

## Development of *Agaricus Bitorquis* (Quel.) Sacc. Mycelium at Different Temperatures

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### Abstract

In this study, the development of *Agaricus bitorquis* (Quel.) Sacc. mycelium at different temperatures was examined. Spores were developed in the wheat agar medium for 20 days at 30°C. At the end of the incubation period, they were grouped as A, B, C, and D. In this way, the main cultures were obtained. The mycelium of these groups was grown at 25, 28, 30, 32, 35 and 38°C. Mycelium grown at 30°C served as a control. A group mycelium had good development at 25, 28, 30, 32°C. For Group A mycelium 35°C was the lethal temperature point; for other groups 38°C was lethal. The growth of C group mycelium at 35°C showed differences from the control.

**Key Words:** *Agaricus bitorquis* (Quel.) Sacc., mushroom cultivation, mycelium, temperature

### Introduction

*Agaricus bitorquis* (Quel.) Saccardo, like most cultivated edible fungi is a Basidiomycete. It is widespread in nature and usually found in moist hard-packet fields, lawns or roadside areas in temperature zones in the fall of year (Raper, 1978). The speed of growth of the *Agaricus* is influenced by different factors. For *Agaricus bitorquis*, the factor temperature was the object of some studies (Poppe, 1972; Zadrazil, 1973; Fritsche, 1982; Magan et al., 1995) and several authors have reported that the lethal temperature point for *Agaricus bitorquis* mycelium. For example, according to Vedder (1975 a) it is 33-34°C; Van Zayen and Rutjen (1981) 48°C. In many studies were announced that *Agaricus bitorquis* is resistant to higher temperatures than *Agaricus bisporus* (Fritsche, 1978; Vedder, 1978; Wood, 1978; Steane, 1980; Zadrazil and Grabbe, 1983). In this paper, the development of *Agaricus bitorquis* (Quel.) Sacc. mycelium at different temperatures were examined.

### Materials and Methods

In this study, the fructifications collected from Middle Anatolia at Turkey and 20 groups were established. The spores taken from these groups were inoculated in to petri dishes, which contained wheat

agar center, by multispore system (Fritsche 1972). After 20 days, the 10 groups whose spore growth is good, were separated for mycelium development. 8mm diameter mycelial agar discs were taken out from these groups and inoculated to solid agar center in 90mm diameter petri dishes. At the end of the 20 days inoculation period, the 4 groups which was the healthiest growth covering 3/4<sup>th</sup> of the petri and which has longitudinally radial mycelium were chosen and grouped as A, B, C, D. Therefore the main groups for the study were established.

The spores germination and mycelium development were made at 30±1°C and dark. Primer myceliums, which were taken from A, B, C, D groups, were transferred into the wheat agar. All groups mycelium were incubated at 25±1°C, 28±1°C, 30±1°C, 32±1°C, 35±1°C, 38±1°C and secondary mycelium were obtained. At the colonization from the main cultures, the radial growth rate taken as criteria. In this study the groups were determined as below:

A(25°C), A(28°C), A(30°C), A(32°C), A(35°C), A(38°C)	B(25°C), B(28°C), B(30°C), B(32°C), B(35°C), B(38°C)	C(25°C), C(28°C), C(30°C), C(32°C), C(35°C), C(38°C)	D(25°C), D(28°C), D(30°C), D(32°C), D(35°C), D(38°C)
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## Results and Discussion

The common characteristics of groups A, B, C, D is the mycelium development started from the inoculation center and their development were parallel to surface of agar without aerial hyphae. After 36 hours from the inoculation, all the A, B, C, D groups, which were developed from wheat agar the mycelium, started to develop.  $30\pm 1^\circ\text{C}$  which is the best temperature for the mycelium development is selected as control in this study. The mycelium developments were shown at Figure 1.

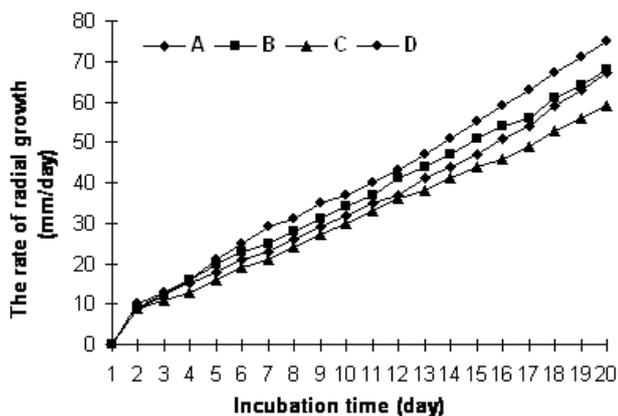


Figure 1. The mycelium curve at  $30\pm 1^\circ\text{C}$ .

At temperature  $25\pm 1^\circ\text{C}$ ; the mycelium development started to incubate on the 4th day at group A&D and on the 7th day at group B&C. The mycelium growth was parallel to the agar surface and there was no pigmentation (Figure 2).

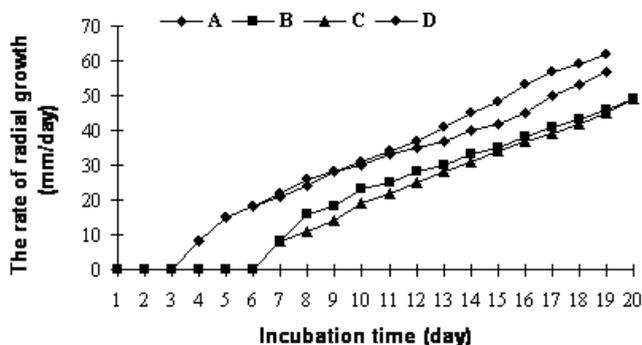


Figure 2. The mycelium curve at  $25\pm 1^\circ\text{C}$

At temperature  $28\pm 1^\circ\text{C}$ , the mycelium development in all of the groups were started on the 2nd day of the inoculation. The mycelium, which developed rhizomorphic, was observed no pigmentation. The

fastest development was on group D. The results for the mycelium development are presented at Figure 3.

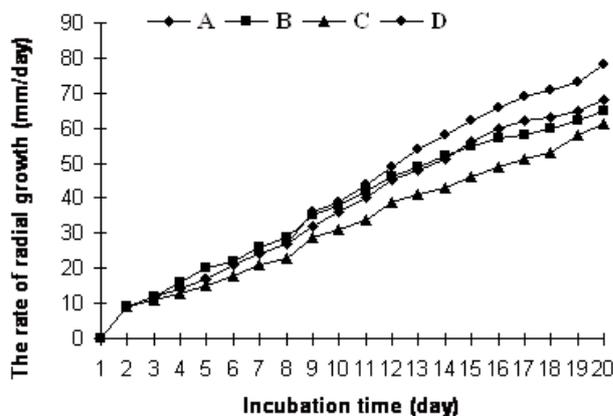


Figure 3. The mycelium curve at  $28\pm 1^\circ\text{C}$ .

At temperature  $32\pm 1^\circ\text{C}$ , the development of the mycelium started on 3rd day of the incubation at groups A&D and at groups B&C on the 4th day. The mycelium developed parallel to the surface of the agar. The mycelium of A&B groups covered the  $3/4^{\text{th}}$  of petri dishes on the 22<sup>nd</sup> day of the incubation, C group 23<sup>rd</sup> day and D group 18<sup>th</sup> day respectively (Figure 4).

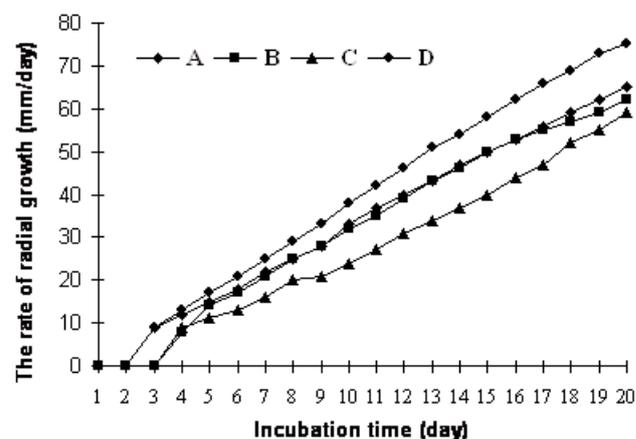


Figure 4. The mycelium curve at  $32\pm 1^\circ\text{C}$ .

At temperature  $35\pm 1^\circ\text{C}$ , at the end of the incubation period, there were no mycelium development at group A. Thus this temperature is the thermal lethal point for group A. At B, C, D groups were observed an abnormal mycelium growth, for example, the mycelium development was not linear, aerial hyphae were obtained, the mycelium developed cottony. B group mycelium started to develop on the 6th day of the inoculation and covered the petri completely during the incubation period. C group mycelium started

to develop on the 10<sup>th</sup> day of the incubation period and covered only half of the petri during this time. D group mycelium started their development on the 6<sup>th</sup> day of the incubation and covered the petri totally and has the fastest development period in spite of the other groups (Figure 5).

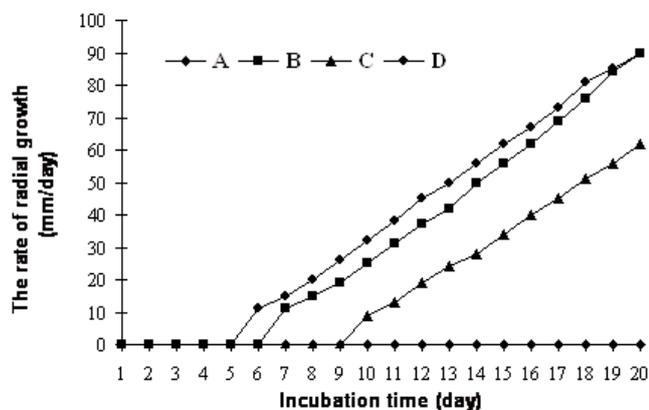


Figure 5. The mycelium curve at 35±1°C

At temperature 38±1°C, there were no development at groups B, C&D, therefore this temperature is the thermal lethal point for these groups.

At the present, the *Agaricus bitorquis* mycelium were developed at different temperatures. Mycelium were inoculated to wheat agar and their development were observed during the 20 day incubation period. During this period the most improvement were seen at groups B&D which were developed under 35±1°C (mycelium covered the whole petri) but this development was not a healthy growth. For example, the mycelium development were not linear and radial and not as surface hyphae. The growth was as cottony and aerial.

At the end of 20 days incubation period, D28°C, D30°C and D32°C groups were formed a healthy and normal mycelium growth. Their mycelium covered the petri dishes close to whole. At the A28°C, A30°C, A32°C, B28°C, B30°C, D25°C groups; mycelium covered the petri up to 3/4th and A25°C, B25°C, B32°C, C28°C, C30°C, C32°C, C35°C groups mycelium covered the petri close to 3/4th. All these groups showed healthy mycelium growth accept C35°C. C25°C group showed healthy mycelium growth and covered half the petri so this group has the latest colonization period.

At literature (Zadrazil et al. 1973; Vedder, 1975 a, b; 1978) 30°C is given as optimum temperature for *Agaricus bitorquis* mycelium development. Thus this temperature is taken control in this study.

In this paper, the earliest mycelium development has started on the 2<sup>nd</sup> day at all groups on 28°C and 30°C. The latest mycelium development has started at group C at 32°C on 10<sup>th</sup> day. The lethal thermal point was determined at 35°C for group A and 38°C for groups B, C&D.

Lemke and Claron (1978) and Fritsche (1982) pronounced that 28°C is the appropriate temperature for the *A.bitorquis* mycelium growth and Işık (1996) said 28°C and 30°C are the temperature. Fritsche (1977) has developed *A.bitorquis* mycelium at 26°C and 30°C and stated that she got better results at 30°C than 26°C. Raper (1976) said that vegetative development was faster at 30°C than 24°C.

In her study, she stated at 12 day period mycelium developed 13 mm at 24°C and at the 30°C period it developed 23 mm. Song (1975) says the optimum temperature for *A.bitorquis* mycelium are 30°C and also stated that the development gets weaker under 15°C and over 40°C. According to Vedder (1975 a) the lethal temperature point for *A.bitorquis* mycelium 33-34°C, and Van Zayen and Rutjens (1981) states the same point as 48°C. Laszlo and Schaffer (1978) have examined the temperature requirement of different *A.bitorquis* strains on petri dishes with malt-agar culture medium. The optimum temperature varied almost equally between 24 and 26°C. 27,5°C as the optimum temperature of *A.bitorquis* development given by Poppe (1972).

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