Mycopath (2013) 11(1)**:** 19-22 **Research Article**

Cultural studies on chinese mushroom (*Volvariella volvaceae*)

Rukhsana Afzal, *Sheikh Muhammad Iqbal and Umer Iqbal

National Agriculture Research Centre, Islamabad
**Corresponding author's email: iqbalsh65@hotmail.com*

Abstract

The effect of different culture media, pH levels, temperature, and carbon and nitrogen sources on the mycelial growth of *Volvariella volvaceae*, a Chinese edible mushroom, was evaluated *in vitro*. The fungus grew better on malt extract agar followed by Sabaroud's agar medium, while showed poor growth on corn meal agar. The mycelia growth was maximum at pH 7.0- 8.0 and 35 °C. Among the five tested carbon sources, glucose significantly stimulated the growth of the fungus followed by starch and maltose. Of the four nitrogen sources, peptone was better and urea was found to be the least effective.
Keywords: Carbon sources, Chinese mushroom, *Volvariella volvaceae.*

Introduction

Volvariella volvaceae (Bull. Ex Fr.) Sing. is an edible mushroom, generally known as Chinese or paddy straw mushroom belongs to phylum Basidiomycota, order agaricales and family pluteaceae. It is sixth most cultivated species all over the world. This mushroom instigates from China in start of 19th century and introduced to other southeast Asian countries in first half of 20th century (Chang 1978; 1999). The fruiting body is egg shaped initially which subsequently become bell shaped with a characteristic vulva and has a greyish-brown cap. Enrichment of Chinese mushroom with essential nutrients i.e. protein, carbohydrates, fats and fibres makes it highly valuable. Moreover, it represents significant therapeutic behaviour such as antitumor, immunomodulatory, hypocholestrolemic and antioxidative etc. (Crison and Sands 1978; Lin and Chou 1984; Hsu *et al.*, 1997; Cheung 1998). Different substrates like cotton waste, rice husk, cassava peels could be utilize to cultivate *V. volvaceae*. In Pakistan, despite the presence of favorable environmental conditions and required waste material, information about mushroom growing technology was lacking. Therefore, some cultural aspects like pH, temperature, culture media, nitrogen and carbon sources on mycelial growth of the fungus were studied *in vitro.*

Materials and Methods

Mycelia of *V. volvaceae* were isolated from the fruiting bodies and cultured on potato dextrose agar (PDA) medium. After incubation period pure cultures of the fungus were utilized for further experimentation. Different growth parameters like effect of carbon, nitrogen, growth media, temperature and pH were assessed. Following five culture media were used to find out the most appropriate one for the mycelial growth of the fungus. Malt extract agar medium (malt extract 20 g; agar 20 g; dextrose 20 g; peptone 4 g), Sabouroud's agar medium (dextrose 40 g; agar 20 g; peptone 10 g), potato dextrose agar medium (potato starch 20 g; dextrose 20 g; agar 20 g), corn meal agar medium (cornmeal 20 g; dextrose 20 g; agar 20 g) and, Waksman's agar medium (agar 20 g; glucose 10 g; peptone 5 g; potassium dihydrogen phosphate 1 g; magnesium sulphate 0.5 g).

Each culture medium was prepared in one liter of water and autoclaved at 120 °C for 20 minutes. These were cooled to 45 °C and then poured to 90 mm Petri dishes for solidification. Fungus was inoculated on each medium and inoculated Petri plates were incubated at 35 ºC for 7 days. Radial growth of the fungus myceliam was assessed 7th day of incubation. The effect of pH was assessed by keeping the pH of growth medium (Sabouroud's agar medium) from 5.0 to 10 with difference of 1 with HCl and NaOH before autoclaving. The fungus was inoculated on growth medium and incubated at 35 °C for 7 days. The influence of temperature was checked at 25 °C, 30 °C and 35 °C by keeping pH constant (7.5). Sabouroud's agar medium was used as the medium for studying the effect of carbon and nitrogen sources. Five carbon compounds viz.,; glucose 13.5 g, sucrose 12.5 g, starch 12.5 g, maltose 13.5 g and mannitol 13.5 g were amended in Sabouroud's agar medium.

Potassium nitrate 10 g, sodium nitrate 8.5 g, urea 8.5 g and peptone 2.5 g were tried individually as a constitute of nitrogen source in Sabouroud's agar medium.

All these experiments were conducted in triplicates.

Results and Discussion

Effect of different culture media:

The results of the experiment revealed that malt extract agar medium was the best one for the radial growth (88.3 mm) of *V. volvaceae,* followed by (72.2 mm) on Sabouroud's agar medium. Waksman's agar medium and potato dextrose agar medium represented 57.8 and 52.5 mm growth of fungus, respectively, while corn meal agar showed poor radial growth of fungus (25.8 mm) (Fig. 1). The maximum growth on malt extract agar could be due to maximum supply of nutrients, water contents and aeration (Jablonski, 1981; Ingold and Hudson, 1993; Edward, 2000). Munj *et al*. (1997) also report effectiveness of malt extract agar medium for *Ganoderma lucidum*.

Effect of different pH levels

pH act as an important factor for the growth of microorganisms. The maximum growth of the fungus was observed at pH 7.0-8.0, whereas minimum at pH 5.0 (Fig. 2).

Effect of temperature

It is obvious that the fungus can grew on all the temperature tested (Fig. 3) but the maximum radial growth 82.3 mm was observed at 35 °C. It is followed by 30 °C and 25 °C at which 71 and 60 mm growth was observed, respectively.

The results are in agreement with Chang and Yau (1977), Fasidi (1996) and Kuforiji and Fasidi (1998).

Effect of carbon sources

The results revealed that among the carbon sources, glucose considerably supported the growth of fungus with radial growth of 82.7 mm and regarded as the best carbon source. Glucose is a monosaccharide and its utilization may be due to its readily metabolization for the production of cellular energy (Jandaik and Kapoor, 1976; Garaway and Evans, 1984; Griftin, 1994). Starch and maltose also showed momentous effect on fungus with radial growth 72.3 and 74.3 mm, respectively. Their utilization showed that fungus may transform complex carbon compounds to simpler one for easily metabolization (Bais *et al*., 1970). Sucrose has a least effect among all carbon sources having radial growth 21mm (Fig. 4). Glucose utilization was also reported by different workers (Jonathan and Fasidi, 2001) on *Psathyrella atroumbonata*

Effect of nitrogen sources

The results of the experiment determined that the peptone supports the best growth of the fungus among all the tested nitrogen sources. The preference of this compound may be due to its composition of carbon and amino acid (Garraway and Evans, 1984). KNO_3 and $NaNO_3$, are the inorganic nitrogen sources, represent the moderate radial growth 56.8 and 48.2, respectively. Whereas urea act as a least effective one having radial growth 27.7 mm (Fig. 5). Similar effect of peptone was also reported by Gbolagade (2006) on *Lepiota procera*, and Munj *et al*. (1997) on *Ganoderma lucidum*.

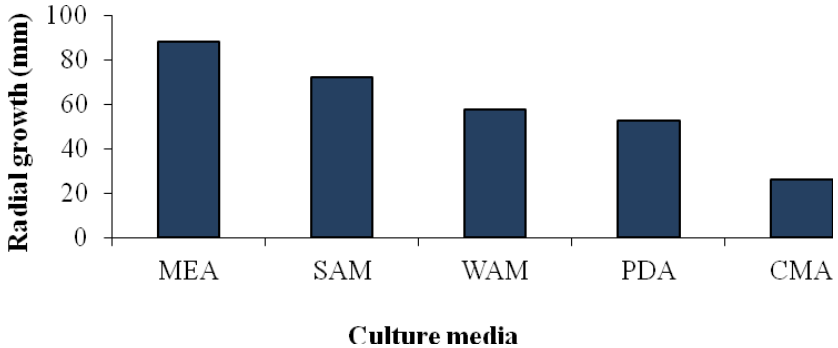

Fig. 1: Effect of different culture media on the radial growth (mm) of *Volvariella volvacea.* MEA (malt extract agar), SAM (Sabouroud's agar medium), WAM (Waksman's agar medium), PDA (potato dextrose agar), CMA (corn meal agar).

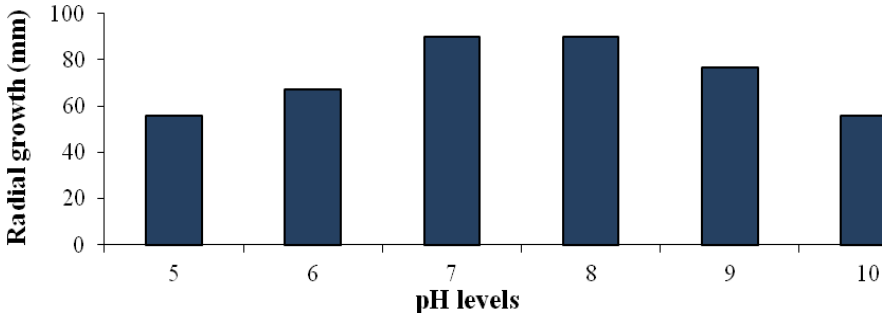

Fig. 2: Effect of different pH levels on the radial growth (mm) of *Volvariella volvacea.*

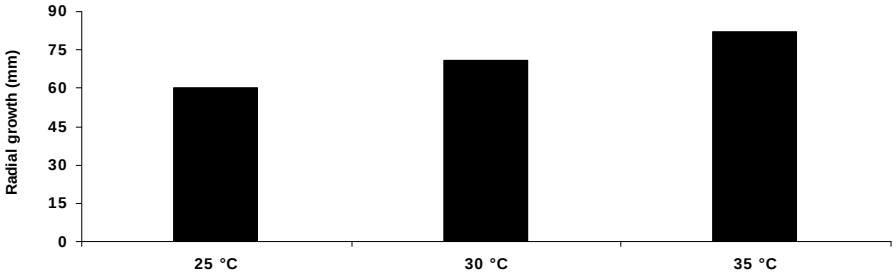

Fig. 3: Effect of different temperatures on the radial growth (mm) of *Volvariella volvacea.*

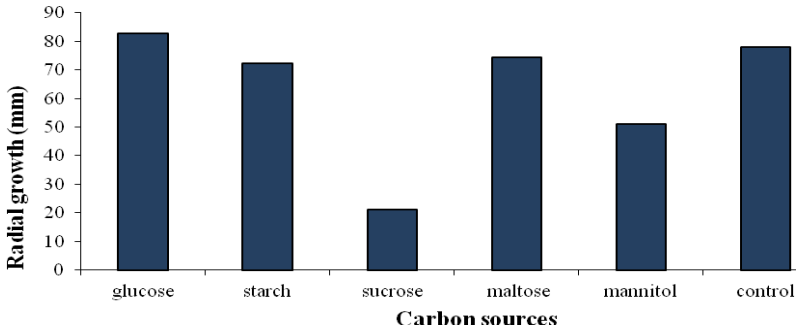

Fig. 4: Effect of different carbon sources on the radial growth (mm) of *Volvariella volvacea.*

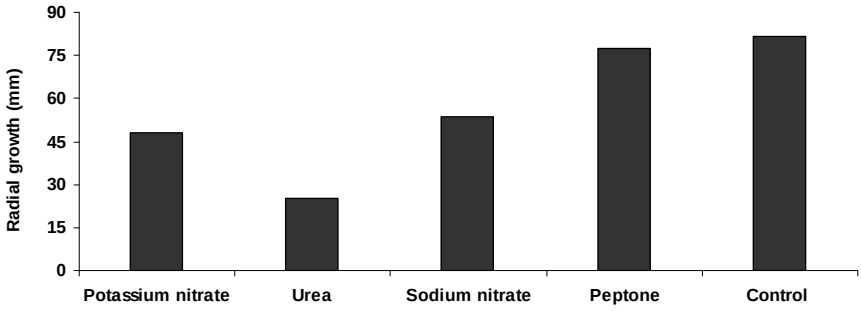

Fig. 5: Effect of different nitrogen sources on the radial growth (mm) of *Volvariella volvacea.*

References

Bais BS, Singh SB, Singh DV,.1970. Effect of different carbon and nitrogen sources an the growth and sporulation of *Curvularia pallescens*. *Indian Phytopathol*., **23**: 511-517.

Chang ST, Yau CK, 1977. Comparative study of the physiology of *Volvariella volvacea* and *Coprinus cinerea*. *Trans. Br. Mycol. Soc*., **68**: 167-172.

Chang ST, 1978. *Volvariella volvacea*. In: The biology and bultivation of edible Fungi. Chang, S.T. and W.A. Hayes. eds. Academic press, New York. pp. 573-605.

Chang ST, 1999.World production of cultivated edible and medicinal mushrooms in 1997 with emphasis on *Lentinula edodes* (Berk.) Sing. in China. *Int. J. Med. Mushr*., **1**: 291-300.

Cheung PC, 1998. Plasma and hepatic cholesterol levels and faecal neutral sterol excretion are altered in hamsters fed straw mushroom diets. *J. Nutr*., **128**: 1512-1516.

Crison EV, Sands A, 1978. Nutritional value. In: The Biology and Cultivation of Edible Mushrooms. Chang, S.T. and W.A. Hayes. eds. Academic press, New York. pp. 168-187.

Edward R, 2000. The missing link. mushrooms in permaculture Magazines. **25**: 37-39.

Fasidi IO, 1996. Studies on *Volvariella esculenta* (mass) Singer: Cultivation on agricultural wastes and proximate composition of stored mushrooms. *Food Chem*., **55**: 161-163.

Garraway OM, Evans CR, 1984. Fungal nutrition and Physiology. New York: John Wiley.

Gbolagade JS, 2006. The effect of different nutrient sources on biomass production of *Lepiota procera* in submerged liquid cultures. *Afr. J. Biotechnol*., **5**: 1246-1249.

Griftin DH, 1994. Fungal physiology (2nd ed). New York: Wiley Liss.

Hsu HC, Hsu CI, Lin RH, Kao CL, Lin JY, 1997. Fip-vvo, a new fungal immunomodulatory protein isolated from *Volvariella volvaceae*. *Biochem. J*., **323**: 557-565.

Ingold CT, Hudson HJ, 1993. The Biology of Fungi. 6th ed. Champan and Hall. pp. 179-206.

Jandaik CL, Kapoor JN, 1976. Effect of carbon and nitrogen nutrition on growth of *Pleurotus sajor-caju*. *Indian Phytopathol*., **29**: 326-327.

Jonathan SG, Fasidi IO, 2001. Effect of carbon, nitrogen and mineral sources on the growth of *P. atroumbonata* (Pegler), a Nigerian edible mushroom. *Food Chem*., **72**: 479-483.

Jablonski L, 1981. Changes in biochemical and physiologicaL activities of substrates colonized by fungi *Pleurotus ostreatus*, *Lentinus edodes* and *Agrocybe negirita*. *Mush. Sci*., **11**: 659-673.

Kuforijii OO, Fasidi IO, 1998. Growth requirement of *Pleurotus teberregium*, a Nigerian mushroom. *Proc. Nigerian Soc. Microbiol*., **1**: 73-78.

Lin JY, Chou TB, 1984. Isolation and Characterization of lectin from edible mushrom, *Volvariella volvacea*. *J. Biochem*., **96**: 35-40.

Munj ZR, Iqbal SM, Khan SM, 1997. Physiological studies on *Ganoderma lucidum*. *Pak. J. Phytopathol*., **9**: 159-162.