

ORIGINAL SCIENTIFIC PAPER

## ***Agaricus blazei*: cultivation and mycochemical contents**

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### **Abstract**

White button mushroom, the cream type (*Agaricus bisporus*) and five different *A. blazei* (syn. *A. subrufescens*) cultivars were cultivated on Phase II. mushroom compost under identical conditions in the study. We compared the yields of strains and the phenol content was measured by spectrophotometer, while total antioxidant capacity of the extracts was determined by FRAP method. Our results revealed a tight correspondence between total antioxidant capacity and total phenol content of samples. We concluded that differences can be found between mushroom species, moreover between varieties in accumulation of secondary metabolites. The measured parameters differed in stipes and caps. Based on these results it is possible to select *A. blazei* cultivars in other point of view, underline the fact that medicinal products and pharmaceuticals prepared from this mushroom species can be very distinct.

Key words: *subrufescens*, free radical, FRAP, mushroom, bioactive

### **Introduction**

The diseases of the human body like cancer, cardiovascular defeat, immune diseases are often caused by presence of free radicals, that can be potentially harmful for lipids, proteins and carbohydrates. The free radicals may have effect on DNA as well. These free radicals appear in a normal metabolism, but environmental conditions and other biotic and abiotic stress factors increase their concentrations at first. In the past, instead of synthetic antioxidants (e.g. BHA, BHT, TBHQ) researchers focused on natural antioxidants due to their effect of disease prevention. The low molecular weight antioxidants (Vitamin-A, D, flavonoids, glutation, etc.) are able to prevent different types of sickness. The mentioned compounds are present in food and usually get into human body by eating. These molecules reserve normal physiological functions and in many cases help in the prevention of diseases related to oxidative deficiency. Numerous studies have shown an inverse relationship between fruit and vegetable consumption and the risk of developing several types of cancers, as well cardiovascular and other diseases (Ames et al., 1993; Weisburger, 1999).

In the past decades many papers were published in nutritional effect about bioactive components of edible mushrooms. Fungi are able to accumulate secondary metabolites, phenolic compounds, polyketides, terpenes and steroids. As previous research demonstrated (Ishikawa et al., 1984) the phenolic compounds of mushrooms could have antioxidant activity. The Basidiomycota fungus *Agaricus blazei* (MURRILL) (syn. *A. subrufescens* (Peck), syn. *A. brasiliensis*) is a well accepted medicinal mushroom around the world (Stamets, 2000). Many reports are available about its medicinal effect in cancer therapy and its beta-glucan compounds are well known.

In present research five different *Agaricus blazei* cultivars (marked: 853; 1105; Brazil; MaHe, Si), white button mushroom (marked: White) and the cream type (marked: Brown) *Agaricus bisporus* were cultivated under identical conditions. The total antioxidant

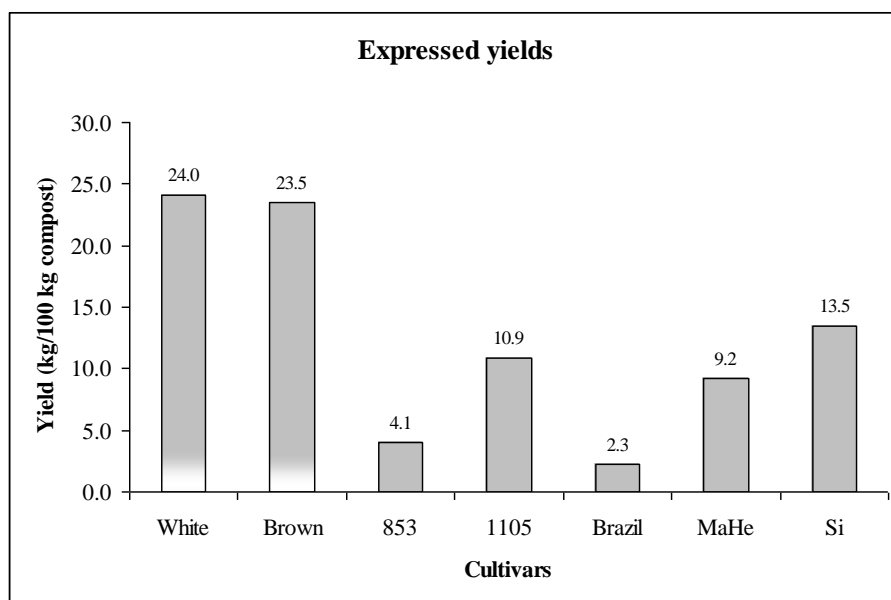
capacity and total phenolic compounds were determined, because earlier results (Geösel-Györfi, 2008; Geösel et al., 2009) suggested differences between cultivars.

### Material and methods

Fermented and pasteurized Phase II. compost was used as a growing media, that was put into 2 kg plastic bags and spawned with different cultivars. The cultivation finished at Corvinus University of Budapest, in the Experimental Mushroom Cultivation tunnel. Mushrooms were picked in „economical stage” which means that pilei were closed. During the experiment two flushes were harvested. The mushroom samples were washed, divided by cap and stem and frozen until measuring. Measuring was carried out at Department of Applied Chemistry. Total antioxidant capacity was evaluated by modified Benzie-Strain (1996) method. FRAP rate was determined in spectrophotometer at  $\lambda=593$  nm and revealed in ascorbic-acid equivalent. The total phenolic compounds were determined by Folin-Ciocalteu reagent at  $\lambda=760$  nm and calculated in gallic-acid equivalent (Singleton-Rossi, 1965). Every measurement was repeated 3 times, statistical analysis using significant differences method was conducted between values.

### Results and discussion

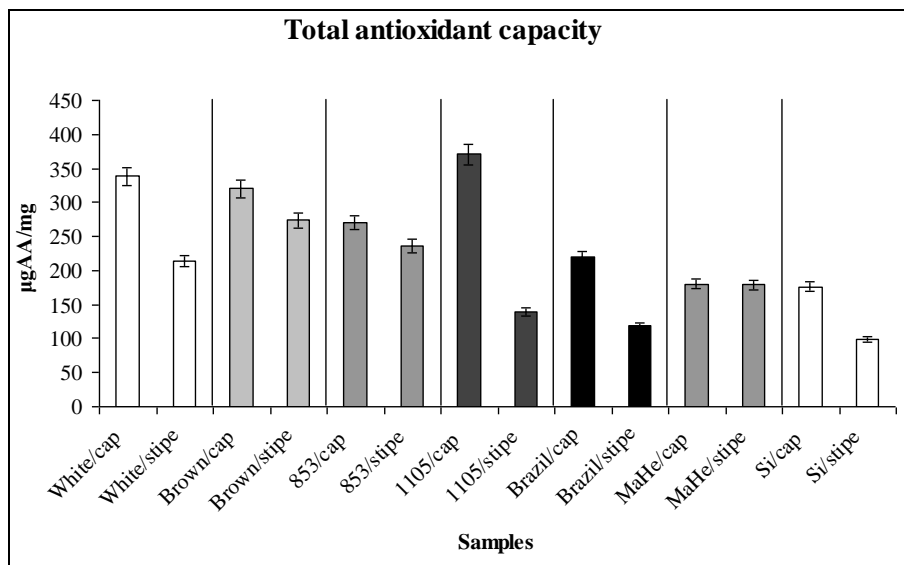
The yields were measured during two flushes; the data is in Figure 1. The average yield lacks behind the normal cropping due to small growing media and experimental conditions. The highest yield of *A. blazei* was at strain ‘Si’ (13, 5 kg/100 kg compost) while less productivity was observed in case ‘Brazil’ (2, 3 kg). Huge differences were observed between *A. blazei* varieties in yield. On the other hand, some morphological variances appeared which maybe the result of different origins.



**Figure 1. Respective yields of the different treatments expressed per 100 kg compost**

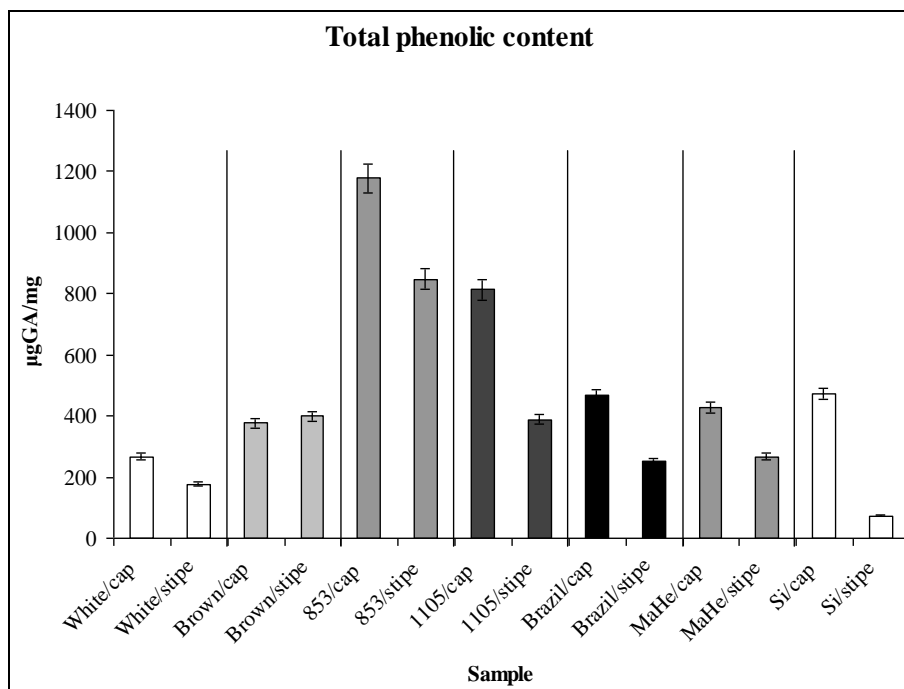
Our data demonstrate differences between cultivars moreover between caps and stipes in antioxidant capacity. In the highest amount consumed, the white button mushroom has a similar total antioxidant capacity as the cream type (Figure 2). Both of the examined *Agaricus* cultivars had a higher level in the caps than the stipes which was similar in *A. blazei* cultivars too. Extremely high differences were measured in antioxidant capacity

between cap and stipe in strain 1105. The average amount of total antioxidant capacity showed that *A. blazei* 853 and 1105 are as similar as white and cream type mushroom, while other *A. blazei* cultivars lag behind the others.



**Figure 2. Total antioxidant capacity of strains expressed in fresh mushroom weight in µgAA/mg**

Levels of total polyphenolics were significantly higher in all *A. blazei* cultivars than in *A. bisporus* varieties (Figure 3). That is probably caused by molecules that are responsible for the colour in mushrooms as well, because *A. blazei* has brown cap and yellow colouring stipe issued by injury. Very high level of total phenolics was measured in *A. blazei* 853, five times higher than white button mushroom.



**Figure 3. Total phenolics compounds of strains expressed in fresh mushroom weight in µgGA/mg**

The aggregated amount of total phenolics and antioxidant capacity of all mushroom were determined, because during normal consumption the caps and stipes are prepared together for food. The data (Table 1) suggest that *A. blazei* cultivar 853 has the highest level of total phenolics. We would like to underline that all tested *A. blazei* have significantly higher phenolics than *A. bisporus* varieties. The total antioxidant capacity shows similarity between 853, 1105 and both mushroom samples, while Si stands at lower level.

**Table 1. The average amount of aggregated total antioxidant capacity and total polyphenol contents in caps and stipes**

Species	Sample	Antioxidant capacity (mgAA/kg fresh mushroom; stipe and cap both)	Total phenolics (mgGA/kg fresh mushroom; stipe and cap both)
<i>A. bisporus</i>	White	552,0	443,4
	Brown	594,6	776,7
<i>A. blazei</i>	853	506,9	2025,6
	1105	510,4	1201,9
	Brazil	337,8	719,6
	MeHe	359,3	695,3
	Si	275,6	544,5

## Conclusions

Because the same compost and cultivational conditions were used during cropping, the mentioned compounds of mushrooms could be caused by differences between varieties. At our present state of knowledge no earlier observations like this were reported in differences between *A. blazei* cultivars. From the point of view of human nutrition the consumption of *A. blazei* is highly recommended. On the other hand, the pharmaceutical industry should take care of differences in product, while mushroom growers need help to select right varieties.

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