EFFECT OF CASING AND SCRATCHING TREATMENTS ON NUTRITIONAL CONTENTS IN CULTIVATED *CALOCYBE INDICA*

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The cultivation of exotic mushrooms worldwide has been increasing in the past two decades, mainly due to the nutritional and medicinal properties they possess [1]. However, conditions for the cultivation of these species are determined by their physiological features, especially temperature, which is best at 14-20°C for *Pleurotus spp, Lentinula edodes, Cyclocybe aegeria*. Apart from *P. pulmonarius*, which is known to fruit at 26-28°C, the summer cultivation of other exotic mushrooms requires high costs for cooling fruiting houses; consequently, the high price of exotic mushrooms in Europe [2]. In the last ten years, there have been many reports from India, China, and other Asian countries on the success with the cultivation of *Calocybe indica* Purkay & A. Chandra [3]. *C. indica* thrives at relatively high temperatures; able to fruit at 25 - 30 °C. This attribute makes it possible to grow under hot and humid climate conditions, common in tropical countries and during summer in Europe and North America. Furthermore, it is a visually attractive valuable medicinal mushroom, which commands a high sales volume in Indian and Chinese markets[4]. It is called *Dhuth Chatta*, which means milk mushroom, because of its matt white color and compact consistency. Though it started to be commercially cultivated in 1997, its production and consumption have increased considerably worldwide [3]. In their opinion, there are several reasons for the industrial cultivation of *C. indica*: high biological efficiency of up to 140%; short cropping cycle (7-8 weeks); resistance to bacterial and mildew infections; low cost of substrates materials (sawdust, rice and wheat straw, etc.); the attractive appearance of fruiting bodies, long shelf life at room temperature and no browning during storage; rich in flavour due to the presence of terpenes. In comparison, *C. indica* has twice low polysaccharides but 1.4 times more essential element contents than *Pleurotus ostreatus* [5].

The technology for the cultivation of *C. indica* is quite simple and effective. *C. indica* grows well at a temperature range of 25-35 °C and relative humidity > 80%. Apart from the casing requirement, the cultivation of *C. indica* is similar to that of oyster mushrooms; the mushroom can be harvested from 32 to 50 days after spawning [6]. The biological efficiency vary 90 to 180.3%, depending on the substrate materials used for cultivation [7]. The raw materials used for cultivation do not require long composting or special thermal treatment (sterilization/pasteurization) during substrate preparation [3]. However, our previous studies indicated that sterile substrates could result in a 1,6 times increase in mushroom yield. This heat sterilization method allows the use of nutrient additives, which enabled a biological efficiency of 134% when cultivated on rapeseed and cornmeal supplemented barley straw substrate [8].

The purpose of study was to investigate the effect of peat-based casing material height on nutrient content in *C. indica* cultivated on sterile local substrates materials. Also tested is the effect of "scratching" or "ruffling" treatment, common in *A. bisporus, P. eryngii* cultivation [9].

The substrate was made from barley straw, sunflower husk, sunflower husk pellets, rapeseeds, cornflour, and chalk combined in the ratio 30:40:70:20:17:1 and water content adjusted to 68 ±1%. The peat used for the casing was moistened with water to attain 75% humidity and applied as a casing layer. For each layer depth of casing tested in this experiment, a sub treatment with and without scratching was included. The treatments T1, T2, and T3 had casing layers 10, 20, and 30 mm depth, respectively, and without scratching before the casing, layers were applied. Treatments T4, T5, and T6 had casing layers 10, 20, and 30 mm depth, respectively, but the casing was preceded by scraping off the aerial mycelia on the surface (the scratching treatment), was applied before casing was done. T7 was without scratching or casing (control).

The analysis of fruiting bodies indicated that the absence of casing (T7) significantly affected the dry matter content in the fruiting bodies (FB). The FB from T7 had the least dry matter content (8.2%), and the highest (12.6%) was in T4, which had casing (10 mm) and scratching treatments (Table 1).

Table 1 – Dry weight and chemical composition of fruiting bodies *from Calocybe Indica cultivated under the casing and scratching treatments*

Treatment	Protein (% dw)	CH (% dw)	EndoPS (% dw)	Lipid (% dw)	Ash (% dw)	Dry weight (%)
1	8.1^{c} ±0.7	67.8^{bc} ±1.6	8.1^{a} ±0.4	7.8^{a} ±1.0	8.3^{ab}±0.3	11.2^{ab}±1.0
2	12.3^{ab} ±0.4	64.9^{c} ±0.3	5.9^{b} ±0.2	8.8^{a} ±0.2	9.1^{a} ±0.4	10.2^{bc} ±0.8
3	11.5^{abc} ±1.2	69.7^{b} ±1.5	5.2^{c}±0.1	4.7^{b} ±0.6	8.7^{a} ±0.1	9.0^{c} ±0.6
4	14.6^{a} ±0.8	71.3^{ab} ±1.1	5.0^{c} ±0.7	3.3^{c} ±0.0	5.7^{d} ±0.1	12.6^{a} ±0.5
5	13.2^{bc} ±1.0	69.9^{b} ±1.0	5.8^{bc} ±0.3	4.3^{bc} ±0.7	6.7^{c} ±0.4	12.0^{ab} ±0.7
6	10.6^{bc} ±0.6	74.3^{a} ±1.2	4.9^{c} ±0.2	3.2^{c} ±0.8	6.7^{c} ±0.2	12.2^{ab} ±0.8
7	11.5^{abc} ±0.8	71.1^{ab} ±0.4	6.3^{b} ±0.3	3.6^{bc} ±0.2	7.4^{bc} ±0.1	8.2^{c} ±0.1
$LSD_{0.05}$	3.59	3.97	1.08	1.87	0.96	2.13
P-Value	0.029	0.001	0.0001	0.0001	0.0001	0.003

CH – carbohydrate, endoPS – endopolysaccharide

Protein, carbohydrates, endopolysaccharides, lipids, and ash content in the fruiting bodies differed significantly between the treatments applied. While increasing casing height (T1-T3) resulted in protein content, the reverse was observed when combined with scratching treatment (T4-T6).

Statistical data analysis with the Mann–Whitney *U* test showed a significant difference ($P < 0.05$) in lipid and ash content in fruiting bodies between the group T1–T3 and T4–T6 treatments. It is possible that scratching decreased lipid and ash contents in fruiting bodies of *C.indica* in our experiments, but we have no explanation for this observation at this moment; further studies are recommended. The protein, carbohydrate, lipid, and ash contents in fruiting bodies in this study are

comparable to reports in the literature.Though, the result in report of Sardar et al. about protein content of 19.32–23.67% was higher but it could be comparable because they were using a conversion coefficient of 6.25 then we were using 4,28 [10].

Calocybe indica or «milky mushrooms» could become amenable to industrial production in European countries during the summer months. The casing and scratching treatments were found to affect fruiting body nutritional contents but in total this species showed higher proteins and endopolysaccharides content as compare with *Pleurotus.*

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