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Studies on the Possidility of Oak Mushroom (Shiitake) Cultivation on Ban Oak (*Quercus incana*) of India

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印度産 참나무(*Quercus incana*)를 이용한 표고栽培의 可能性에 관한 硏究

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Abstract : The study has been carried out to invetigate the possibility of oak mushroom (shiitake) cultivation on Ban Oak (*Quercus incana*) growing naturally in Simlaregion, India.

The survival and growth of oak mushroom mycelium and fruit body formation on *Q. incana* as well as the composition of the log were compared with that of Bristle-tooth oak (*Q. serrata*) which are being used for mushroom cultivation in Korea. The results are summarized as follows.

1. The content of alcohol-benzen extract, NaOH extract, NaOH extract and ash were higher in *Q. incana* than in *Q. Serrata*. While cellulose and pentosan were less in the formers.
2. The mycelial growth of oak mushroom were more rapid on sawdust medium of *Q. serrata* than on *Q. incana*. However the mycelial growth on the later were more compact.
3. The mycelial growth of oak mushroom were more rapid on the logs of *Q. serrata* than *Q. incana*. The mycelium survived well on both two species, and no difference in the survival rate of mycelium were observed.
4. The first fruit bodies on logs of *Q. Serrata* and *Q. incana* were appeared 16 months inoculation of spawn.
5. In view of the above results, it seems that the cultivation of oak mushroom (shiitake) on Ban oak (*Q. incana*), growing in India, is possible.

Introduction

Oak mushroom, *Lentinus edodes*(Berk) Ito et Imai, is widely cultivated artifically on logs of several broad-leaved tree species in Korea, Japan and China, and it is prized for its unique flaver, taste and nutritive value.

In order to investigate the possibility of oak mushroom cultivation on Ban oak(*Puercus icnana*) that occurrs naturally in Simla, nothern area in India, the author has taken an official trip under the IBRD-HPMC supervision mission.

The suitability of *Q. incana* for oak mushroom cultivation is compared with the *Q. serrata which is used for oak mushroom* cultivation in Korea.

It is hoped that this study will contribute in exploring the possibility of oak mushroom cultivation on *Q. incana*.

Materials and Methods

The logs of oak used in this study were *Quercus incana* growing in India, and *Quercus serrata* which are being used for mushroom cultivation in Korea. The oak mushroom spawn inoculum used here was Variaty Jaeju 1.

1. Analysis of composition of logs

The quantitative analysis of cellulose, lignin, ash, pentosan, alcohol-benzen extract and NaOH extract contained in logs was performed.

2. Mycelial growth in sawdust medium

The sawdust were prepared from the logs of *Q. incana* and *Q. serrata*, and moisture content was adjusted to 60±2%. These were put into the test tubes to reach 80mm in hight, and sterilized at 121°C for 60 minutes.

After sterilization, top side of sawdust media were inoculated with spawn inoculum and placed in incuator and kept at. 20~25°C for 30 days.

The vegetative growth of mycelium on sawdust media of *Q. incana* and *Q. serrata* were compared every two days.

3. Mycelial growth on logs

A. *In vitro* experiment

Small branches of *Q. incana* and *Q. serrata*, 150mm in length and 15~20mm in diameter, were sterilized at 121°C for 60 minutes.

The sterilized branches were then placed into the test tubes that contain spawn inoculum. The inoculated branches kept in the incubator at 20~25°C for 30 days.

The vegetative growth of mycelium on pieces of branch were observed on two days intervals. Mycelial growth in the internal part of wood were investigated on 50th day after inoculation.

B. Field experiment

Holes were made in a spiral order around the log by electric drill and spawn was inoculated into each hole. The diameter of holes was 1.0~1.5cm and depth was 1.5~2.0cm.

After inoculation, holes were plugged with bark plug and logs were layed down under needle-forest. Inoculated logs were covered with reed blind for protection from direct sunlight and drying out during cultivation.

The survival rate and the state of mycelial growth of mushroom spawn in logs were investigated on 50th day after inoculation.

Three replications were made for each experiments except chemical analysis of log composition.

Results

1. Composition of logs

The composition of *Q. incana* and *Q. serrata* were as follows, (Table 1).

Table 1. Chemical composition of *Q. incana* and *Q. serrata*

Chemical Component	Percentage	
	Q. incana	*Q. serrata*
Cellulose	68.4	75.6
Lignin	21.0	21.4
Pentosan	20.6	22.3
Alcohol-benzen extract	7.3	3.3
Ash	3.17	1.29
1% NaOH extract	22.1	16.2

The contents of alcohol-benzen extract, ash and NaOH extract in *Q. incana* were higher than in *Q. serrata* by 4, 1.88 and 5.9% respectively, the con tents of cellulose, lignin and pentosan in ○. *incan a* were lower than in *Q. serrata* by 12.8, 0.4 and 1.7 percentage.

2. Mycelial growth in sawdust medium

The growth rates for mycelia of oak mushroom in sawdust media were determined by linear growth measurement on every two days.

The mycelium spread over the entire area of

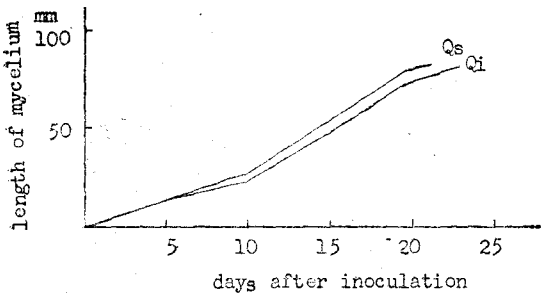

Fig. 1. Linear growth of mycelium of oak mushroom in sawdust medium.
Qi : *Quercus incana*
Qs : *Quercus serrata*

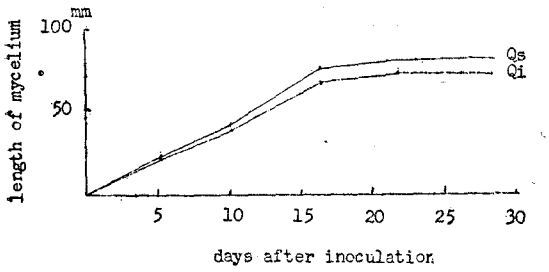

Fig. 2. Growth appearance of the oak mushroom mycelia on sawdust of *Q. serrata* and *Q. incana*, 30 days after inoculation.

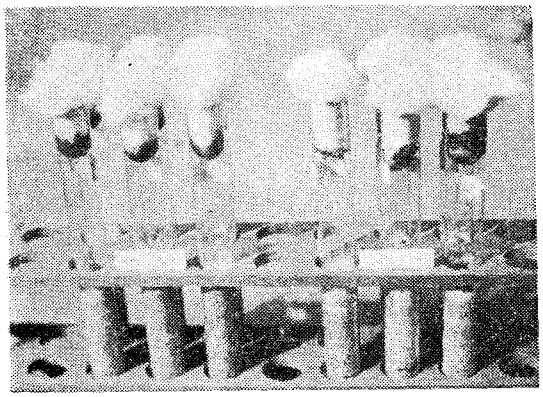

Fig. 3. Linear growth of mycelium of oak mushroom on bark of branch piece.
Qi: *Quercus incana*
Qs: *Quercus serrata*

sawdust medium of *Q. incana* on 23 days after inoculation while it took 19 days in the case of *Q. serrata*(Fig. 1). Though, mycelial growth was more compact on sawdust media of *Q. incana* than *Q. serrata* (Fig. 2).

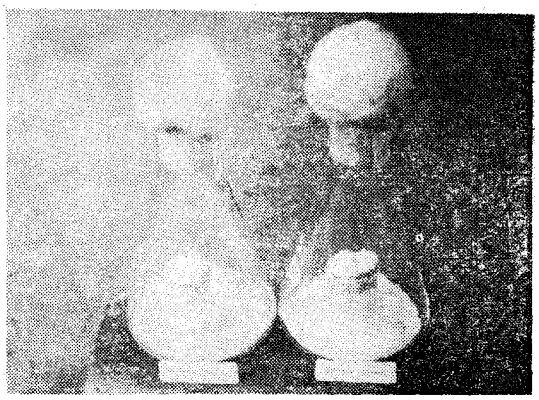

Fig. 4. The appearance of mycelial growth of oak mushroom on branch pieces of *Q. serrata* and *Q. incana*, 30 days after inoculation.

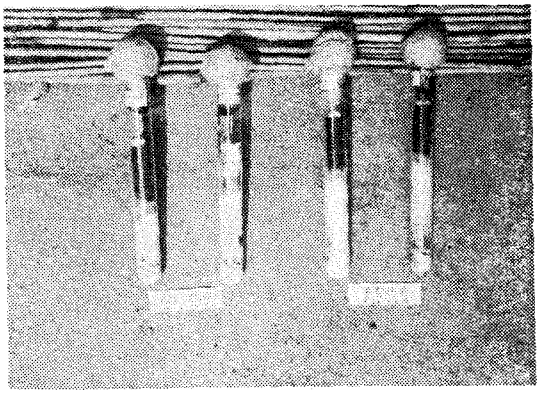

Fig. 5. The appearance of mycelial growh of oak mushroom on branch pieces of *Q. incana* and *Q. serrata*, 25 days after inoculation.

3. Mycelial growth in logs

A. *In vitro* experiment

The growth rate of mycelia of oak mushroom on the bark of branch piece were determined by measuring the linear growth of mycelium.

Mycelial growth of oak mushroom were more rapid on *Q. serrata* than on *Q. incana*. 40 days after inoculation, mycelial growth was 90mm on average in the former and 71mm in the latter.

Mycelial growth was more compact on *Q. incana* than *Q. serrrata*(Fig. 4~5).

In the internal part of wood, mycelial growth of oak mushroom were more rapid on *Q. serrata* than on *Q. incana*. 50 days after inoculation, the linear growth of mycelium was 117mm on the average in the former and 69mm in the latter (Table 2).

Table 2. Mycelial growth of oak mushroom in the internal wood part of *Q. incana* and *Q. serrata*, 50 days after inoculation

Oak Species	Growth of mycelium (mm)									
	I		II		III		Average			
Q. Incana	69	70	66	67	70	71	69	68	72	69
Q. serrata	116	113	118	117	121	119	114	120	115	117

B. Field experiment

There was no difference in the survival rate of oak mushroom spawn grown on *Q. incana* and *Q. serrata*. The survival rate was 95 percentage in both oak species(Table 3, and Fig. 6).

Then, the first fruit bodies on logs of *Q. serrata* and *Q. incana* were appeared 16 months after inoculation of spawn(Fig. 7).

Table 3. The survival rate and vegetative growth of oak mushroom mycelium in formative tissue of logs in natural condition, 50 days after inoculation.

Oak Species	Growth of mycelium (mm)				Survival rate (%)			
	I	II	III	Average	I	II	III	Average
Q. incana								
width	12	12	15	13	94	94	96	95
length	52	54	54	53				
Q. serrata								
width	19	19	20	18	91	97	97	95
length	72	71	73	72				

Vegetative growth of mycelium on *Q. serrata* was superior to that of *Q. incana* The size of area, the mycelia spreaded over there, was 18×72mm on the average in *Q. serrata* and 13×53mm in *Q. incana*.

Discussion

Mycelia of oak mushroom grew more rapidly in *Q. serrata* than in *Q. incana*. On the other hand, mycelial growth was more compact on *Q. incana* than *Q. serrata*. There was no difference in the survival rate of mycelia between the two oak species, i.e. the mycelium survived well on both two species.

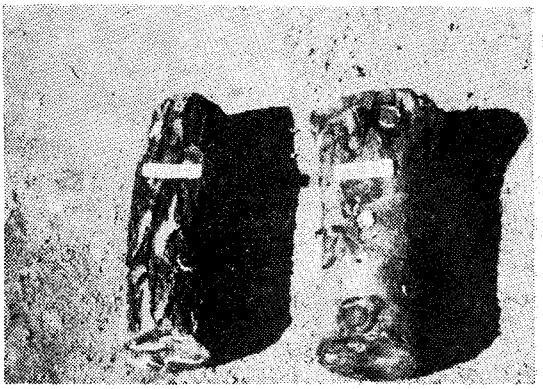

Fig. 6. The appearance of vegetative growth of oak mushroom on logs of *Q. serrata* and *Q. incana* in natural condition, 40 days after inoculation.

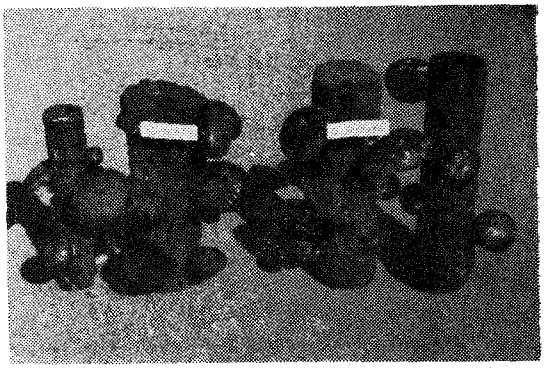

Fig. 7. Fruit-bodies on logs of *Q. serrata* and *Q. incana* in natural condition, 16 months after inoculation.

Q. incana had higher content than *Q. serrata* in alcohol benzen extract, NaOH extract and ash, but lower in its content of cellulose, lignin and pentosan.

Ishikawa(1960) reported that cellulose, lignin and pentosan decreased when oak mushroom was cultivaated in oak logs and these components are being used by oak mushroom for its growing. He also reported that cellulose, Lignin and pentosan are being taken primarily at the first growing stage of oak mushroom and cellulose is being taken at the later stage,

His experimental results coincides with that of present study. Mycelial growth was slow in *Q. incana* which had less content in cellulose and pentosan than *Q. serrata*. And this difference in the contents of cellulose and pentosan may have effects on the mycelial growth of oak mushroom.

It may be concluded that the survival and mycelial growth of mushroom is possible on *Q. incana*. Though it is slower in its vegetative growth than on *Q. serrata*.

Further research concerning with fruit body formation on log, quality of mushroom and its productivity is thought to benecessary before final conclusion on the possibility of oak mushroom cultivation on *Q. incana* is made.

要 約

本 實驗은 印度 Simla地方에서 自生하고 있는 참나무 Ban oak(*Q. incana*)의 표고栽培利用 可能性을 檢討하기 爲하여 遂行되었다. 표고 菌糸의 活着과 發育 및 子實體의 發生狀況을 觀察하고 原木成分을 韓國의 졸참나무(*Q. Serrata*)와 比較 調査한 結果는 다음과 같다.

1. *Q. incana*는 *Q. serrat*에 比하여 Alcohol-Benzen extract. NaOH extract 및 Ash의 含有量이 많았으나 cellulose pentosan은 적었다.
2. *Q. incana*를 利用한 톱밥培地에서의 菌糸發育은 *Q. serrata*보다 伸長速度는 늦으나 菌糸가 緻密하게 發育하였다.
3. 原木에서의 菌糸發育은 室內試驗이나 野外試驗 共히 *Q. serrata*가 빨랐으며 菌糸의 活着率은 두 樹種間에 差異가 없고 良好하였다.
4. 原木에 種菌接種後 16個月만에 Ban oak(*Q. incana*) 및 졸참나무(*Q. serrata*)에서 첫 버섯이 發生하였다.
5. 以上의 結果에서 Ban oak(*Q. incana*)를 利用한 표고栽培는 可能하다고 思料된다.

References

Akizama, Hiro-o : (1974) The new cultivation of Shiitake in a short period. Mus. Sci. (part 1) 423～433.

Ando Masatake : (1974) Fruit-body formation of *Lentinus dodes*(Berk) Ito et Inai on the artificial media. Mus. Sci.(Part 1) 415～422.

溫水竹則(1956) : シイタケ 子實體の發生時期, 安滕正武發生量および形態 林試研報 116 : 27～57

日高俊昭 : (1974)シイタケ種菌 活力檢定試驗 宮崎林試研報 7 : 64～65

河合晃 栢木仁悅 : (1968)シイタケ子實體の生長溫度と收穫數量との關係 菌蕈研報 3 : 53～81.

森喜 : (1963)シイタケ 栽培の研究 (養賢堂發行)

時本景亮 河合 : (1977)シイタケの 子實體發生とほ木の渡分動態 菌蕈研報 15 : 65～69

石川久雄 : (1960)椎茸菌糸生育た關係する木材成分について菌蕈 6 : 7～11.

石川久雄, 波邊計(1961) : シイタケ菌による木材主要成分特たリグニンの分解について菌蕈研報, 1 : 35～43