

# HEAT INDUCED GERMINATION OF BASIDIOSPORES OF *AGARICUS BISPORUS* (LGE.) SING

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## Abstract

Induced spore germination of *A. bisporus* as affected by heat treatment was studied. The optimum temperature for the stimulation of basidiospore germination was 45°C. The time required for the treatment to obtain better germination was also studied. For spore germination 10 to 50 minutes of heat treatment was considered effective. The optimum temperature for incubation of the heat-treated basidiospores was 28°C. The highest percentage of spore germination thus obtained was 25 per cent.

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## Introduction

Mushroom industry has made a good stand in Taiwan in the last decade. It occupies an important role in the export of agricultural products from Taiwan. The total area for the growth of mushroom has been increasing with the lapses of time. But the yield of mushroom is decreasing gradually. Breeding new strain or variety of high yield mushroom for commercial production is emphasized at the present moment. However, the research workers are suffering the difficulty in bringing about germination of basidiospores of *Agaricus bisporus* under laboratory conditions.

Single spore isolations have been emphasized and utilized in many fields of study of fungi. It was also employed on the mushroom research. However, it is not well demonstrated to obtain a higher percentage of germination of basidiospores of *Agaricus bisporus in vitro* (4). Genetics and breeding program can be achieved by a higher percentage of germination of basidiospores. An attempt was, therefore, made to stimulate better germination of basidiospores under the aseptic condition.

## Materials and methods

Basidiospores were obtained from the mature fruiting body of the commercial strain 543. Spores were discharged on a sterile filter paper. They were collected aseptically and used for experiments within a week.

### 1. Effects of exposure to temperature prior to incubation on the germination of basidiospores.

Basidiospores were suspended in test tubes containing 2 ml of sterile deionized

water. They were placed in a series of water bath for 30 min with temperature controlled from 10°C to 60°C at intervals of 5°C. They were then incubated in an incubator at the temperature of 28°C. Germination of basidiospores was observed and noted every two days.

## 2. Effects of time for exposure to temperature prior to incubation on the germination of basidiospores.

Preparations of spore suspension were the same as mentioned above. They were placed in a water bath with the temperature standing at 45°C. Time of treatment was varied from 5 to 90 min at intervals of 10 min. Spore germination was noted at the twentieth day.

## 3. Effects of temperature during incubation on the germination of basidiospores.

Spore suspensions were treated in a water bath at 45°C for 30 min. They were, then, incubated in a series of incubator with the temperature ranging from 10°C to 40°C at intervals of 2°C. Reading of spore germination was taken at the twentieth day.

In all experiments, unheated spore suspensions served as control. All trials were run in 4 duplicates

## Results

1. Effects of exposure to temperature prior to incubation on spore germination are shown in Fig. 1. No spore germination was observed when the spore

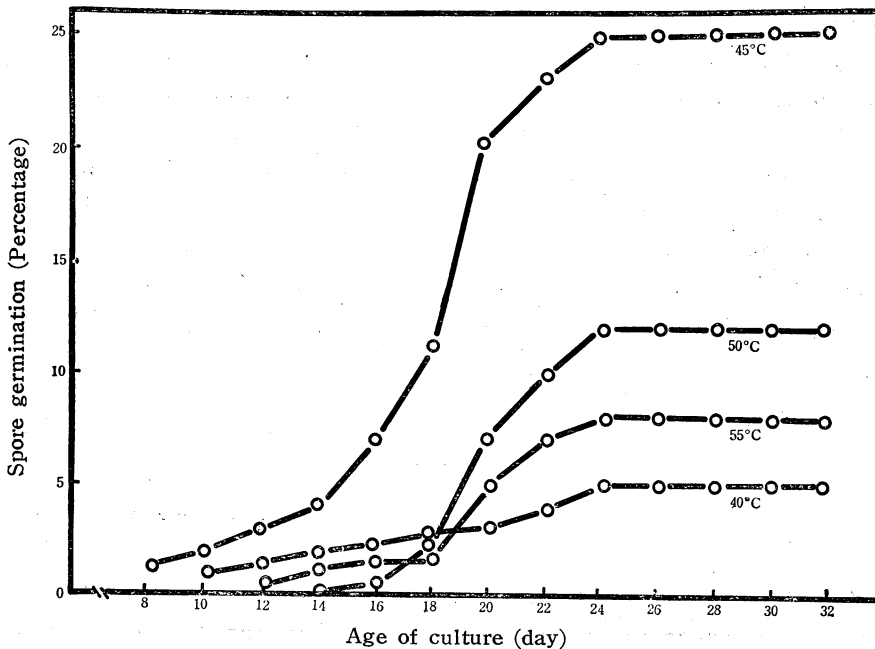


Fig. 1. Effects of exposure to temperature for 30 min before incubation on the germination of basidiospore of *A. bisporus*

suspension was heated at the temperature higher than 60°C or lower than 35°C. The best result was observed when the spore suspension was heated at 45°C. Spore germination was prolonged when the spores were heated at the temperature beyond 50°C as compared with those heated at 40°C. However, the percentage of spore germination from the spores heated at 50°C was next to those heated at 45°C. When the spore suspension was treated at 40°C, germination of basidiospores was obtained earlier than those of 50°C and 55°C, while the lowest percentage of germination was observed. Untreated spores did not germinate at all.

2. Effects of time of heating on the germination of basidiospores are shown in Fig. 2. Spore germination increased proportionally as the time for heat treatment increased from 0 to 10 min, then followed by a stationary phase up to 50 min. When the time of treatment was longer than 50 min, spore germination decreased.

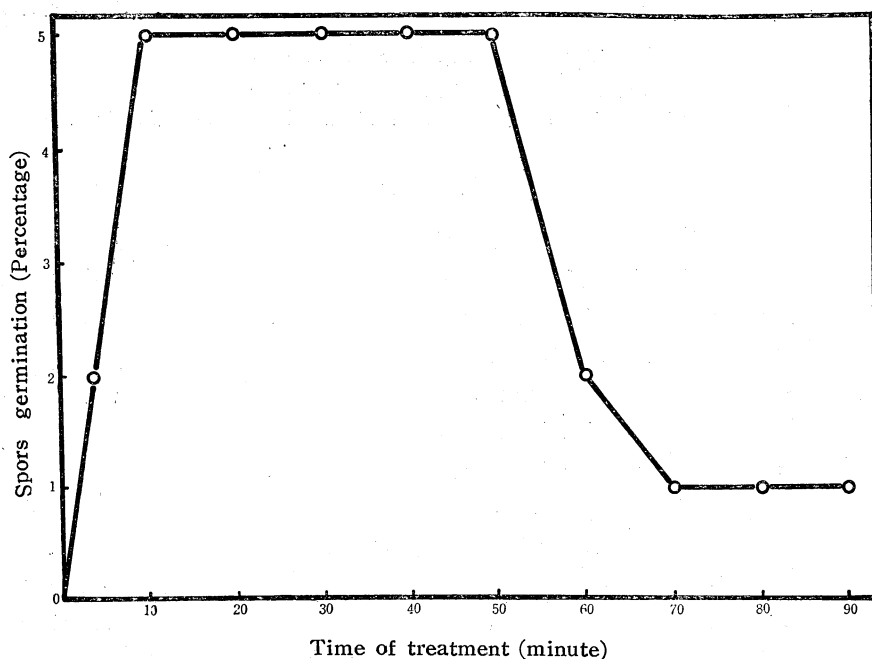


Fig. 2. Effects of time for exposure to 45°C before incubation on the germination of basidiospores of *A. bisporus*

3. Effects of the temperature for the incubation upon the spore germination are shown in Fig. 3. When the spore suspension was treated at 45°C for 30 min in a water bath, the optimum temperature for incubation of these spores was 28°C. No spore germination was observed when the temperature was lower than 14°C or higher than 36°C. Again, untreated spores did not germinate at the temperature used for incubation.

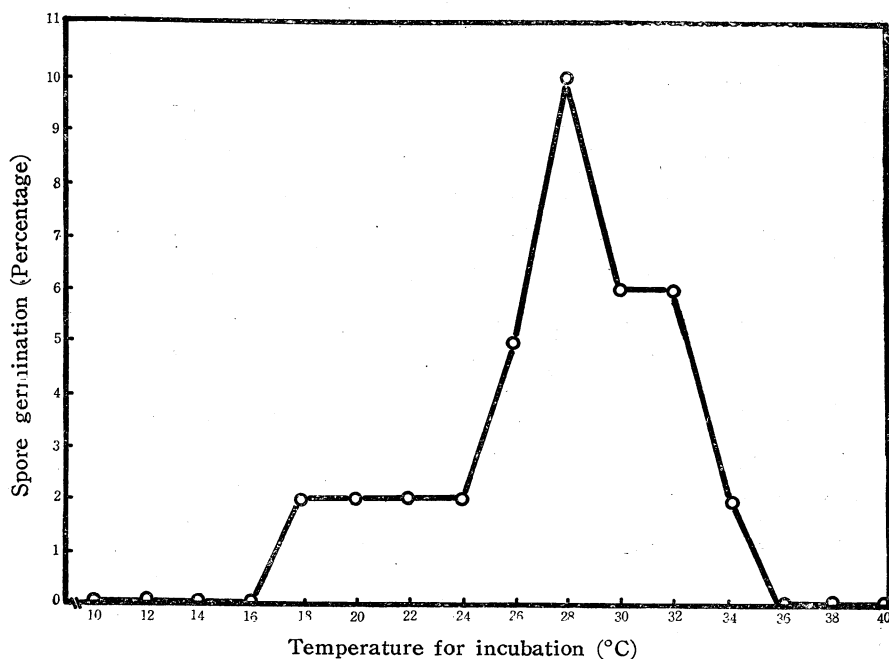


Fig. 3. Effects of temperature during incubation after exposure to 45°C for 30 min on the germination of basidiospores of *A. bisporus*

### Discussion

Factors stimulating spore germination of fungi have been reported (1, 5). Experiments on germination of basidiospores of *A. bisporus* has also been studied (2, 3). However, no report dealing with the germination of basidiospores of the cultivated mushroom by heat induction is available at present.

Heat treatment has been found to be one of the stimulating factor for germination of ascospores of *Neurospora tetrasperma*. The present study also showed that germination of basidiospore of *A. bisporus* could be stimulated by heat induction. Better spore germination could be obtained when the spore suspension was placed in a water bath at 45°C for a certain length of time. Such phenomenon was signified when the spore suspension was treated at 45°C for 30 min and then incubated at 28°C. It was also found that spores of different colonies were different in their abilities to germinate.

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# 溫度對洋菇孢子發芽之影響

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## 摘 要

1. 本試驗應用溫度處理洋菇孢子，探求處理孢子發芽最適合之溫度與時間，俾能提高洋菇孢子之發芽率，進而應用於單孢分離，選種培養與育種工作。
2. 刺激洋菇孢子發芽之溫度自  $40^{\circ}\text{C}$  到  $55^{\circ}\text{C}$  不等，而以  $45^{\circ}\text{C}$  為最適溫度。
3. 洋菇孢子在  $45^{\circ}\text{C}$  之溫度下處理 5 分鐘到 90 分鐘不等，均可刺激其發芽，其中以 10 分鐘到 50 分鐘為最佳，而且具有同樣效果。
4. 最適洋菇孢子發芽之培養溫度為  $28^{\circ}\text{C}$ ，最低極限為  $18^{\circ}\text{C}$ ，最高極限為  $34^{\circ}\text{C}$ 。
5. 洋菇孢子經  $45^{\circ}\text{C}$  處理 30 分鐘後培養於  $28^{\circ}\text{C}$  下，可將其發芽率提高達百分之二十五。