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Culture Conditions Affecting the Optimal Mycelial Growth of *Cystoderma amianthinum*

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***Cystoderma amianthinum*, one of edible fungi belongs to Agaricaceae of Basidiomycota, has a good taste and flavor. This study was carried out to obtain the basic informations for the optimum mycelial growth of *C. amianthinum*. The optimal conditions for the mycelial growth were 25°C and pH 5 in potato dextrose agar (PDA). *C. amianthinum* showed the favorable growth in the PDA and yeast malt extract agar (YMA). The favorable carbon and nitrogen sources promoting mycelial growth were fructose and histidine, respectively. The optimum C/N ratio was about 30 : 1 in case that 1% glucose was supplemented to the basal medium as a carbon source.**

KEYWORDS: Cultural conditions, *Cystoderma amianthinum*, Edible mushroom, Mycelial growth

Cystoderma amianthinum (Scop. Ex Fr.) Fayod, an edible mushroom belongs to Agaricaceae of Agaricales and has been known to be as leaf-decay fungi occurring in a gregarious style on soil surface in the forest of conifer trees for the duration of summer to fall (Park and Lee, 1996). *C. amianthinum* has been distributed not only in the region of Australia and Africa but in the northern areas of Asia such as Korea, China and Japan. Pileus is the range of 1.4~4.5 cm in diameter, convex in the early stage of its development and then opens gradually to a umbonate plane when it grows. The stipe is stiff and has a range of 2.5~6 cm in length and 0.2~0.7 cm in diameter. The spore is composed of an ellipsoidal morphology with 5~7.5 × 2.5~3.5 cm in size, and white color in spore print. *C. amianthinum* has been known to contain nutrient sources such as protein, amino acid, vitamin, an inorganic salt, lipid and glucose, which are important for promoting the growth of human body. Since *C. amianthinum* is not only good in taste and flavor but also outstanding in its pharmacological effect, the fruiting bodies have been extensively used for manufacturing traditional foods and medicines. The purpose of this study was focused to obtain basic data for an artificial cultivation of *C. amianthinum*. Therefore, this study was carried out to investigate the culture conditions affecting the optimal mycelial growth of *C. amianthinum*.

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The fruiting body of *Cystoderma amianthinum* was collected at Mt. Halla, Jeju island, Korea in November, 2001. The pure culture of *C. amianthinum* was obtained as previously described (Shim *et al.*, 2005), and deposited to the "Culture Collection of Wild Mushroom Species" and acquired accession number, "IUM00183". To determine favorable culture conditions for mycelial growth of *C. amianthinum*, the fungus was cultivated using ten different media (Shim *et al.*, 2005).

Cultural conditions of *C. amianthinum*.

Effect of pH The pH value suitable for a favorable growth of *C. amianthinum* was obtained in the pH 5, and its mycelial growth had been decreased gradually in proportion to the gradual rise of pH values (Fig. 1). Choi *et al.* (1999) reported that mycelial growth of *P. japonica* was optimal at pH 7. Shim *et al.* (2003) also reported that *P. sinclairii* showed the maximal mycelial growth at pH 8. Since the mycelial growth of *C. amianthinum* was generally favorable in the pH range of 4~6, *C. amianthinum* may have an acidic pH range for its favorable mycelial growth in nature.

Effect of temperature: The temperature suitable for the mycelial growth of *C. amianthinum* was obtained at 25°C (Fig. 2) and the result was similar to that of Lee *et al.* (1999). Lee *at al.* (1999) reported that the mycelial growth of *C. amianthinum* had been expedited gradually in proportion to the rise of temperature and was exceed-

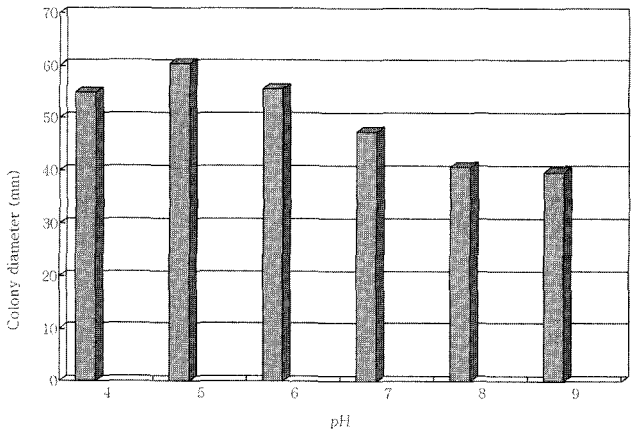

Fig. 1. Mycelial growth of *Cystoderma amianthinum* on the PDA at different pHs for 20 days of incubation at 25°C.

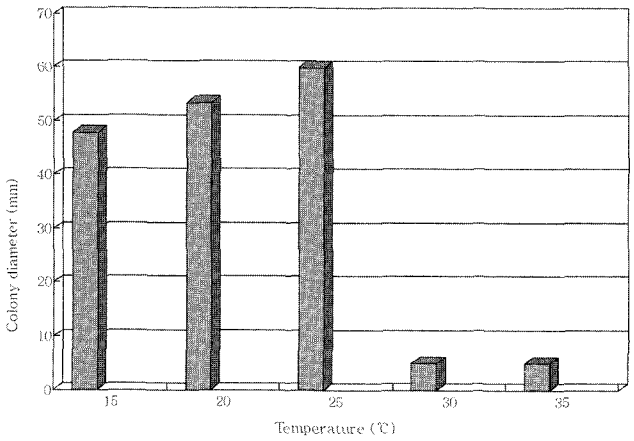

Fig. 2. Mycelial growth of *Cystoderma amianthinum* on the PDA for 20 days of incubation at different temperatures.

ingly favorable at 25°C. Even though the mycelial growth of *C. amianthinum* was exceedingly favorable at 25°C and had been expedited by gradual increase of temperature, its mycelial growth appeared to be drastically suppressed above the temperature of 30°C (Fig. 2).

Screening of favorable culture media: Ten different culture media were used to screen the optimal mycelial growth of *C. amianthinum*. Of 10 culture media (Shim *et al.*, 2005), YMA medium was exceedingly favorable for promoting mycelial growth of *C. amianthinum* whereas glucose triptone medium was extremely poor (Table 1). PDA medium was also suitable for a favorable growth of *C. amianthinum*.

Effect of carbon and nitrogen sources: The mycelial growth of *C. amianthinum* was checked on each of the basal media which were supplemented with 11 carbon sources and 17 nitrogen sources, respectively. Fructose and histidine were screened as carbon and nitrogen source suitable for the mycelial growth of *C. amianthinum* (Table 2 and Table 3). After 30 days of incubation, the colony diameter of *C. amianthinum* was recorded 37.4 mm in fructose and 77.4 mm in histidine, respectively. Shim *et al.* (1997) reported that glucose, one of monosaccharides was exceedingly good for promoting a mycelial growth of *Grifola umbellata*. However, it was observed that glucose was unsuitable for promoting the mycelial growth of *C. amianthinum* (Table 2). As described on Table 2, fructose, one of monosaccharides was screened as carbon source suitable for the mycelial growth of *C. amianthinum*. Chi *et al.* (1996) reported that though each of some monosaccharides was supplemented in the basal medium to check a mycelial growth of *Phellinus linteus*, its mycelial growth was dissimilar among monosaccharides. Though each of some monosaccharides was used to check the

Table 1. Mycelial growth of *Cystoderma amianthinum* on various culture media

Culture medium	Colony diameter[a] (mm)	Mycelial density[b]
Czapex dox	19.7	SC
Glucose peptone	37.9	C
Glucose triptone	6.3	C
Hamada	37.8	C
Hennerberg	13.7	SC
Hoppkins	20.4	SC
Lilly	46.4	SC
Mushroom complete	51.9	C
PDA	60.8	C
YMA	63.7	C

[a]The colony diameter was measured at 20 days after incubation.
[b]Mycelial density: C, Compact; SC, Somewhat compact; ST, Somewhat thin; T, Thin.

Table 2. Effect of carbon sources for the mycelial growth of *Cystoderma amianthinum* in the basal medium[a]

Carbon source[b]	Colony diameter[c] (mm)	Mycelial density[d]
Dextrin	34.8	T
Fructose	37.4	T
Galactose	24.5	T
Glucose	24.3	T
Lactose	31.0	T
Maltose	27.4	T
Mannitol	27.5	T
Mannose	27.3	T
Sorbitol	30.3	T
Sucrose	24.9	T
Xylose	21.8	T

[a]The basal medium was composed of $MgSO_4$ 0.05 g, KH_2PO_4 0.46 g K_2HPO_4 1.0 g, Peptone 5 g, Thiamine-HCl 120 μg, agar 20 g and D. W. 1000 *ml*.
[b]Each carbon source was added to the basal medium at the concentration of 0.1 M.
[c]The colony diameter was measured at 40 days after incubation.
[d]Mycelial density: C, Compact; SC, Somewhat compact; ST, Somewhat thin; T, Thin.

Table 3. Effect of nitrogen sources for the mycelial growth of *Cystoderma amianthinum* in the basal medium[a]

Nitrogen source[b]	Colony diameter[c] (mm)	Mycelial density[d]
Alanine	68.3	SC
Ammonium acetate	46.5	SC
Ammonium oxalate	16.8	SC
Ammonium phosphate	72.9	C
Arginine	71.5	C
Asparagine	7.2	C
Calcium nitrate	5.6	ST
Glutamic acid	72.6	C
Glutamine	26.7	C
Glycine	37.3	C
Histidine	77.4	C
Methionine	11.6	SC
Phenylalanine	18.7	C
Potassium nitrate	16.4	ST
Sodium nitrate	30.6	ST
Valine	11.9	SC
Urea	5.3	SC

[a]The basal medium was composed of $MgSO_4$ 0.05 g, KH_2PO_4 0.46 g K_2HPO_4 1.0 g, Thiamine-HCl 120 μg, agar 20 g and D. W. 1000 *ml*.
[b]Each carbon source was added to the basal medium at the concentration of 0.1 M.
[c]The colony diameter was measured at 40 days after incubation.
[d]Mycelial density: C, Compact; SC, Somewhat compact; ST, Somewhat thin; T, Thin.

mycelial growth of edible fungi, it may be reasonable to mention that the mycelial growth can be dissimilar according to indigenous characteristics of edible fungi. Histidine, one of amino acids was screened as nitrogen source suitable for the mycelial growth of *C. amianthinum* (Table 3). Though asparagine, one of amino acids was used to check the mycelial growth of *C. amianthinum*, its mycelial growth was extremely poor in the basal medium supplemented with asparagine. This result seemed to confirm that the mycelial growth of *C. amianthinum* is dissimilar in different sources of amino acids.

Effect of C/N ratio: Optimum C/N ratio suitable for a favorable growth of *C. amianthinum* was observed in the culture media which were mixed with 1% glucose as carbon source and then adjusted to C/N ratio of 30 : 1. On the culture media which were mixed with 1% glucose as carbon source and then adjusted to the C/N ratio of 30 : 1, colony diameter of *C. amianthinum* recorded 55.7 mm (Table 4). Generally, the mycelial growth of *C. amianthinum* seemed to be suppressed in proportion to the gradual rise of C/N ratio. Song and Cho (1987) reported that optimum C/N ratio suitable for a favorable growth of *Lentinula edodes* was observed in the C/N ratio of 30:1. Also, Shim *et al.* (1997) suggested that optimum C/N ratio suitable for a favorable growth of *G. umbellata* was observed in the C/N ratio of 30:1. it was considered that our result was similar to that of Shim *et al.* (1997).

Table 4. Mycelial growth of *Cystoderma amianthinum* on various C/N ratio in the basal medium[a]

C/N[b] ratio	Colony diameter[c] (mm) at different D-glucose concentrations (%)			
	1	2	3	4
10 : 1	26.9	26.7	20.3	21.8
20 : 1	25.9	24.8	22.8	24.9
30 : 1	55.7	23.6	25.7	24.1
40 : 1	25.1	24.7	27.5	26.3

[a]The basal medium was composed of $MgSO_4$ 0.05 g, KH_2PO_4 0.46 g K_2HPO_4 1.0 g, Thiamine-HCl 120 μg, agar 20 g and D. W. 1000 *ml*.
[b]The ratio of $NaNO_3$ versus D-glucose was adjusted to the ratio of 10 : 1, 20 : 1, 30 : 1 and 40 : 1, respectively.
[c]The colony diameter was measured at 30 days after incubation.

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