 2.

D. Margin of fruit body: *Termitomyces heimii* produced fruit bodies with incurved margin and smooth type of pileus, *T. clypeatus* produced fruit bodies with silky surface of pileus and irregularly lobed margin. *T. mammiformis* produced fruit bodies having entire margin with smooth pileus and *T. microcarpus* have smooth pileus with glabrous margin (Table- 2).

E. Colour of fruit body: Table- 2 showed that all the four species varied in terms of colour of the fruit bodies' viz. *T. clypeatus* produce orange grey to greyish orange colour fruit bodies, *T. heimii* produced cream colour fruit bodies, *T. mammiformis* generated whitish grey, silvery shining fruit bodies, and *T. microcarpus* produced brownish fruit bodies with cream dark in centre.

F. Gills: *T. heimii* produced crowded, free whitish, turn pinkish with age, margin; serrulate, *T. mammiformis* produced crowded gills, free, white in colour, gills of *T. microcarpus* are crowded, free or adnexed, thick, white, turning creamy at maturity, gills produced by *T. clypeatus* are free, white, pink at maturity, edge entire.

G. Flesh: Flesh of *T. clypeatus* are soft and inflated, hymenophoral trama regular, *T. heimii* produced white flesh, hymenophoral trama regular with thin walled parellal hyphae, *T. mammiformis* generated white flesh, soft, hymenophoral trama bilateral while young, regular at maturity, *T. microcarpus* produced soft, brownish flesh, hymenophoral trama regular.

H. Spore print: Spores prints of *T. heimii* are purplish grey, *T. clypeatus* shows pink spore, *T. mammiformis* having pink spore print and *T. microcarpus* shows pale pinkish spore print.

I. Annulus: *T. heimii* produced thick and persistent annulus; *T. mammiformis* produced persistent annulus, *T. microcarpus* and *T. clypeatus* lacking both an annulus and other velar remnants.

J. Pseudorrhiza: *T. heimii* produced significantly long and hallow pseudorrhiza up to 16 cm below ground level, *T. mammiformis* produced hallow pseudorrhiza with blunt end, *T. clypeatus* having cylindrical, slender, surface pale grey, smooth, glabrous, solid, fibrous and up to 13 cm long pseudorrhiza but in *T. microcarpus* pseudorrhiza absent.

The biomass yield of four different species of Termitomyces has shown in Table-1. The result shows that highest average weight of fruiting body was found in *Termitomyces heimii* (11.60) followed by *Termitomyces clypeatus* (11.53), *Termitomyces mammiformis* (11.20) and *Termitomyces microcarpus* was 10.30 (fig.-1).

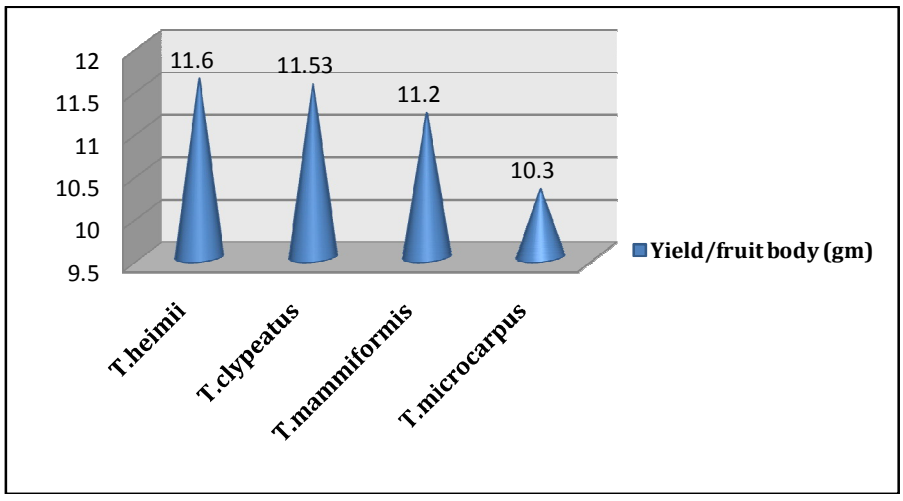

Fig.1- Biomass yield by different species of *Termitomyces*

Table 1: Yield performance of different *Termitomyces* species

Sl. No	Species	Av. No. of fruit bodies	Av wt./fruit body (gm)	Biomass Yield (Average) (gm)
1.	*Termitomyces heimii* Natarajan	**24**	**11.60**	278.40
2.	*Termitomyces clypeatus* R. Heim	**30**	**11.53**	345.90
3.	*Termitomyces mammiformis* R. Heim	**36**	**11.20**	403.20
4.	*Termitomyces microcarpus* (Brek&Br) R. Heim	**20**	**10.30**	206.00

Table 2- Morphological characters of different species of *Termitomyces*

Sl. No.	Species	Stipe length (cm)	Pileus length (cm)	Margin of fruit body	Colour of fruit body	Spore print
1.	*Termitomyces heimii*	5	8	Incurved, smooth	creamy	purplish
2.	*Termitomyces clypeatus*	3-7	5.5-8	Lobed, silky	Orange grey to greyish orange	pink
3.	*Termitomyces mammiformis*	8.5	6	Entire, smooth	Whitish grey, silvery shining	pinkish
4.	*Termitomyces microcarpus*	4	.5-1.5	Glabrous, smooth	Brownish, cream dark in centre	pale pinkish

ACKNOWLEDGEMENT

The authors are thankful to Department of Science and Technology, New Delhi for Financial assistance and to the Head, Department of Botany, DDU Gorakhpur University, Gorakhpur for providing necessary facilities.

REFERENCES

1. Chan, H.K.M.(1981). Consumption of edible mushrooms in Hong Kong.Mushrooms Newsletter for the Tropics 1 (4): 5-10
2. Chang, S.T. and Miles, P.G. 1991. Recent trends in world production of cultivated edible mushrooms. *Mushroom J.,* 504 : 15-18.
3. Hosford D, Pilz D, Molina M and Amaranthus M (1997). Ecology and management of the Commercially harvested American Matsutake Mushroom. General Technical Report PNW-GTR-412. Portland, OR: US Department of Agriculture, Forest Service, Pacific North West Research Station.
4. Boa, E (2004). Wild edible fungi. A global overview of their use and importance to people. Non- Wood Forest Product, Series no. 17.Rome; FAO.
5. Devkota, S. (2006). Yarsagumba; Traditional utilization in Dolpa district, Western Nepal. Our Nature. (An International Biological Journal). 4:48-52.
6. Batra, L.R., S.W.T.Batra (1979). Termite-fungus mutualism. In: Insect-fungus symbiosis (BatraL.R.ed) 117-163, Wiley, New York.
7. Apetorgbor, M M., Apetorgbor A.K. and Nutakor, E. (2005). Utilization and cultivation of edible Mushrooms for rural livelihood in Southern Ghana. 17th Commonwealth Forestry Conference, Colombo, Srilanka.