Prospective of local Oyster mushroom production in Lebanon

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Abstract: The development of agricultural sector in Lebanon is highly dependent on the introduction of untraditional crops i.e. mushroom and the availability of required materials for its production in the local area. Therefore this experimental trial was carried out in order to investigate the possibility of producing Oyster mushroom locally using available materials and growing new spores obtained from the produced head bodies for new mushroom generation to reduce the cost of production. Standard procedures were followed to sterilize the growing environment and substrate. Bottles filled with Wheat seeds were inoculated with growing mycelium on PDA (Potato Dextrose Agar). Wheat bottles completely covered with disease-free mycelium were used to inoculate malt bags for fruitbody production. Data showed that mycelium took 10-15 days to completely cover the wheat seeds. A bag of mushrooms yielded between 250 - 350 grams of mushrooms in 4 to 5 flushes. Growing spores from harvested fruitbodies resulted in 100% in first generation (G1) and decrease in level G2 to 88 %, whereas, at third generation G3 level, it reached 63 %. It could be concluded that following the hygienic procedures of oyster mushroom production lead to a higher production and decrease the risks of contamination which can provide farmers a good quality of spawn with lower prices than imported glasses.

Key words:

INTRODUCTION

The economy of most developing countries is still based on agriculture and the way to develop it is to improve the diversification of the new culture and productivity. In Lebanon, mushrooms represent a promising alternative to traditional cultivations, and could be nurtured in rural areas, where the climate is suitable, in the aim of promoting the economic and social development of such areas. Mushrooms are an important source of nutrients for humans[1,2] and also for preventing and/or alleviating some diseases such as cancer and heart diseases[3-5]. It also supplies high levels of protein and vitamins[6,7]. In addition, mushrooms are well accepted in the industrial countries because the low content of energy and its dietary effect. Therefore the consumption of mushrooms in the world is growing every year. The consumption of the different mushroom types differ as well as the amount of produced mushrooms in the continents.

Cultivation of oyster mushroom is very time consuming, therefore investigations seem to be necessary focusing on the reduction of the incubation time. In this regard an effect of the temperature during the incubation and primordial development is important to investigate. The Oyster mushrooms are by far the easiest and least expensive to grow. For small cultivators with limited budgets, oyster mushrooms are the clear choice to for gaining entry in the gourmet mushroom industry. However, essential materials to grow materials are not locally available and usually is imported from abroad which increases the production cost. Local alternatives of materials needed for mushroom (Agaricus bisporus) production have been extensively investigated by Sassine et.al. [8-10] and some success has been reached. However for Oyster mushroom nothing has been done in this respect. Availability of locally produced spawn is the main obstacle which forced the grower to import it from European countries which increases cost production. Therefore the main aim of this work is to investigate the possibility of spawn production of Oyster mushroom and the reflection of such process on the economy of mushroom production in Lebanon. Other aims were

- To introduce a new culture at the agricultural sector;
- To improve the diversification of new culture;
- To improve the productivity of oyster mushroom;
- And to introduce it in the Lebanese market as competitor product.

MATERIALS AND METHODS

Practical study has been carried out in controlled atmosphere, equipped also for commercial production of Pleurote. For production, one room has been used
for inoculation, incubation, harvesting and conservation of mushroom. Mushroom cultivation Protocol was followed according to Arunyik Mushroom Center, 2001; from step 1 to step 6. wheat seeds are soaked for one night in 2 liters of water for every 1 kg of grain. After soaking, wheat is washed and strained to remove all water. Wheat seeds are steamed for 30-45 minutes to soften grains and to cook about 25%. After cooking, water is drained and wheat is spread to allow it to cool down and to decrease moisture. Bottles are filled at their ¾ of volume with wheat seeds. After filling, bottles were carefully plugged by cotton plugs and left out for ventilation. All prepared bottles were then transferred to the sterilization chamber which was closed and heated with the burner or stove for 121° Celsius for 30-45 minutes. When the heating process is finished, bottles were allowed to cool down. Inoculation was carried out in laminar flow chamber which has been cleaned by alcohol. All materials and tools used in the inoculation process were pre-disinfected i.e. PDA (Potato Dextrose Agar), wheat seed bottles, paper and rubber bands are transferred in laminar flow chamber and Ultra violet (UV) lamp was lightened for 10 - 15 minutes and needle is immersed in alcohol. After the needle cool down to normal temperature, it was used to cut small square (5mm x 5mm) of PDA with mycelium and placed it in the middle of the wheat seeds bottle. Immediately the bottle was closed and square paper was placed over cotton and tied with plastic neck or rubber band. Bottles were kept in a dark, highly humid place with a temperature varying around 25°C. When the vegetative growth of the mycelium filled the whole bottle, the latter was transferred in the refrigerator. Regular checks for infection were made to clean contaminated bottles. In this step, clean and infected bottles were counted in order to measure the degree of purity of the spawn. Pasteurizing substrate was made before inoculation step. The malt substrate was heated for pasteurization at 105 C for 30 min. Then, the substrate was transferred to the inoculation area. Hands and substrate bags were disinfected with alcohol. The content of wheat bottles coated with spawn (all white color) was spread in the bag, with alternation of wheat and malt coats. Bottle was closed after the inoculation process was done. After inoculation, the bags were sealed and cut their bottom edges and transferred into incubation room. At the beginning, little ventilation and light were allowed. After about 10 days, ventilation was increased to regulate the desired temperature at about 25°C. After 20 - 25 days, area was well ventilated and more light was let in for constant control of the conditions. Holes were cut on the bag and sealed them with cotton plugs during the first 10 days. After this period, cotton plugs were removed. The conditions (light, ventilation, temperature, humidity) inside the room were controlled by opening or closing doors and windows. The optimum temperature for fruit body development was between 20-25°C. If temperature was too high, doors were opened during the night to allow heat dissipation. Mycelium was checked on a daily basis looking for abnormalities (such as black spots, green spots, brown spots, orange or red spots, etc....) and finding out the causes of these abnormalities (pest, disease). Contaminated bags were discarded. Mites and other pests were always checked at least twice a week and we were sure of keeping bags clean all the time.

**Reproduction of mycelium from Growing spores:**

When harvesting the mushroom flush (Figure 1), the presence of powder in lower side of the fruit was noticed (figure 2). Collecting this powder for identification under the stereoscope showed that it was spores (figure 3). Those spores were grown on PDA Petri dishes. Results were obtained one week after the experiment: the mycelium began to appear. The same process used before for the wheat bottles was applied again to the obtained mycelium.

**RESULTS AND DISCUSSION**

The preparation of the mycelium, took about 10-15 days to get full grown wheat grain mycelium which depending on the species. The optimum temperature for fruit body primordial formation and fruit body development was between 21-29°C for 3-4 days. If temperature rises to 36°C and above, mycelium development is prevented. Optimal humidity levels for each fruiting stages were as followed: 98% for primodia formation, between 90-95 % for fruit body development. At the beginning, little ventilation and light were allowed. After about 10 days, ventilation was increased to regulate the desired temperature at about 25°C. After 20 - 25 days, area was well ventilated and more light was let in for constant control of the conditions. Humidity was controlled in mushroom houses and water was sprayed regularly mushroom bags where protruding fruiting are outside the holes and moderately in the atmosphere and not directly on the bags. Measurements made showed that the humidity was between 75 and 90% and the temperature between 23 and 25°C.

Mushrooms mature three days after they first appear (figure 1). They are picked gently then put in order in a basket. Trim and peel by cutting the base of the stalk to make the mushroom clean. All mushrooms were weighed and notes were taken. Mushrooms were harvested at the most appropriate time. If too small, they cannot fetch a good price. If too big, their
conservation period is reduced and their taste is bitter. Harvesting was done two or three times a day.

A bag of mushrooms was yield between 250 - 350 grams of mushrooms in 4 to 5 flushes. The productivity and yield of bags decreased with time.

Expected Benefits of Reproduction of Mycelium from Growing Spores: The results were excellent with 0.0% of contamination. The collected spores (Figs. 2&3) can be stored for ulterior usage instead of buying spore tubes which generates more profit and reduces the production costs.

**Fig. 1:** A close view of the mushroom fruiting system 18 days after incubation.

**Fig. 2:** Spores on the lower side of the flush

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**Table 1:** Percentage of contamination

<table>
<thead>
<tr>
<th>Stage</th>
<th>Number of glasses (Spawn)</th>
<th>Number of contaminated glasses</th>
<th>Percentage of contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Generation (G1)</td>
<td>100</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Second Generation (G2)</td>
<td>1000</td>
<td>120</td>
<td>12%</td>
</tr>
<tr>
<td>Third Generation (G3)</td>
<td>10000</td>
<td>3700</td>
<td>37%</td>
</tr>
</tbody>
</table>

According to table (1), the benefit from the first generation G1 level was approximately at 100% and decrease in level G2 to 88 %, whereas, at third generation G3 level, it reaches 63 %. This means that a lower contamination was obtained at G2 level due to a small quantity of glasses compared to G3, and a short period of time of production. On the other hand, at G3 level, a higher production and financial benefits are much more obtained than G2 level, but the risk of contamination will be higher.

**Fig. 3:** Spores under the stereoscope

**Conclusion:** It could be concluded that the hygienic procedures of oyster mushroom production lead to a higher production and decrease the risks of contamination. Therefore, a local laboratory which follows these rules will provide farmers a good quality of spawn with lower prices than imported glasses. According to this study, the benefit from G2 level was approximately 88 %, whereas, at G3 level, it reaches 63 %.

**REFERENCES**


