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Production of Mushroom *(Pleurotus ostreatus)* in Egypt as a Source of Nutritional and Medicinal Food

Ayman S. Daba, S.S. Kabeil, William A. Botros and M.A. El-Saadani

Mubarak city for scientific Research and Technology Applications, Alexandria, Egypt

INTRODUCTION

Mushroom production is completely different from growing green plants. Mushroom is a fungus belong to basidomycata division.Mushrooms do not contain chlorophyll and therefore it known as eukaryotic heterotrophs which obtain food from decay in organic matter.Which has aclub - shaped reproductive structure The part of the organism that we see and call a mushroom is really just the fruiting body. Unseen is the mycelium-tiny threads that grow throughout the substrate and collect nutrients by breaking down the organic material. This is the main body of the mushroom. Generally, each mushroom species prefers a particular growing medium, although some species can grow on a wide range of materials.

It is strange that even though mushroom must have been known to very early civilizations, we have no evidence from Sumerian, Babylonian or even biblical sources to indicate attitudes to mushroom. After all, the usefulness of a plant measured only by weather or not it was edible or had a medicinal purpose. Imagine too how many deaths from mushroom poisoning must have occurred before the time of the first real chroniclers of mushrooms the Greeks and Romans.

From ancient times man has been interested in mushroom. Food of gods was what the Romans called mushroom. The Greek regarded mushrooms as providing strength for warriors in battles. The Pharaohs prized mushroom as a delicacy food. Certain kinds of mushroom have been welcomed as food and some as inebriants, but others have been shunned and feared because of their known or suspected poisonous nature.

It is not surprising that the mushroom, appearing as it does suddenly after rains and often in damp, dark places associated with decaying material, it does not have leaves or seeds and its saprophetic was of obtaining nutrition is not understood until fairly recently.

So far about 25 species of more than 2000 edible fungi are widely accepted for human consumption, but only few of them are commercially cultivated with technical advances. During the past few decades, the cultivation of mushroom has been spread worldwide [1]. Total mushroom production world wide has increased more than 18 folds in the last 32 years, from about 350,000 metric tons in 1965 to about 6,160,800 metric tons in 1997 (Table 1).

Since cultivated mushrooms can grow on agricultural and industrial wastes they constitute a source for obtaining food protein from such wastes and thus they can be marshaled to aid in solving many problems of global importance including protein shortages, resources recovery and environmental management. Different plant waste materials [3] were used as substrate for cultivation of mushroom (Table 2).

Mushrooms have been used as medicinal materials from 100 years ago.In the fields of Chinese 0riental medicine, dried mushrooms are used as diuretics and some other species have recently been getting attention as carcinostatic substances [4,5]. Historically starting from 1970s, Japanese researchers found that antitumour compounds in some mushroom species were polysaccharides whose basic structure was beta glucan. These polysaccharides were different from the usually used carcinostatic effects were based on the immunological enhancement in host.

Since Mushrooms contain high fiber content, plant sterol, Proteins, microelements, of lower caloric content are found almost ideal for a nutrition program aimed to the prevention of hypercholesterolemia and cardiovascular disease [6].

Moreover Mushroom as Part of natural hypocholesterolemic diets was suggested first in oriental medicine. Chibata [7], Suzuki and Ohshima [8] and Kurusawa *et al* [9] reported that Mushroom effectively Lowered plasma cholesterol in Laboratory animals.

Corresponding Author: Ayman S. Daba, Mubarak city for scientific Research and Technology Applications, Alexandria, Egypt

Table 1: World production of Mushrooms

Mushroom species	Fresh weight (x 1,000 t) 1986		1997	
Agaricus bisporus	1.227	56.2%	1.956	31.8%
Lentinula edodes	314	14.4%	1.564	25.4%
Pleurotus spp.	169	7.7%	876	14.2%
Auricularia.	119	5.5%	485	7.9%
Volvariella volvacea	178	8.2%	181	3.0%
Grifola frondosa	---	---	33	0.5%
Others	175	8.0%	1,063	17.2%
Total	2.182	100.0%	6.158	100.0%

*Production % in relative to the total production [2].

Table 2: Composition of substrate materials

Substrate	Lignin%	C%	N%	C:N	pH	Ash%
Beech sawdust	30.6	48	0.09	510	5.0	0.52
Reed stems	20.1	42	0.84	50	4.0	8.71
Rape straw	22.7	48	0.63	70	6.0	5.77
Sunflower stalks	25.1	43	0.73	60	5.8	8.32
Rice Husks	29.0	35	0.50	70	5.9	19.00

(Source: Zadrazil, [3]

The following is a report of 2 years research work carried out to identify suitable conditions for growing mushroom in Egypt. A fair degree of success was obtained for growing Pleurotus mushroom.The process of production has been established and cultivation is presently being carried out on a small scale in mushroom growing room. The authors would be pleased to receive comments and reprints from other researchers workers about their recent experience on cultivation of mushroom.

Mushroom Growing Program in Egypt: Mushroom production began in this country about 20 years ago and with it became a new and alternative demand for poultry and animal protein fresh mushrooms. The demand is increasing rapidly as consumers discover the delicious meaty flavor of mushrooms.

A considerable number of mushrooms are edible, but no one should experiment with eating them unless he is fully familiar with the poisonous ones that must be avoided. In Egypt, only a minute proportion of fruit bodies for sale in shops and markets, they are always either *Pleurotus* or *Agaricus* mushroom.The Egyptians are in general highly suspicious of mushroom and few are prepared to eat any mushroom cultivation is an exercise in applied ecology and not a pure culture process, except for the initial production of spawn. Spawn prepared in special laboratories, consist of dried pure culture of the fungus impregnating sterilized compost Spawn making is so critical that separate industries have been established for this purpose. Ray and millet grains are generally used for commercial spawn making,but theoretically any type of grain,which does not become soft when boiled,may be used

Fig. 1: Mushroom Growing room at Mubarak city for Scientific Research and Technology Applications Alexandria, Egypt

The primary substrate used for *Pleurotus* spp. production in Egypt are chopped rice straw (5 cm) other substrate include Wheat straw and cottonseed hulls. At Mushroom Research Center (Mubarak city for scientific research and technology applications, Egypt) Figure 1, the substrate is filled into galvanized metal boxes with perforated floors.The substrate is subjected to prefermentation or pasteurization for 1hour in order to destroy the vegetative form of competing microorganisms. Spawn was transferred to polyethylene bags containing the sterilized rice straw substrate and left 21 days at 27 °C and humidity of 80%.

During spawn running, the growing hyphen interconnects and intertwines with pieces of the substrate to form the base for the production of fruit bodies. Increasing the amount of spawn used has resulted in increased yield the increased level of spawn would provide more energy for mycelial growth. After completion of the spawn run the bags were exposed to light by cutting holes of about 2 cm in diameter. Tiny knots of mycelia were formed which later on differentiated into tiny mushroom like structures called initials.The initials lengthened and enlarged to form mature fruit During spawn running, the growing hyphae interconnect and interwine with pieces of the substrate to form the base for the production of fruit bodies (Figure 2).

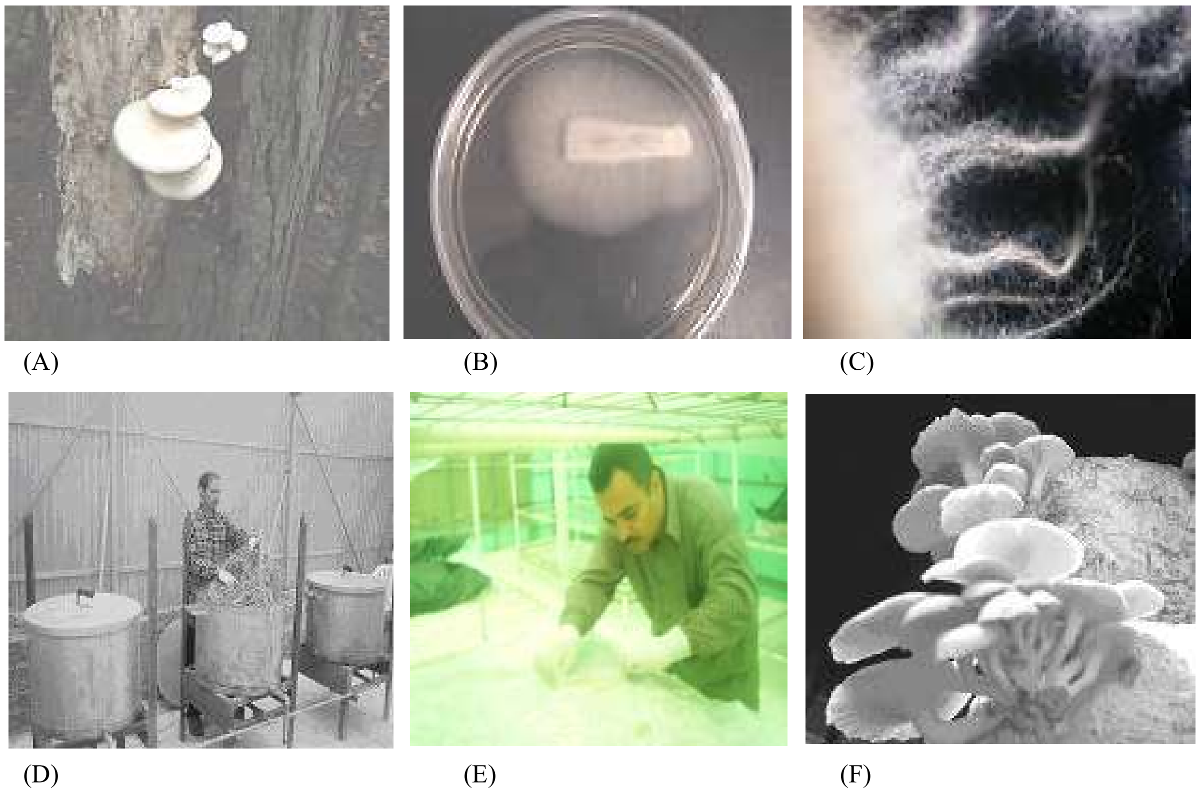

Fig. 2: The steps of production of oyster mushroom. A: wild oyster mushroom growing in the forest trees, B: preparation of slants, C: mycelial threads under the microscope, D: the rice straw was filled into galvanized metal boxes, E: Inoculation of the substrate with the spawn and incubation for 21 days, F: production of fruit bodies

Fig. 3: Submerged culture of oyster mushroom in shake flasks and 15 L. bioreactor

Increasing the amount of spawn used would provide more energy for mycelia growth. has and resulted in increased yield.The initials lengthened and enlarged to form mature fruit bodies after 7-10 days of exposure to light. A study of the effect of temperature on the mycelia growth of *Pleurotus* showed that the optimum temperature for growth is 25 C. Development intensity decreased by decreasing the temperature and stopped at 10 C, while the heat tolerance reached its maximum at 40 C. In describing the ecology and industrial production of *P.osteratus*, Zadrazil [10,11] established that the spread of mycelial growth was related to temperature of substrate. At temperatures below 15 C the growth rate was lower and from 15-20 °C there was an acceleration of growth which dropped off between 20 °C and 30 °C. Mycelia development forms the vegetative growth phase of mushroom growing and temperature is highly important since it affects the growth and adaptability as well as quantity and quality of fruiting bodies produced.

Fig. 4: Masks are suitable precaution for avoiding dangerous contamination

Table 3: Composition of Oyster mushroom fruit bodies

Chemical composition	Oyster fruit bodies(%)
Carbohydrate	50.0
Total protein	24.5
Lipids	5.0
Fiber	3.0
Ash	6.0
Moisture	90.0
Energy value (Kcal/100g dry w)	320

Table 4: Comparison of the mean levels of total lipids, total cholesterol and triacylglycerols in sera of hamsters

Parameters (Mean±SE) (mg/dl)			
Groups	Total lipids	Total cholesterol	Triacylglycerols
Groups I (HL)	748.8±14.2	237.7±4.2	272.2±3.7
Groups II (HL/B)	724.4±7.9	231.0±2.4	230.0±6.4
Differnce %	-3.2	-2.8	-15.8
P	> 0.05	>0.05	> 0.01
Groups I11 (HL/E)	667.0±8.1	187.0±2.8	151.4±3.0
Differnce %	-10.9	- 21.3	- 44.6
P1	< 0.01	< 0.01	< 0.01
	< 0.01	<0.01	<0.01

Highly significant (< 0.01), Non Signifcant (>0.05)

P: Significance levels when comparing data of group II, III, IV and V versus that of group I.

P1: Significance levels when comparing data of group IV versus that of group III.

Group I: Hamsters fed For 3 weeks hyperlipidemic diet.

Group II: Hamsters fed hyperlipidermic diet for 2 weeks then switched to feed basal diet in the 3rd week.

Group III: Hamsters fed hyperlipidemic diet for 3 week orally given mushroom extract from the 1st day of the 3rd week.

Production of mushroom mycelium by submerged culture process: The growth of an edible mushroom is a lengthy and complex process involving the use of lignocelluloses wastes, such as straws followed by long cultivation period. The potential of mushroom as fungal protein and as a source of medicinal compounds make the production of mycelium in submerged liquid culture a most attractive prospect. In this study we succeed in growing *Pleurotus ostreatus* mushroom by submerged fermentation (Fig. 3 a, b), using glucose as a medium for growing mushroom.

The chemical composition of *Pleurotus ostreatus* mushroom fruit bodies produced in rice straw, contain high content of moisture.Carbohydrates represent the major constituent in *Pleurotus* species ranging from 50 to 80% (Table 3). The composition of mushroom mycelia cultivated on liquid medium indicated high percent of moisture as well as its high crude total protein content.

Allergy of Pleurotus spores among farmers The enormous amounts of spores produced by oyster mushroom can cause lung related health problems among employees working in oyster mushroom cultivation. The wearing of special masks (Figure, 4),careful handling of substrates and ventilation are recommended during cultivation of mushrooms to avoid health problems. Sporeless varieties are now used for large scale production to avoid health problems.

Table 4 showed the role of Mushroom extract in prevention the derolopment of in hamsters of hypercholesterolemia in hamsters fed hyparlipedimic Diet Throught The marked Lowerd valuse Of different tested lipid parametrars [12].

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