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Optimization of growth of oyster mushroom mycelium (*Pleurotus* sp.) from Tasikmalaya on several kinds of cereal medium

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Abstract

Pleurotus sp. or oyster mushroom is one type of edible mushroom that contains essential nutrients for the human body. This mushroom has been widely cultivated in Indonesia, one of which is *Pleurotus* sp. from Tasikmalaya. The key to the success of oyster mushroom cultivation is the seeds and growing medium or *baglog*, while the factors that influence the quality of the seeds include the type of medium. This study aims to determine 1) the effect of the type of seed medium from the type of cereals used on the growth of mycelium *Pleurotus* sp. from Tasikmalaya, 2) determine the type of seed medium that has the best mycelium growth. This study uses an experimental method with a Completely Randomized Design (CRD). The parameters measured include the main parameters, namely the rate of growth of mycelium *Pleurotus* sp. from Tasikmalaya on the seed medium. Supporting parameters are the quality of mycelium growth in the seed medium, the proximate value of cereals used for the seed medium. The results of the analysis showed that the medium of cereals used as seeds ready for cultivation could affect the quality of the seeds produced. The seedling medium from milled corn has the best growth of mycelium.

Keywords: *Pleurotus* sp from Tasikmalaya, growth mycelium, cereals medium

Introduction

The development of mushroom cultivation will continue to contribute to national development, both directly and indirectly. The development of mushroom cultivation in Indonesia is still considered important from economic development. Some of the reasons that underlie the importance of mushroom cultivation in Indonesia included the potential for large and diverse natural resources, the large number of people who depend their lives on this sector and mushroom cultivation as a growth base in rural areas.

Indonesian Human Resources, especially those with an interest in the development of mushroom cultivation, are expected to be able to engage even further. It is hoped that later creativity and innovation will emerge and be able to provide added value to the Nation and the State, especially in matters of food security.

The achievement of food security becomes a benchmark of the welfare level of a nation. In history, it has been proven that no country can carry out steady development before it is able to realize food security. Efforts to achieve food security must rely on local food resources and must be avoided as far as possible dependence on imports.

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Farmers in conducting oyster mushroom cultivation generally do not pay attention to the seeds used, the orientation is more based on the productivity of mushrooms planted, by relying on seeds available in the market that are still not good growth of mycelium. This resulted in the optimum development of oyster mushroom development, which until now the public demand for mushrooms is increasing (Parjimo and Andoko 2007), it is necessary to optimize the production of these mushroom seeds. The stages of making mushroom seeds are generally known as making pure culture (F0), which is the result of the isolation of the mushroom fruit body which is inoculated on a solid medium with synthetic or semi-synthetic nutrients. The mycelium is then developed to the next stage which is to become (F1) by transferring the fungus mycelium from solid medium to natural medium (generally cereals) which are rich in nutrients and used as parent seeds.

Oyster Mushroom used in this study is *Pleurotus* sp. from Tasikmalaya. This study aims to determine the effect of the type of seed medium from the types of cereals used in the growth of *Pleurotus* sp from Tasikmalaya, as well as determine which type of seed medium has the best mycelium growth.

Materials and methods

Materials

This research was conducted from July to August 2019, at the Parasitology Laboratory of STIKes Bakti Tunas Husada Tasikmalaya. The material used in this study was *Pleurotus* sp. isolate from Tasikmalaya medium agar from taro material, milled corn, millet var seeds. KING, sorghum var seeds. SARI (Sari Farm), var corn seeds. BIMA-10 (PT. Tossa Agro), bran, lime ($CaCO_3$), cotton, label paper, bunsen electric 70% alcohol, gas, water, material for proximate analysis.

The tools used in this research were autoclaves, petri dishes, test tubes, ose needles, laminar air flow, water baths, measuring cups, hot plates, stirrers, gas stoves, scissors, scale rulers, scales, sprayers, gloves, newspapers, elastic band, spirits lamp, incubation rack, stationery, camera, and tools for proximate analysis.

Methods

Seed medium preparation

Cereal medium with the basic ingredients of each type of seed used based on the method of Sumiati *et al.* (2006) by mixing 84% seeds, 1% lime ($CaCO_3$), 1% gypsum ($CaSO_4$), 14% fine bran, and a little vitamin B complex, plus water until the humidity reaches 60%. The mixture is then put into a sauce bottle measuring 10 cm in diameter by 20 cm in length, filled to the full surface of the mixture and compacted by pressing the entire top surface of the mixture to a depth of 5 cm from the top surface of the bottle (reaching medium density) for further closure cotton and newsprint and tied with rubber. The seed medium is made aseptically by a sterilization process. Sterilization is carried out in a humid pressurized heat using an autoclave (121 °C, 1 atm, for 20 minutes) (FAO 1982). Then cold for 12 hours.

Mushroom cultivation

After the sterilized seed medium is inserted into the inoculation room that is already in a sterile state. The finished seed medium was then inoculated with 1 piece of B4 isolate inoculum from the test results on agar medium with a length of 3.5 cm and a width of 1.5 cm prepared by placing the pieces of the inoculum on the surface of the seed medium without being immersed (Khusnul 2019). The incubation is the process of growing inoculated mycelium. Each outside of the seed medium is given a longitudinal line that divides 4 (four) parts equally. The seed medium is arranged horizontally in an incubation cupboard.

Mycelium in the medium will grow to meet the medium within 25-30 days (Chang and Miles 1989).

Experiment design

This experiment was arranged based on Completely Randomized Design (CRD). *Pleurotus* sp. mushroom isolated from Tasikmalaya was cultivated on the different types of medium, as follows:

PTM: *Pleurotus* sp. mushroom from Tasikmalaya on millet medium
PTS: *Pleurotus* sp. mushroom from Tasikmalaya on sorghum medium
PTJ: *Pleurotus* sp. mushroom from Tasikmalaya on corn medium (ø12 mm)
PTG: *Pleurotus* sp. mushroom from Tasikmalaya on milled corn medium

Each treatment was carried out 6 replications so that a total of 24 experimental units were obtained. The data obtained were analyzed by analysis of variance (one-way ANOVA test) and continued with the Least Significant Difference Test at an error rate of 5% and 1% (Steel and Torrie 1991).

Results

Based on the results, the fastest growth of oyster mushroom mycelium was showed by PTG treatment. It can grow with the average mycelium growth rate of 1.598 mm/week, while the slowest mycelium growth was found on PTS treatment with an average mycelium growth rate of 1.541 mm/week. This results showed that the *Pleurotus* sp. mushroom isolated from Tasikmalaya was able to grow well on medium with material from milled corn, whereas on sorghum medium, the growth was slow. The analysis of variance showed that the treatment has a very significant influence on the growth rate of the mycelium *Pleurotus* sp. The type of seed medium used affects the growth ability of the mycelium *Pleurotus* sp. These effects occur because of differences in the nutritional content of the types of cereals used. The effect of the treatment on the mean growth of mycelium *Pleurotus* sp. on seed medium was determined by the Least Significant Difference Test (LSD). The complete data can be seen in (Fig. 1).

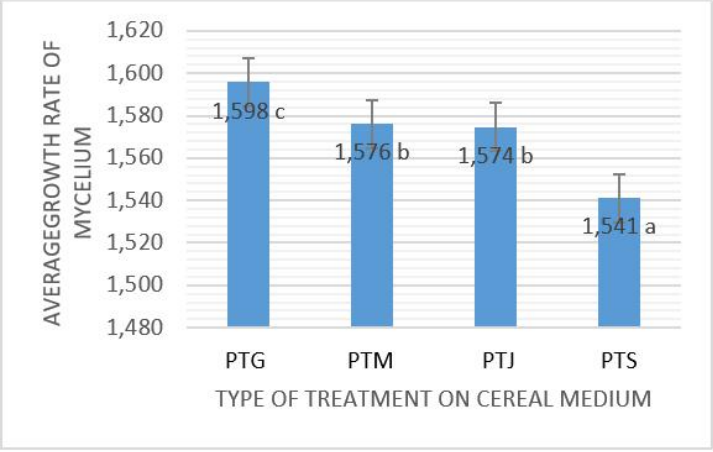

Figure 1. Least Significant Difference test on the growth rate of the *Pleurotus* sp. mycelium on cereal medium.

Note :
PTM: *Pleurotus* sp. mushroom from Tasikmalaya on millet medium
PTS: *Pleurotus* sp. mushroom from Tasikmalaya on sorghum medium
PTJ: *Pleurotus* sp. mushroom from Tasikmalaya on corn medium (ø12 mm)
PTG: *Pleurotus* sp. mushroom from Tasikmalaya on milled corn medium

LSD test results showed that the highest mycelium growth rate from *Pleurotus* sp. occurred in the PTG treatment (medium of milled corn). PTM treatment (medium of millet seeds) was not significantly different from PTJ (medium of corn seeds size ø 12 mm). The lowest mycelium growth rate occurred in PTS (medium of sorghum seed) treatment. These results indicate that the medium of ground maize is suitable for the growth of mycelium *Pleurotus* sp. from Tasikmalaya rather than the medium of cereals from millet, sorghum, and corn.

Table 1. Proximate analysis of millet, sorghum, and corn

Type of cereal	Total proximate level (%)			
	Fat	Water	Protein	Carbohidrate
Corn ø 12 mm	5,07	13,07	7,53	73,07
Millet	4,06	10,12	11,54	71,13
Sorghum	3,94	12,02	8,61	73,85

Factors affecting growth in the seed medium include the nutrient content of the cereal seeds tested. Proximate analysis results show that millet seeds contain 71.13% carbohydrates, 11.54% protein, and fat content about 4.06%. The complete data can be seen in (Table 1).

Table 2. Mycelium growth of *Pleurotus* sp. from Tasikmalaya on cereals medium

Treatment	The quality of mycelial growth
PTG	+++++
PTS	++
PTM	++++
PTJ	++

Figure 2. Mycelium growth of *Pleurotus* sp. from Tasikmalaya on milled corn medium

Discussion

The highest growth rate of *Pleurotus* sp. occurred in milled corn which showed that the composition of nutrients, especially carbohydrates, proteins and fats in these cereals was in accordance with the nutritional needs of *Pleurotus* sp. However, Subowo and Nurhasanah (2000) state that millet seeds contain starch which is easily broken down into sugar. Furthermore, sugar will be broken down into glucose and fructose. According to Cochrane (1958), glucose is the best carbon source for mycelium growth. Among sugars and hexoses, glucose is the most effective source of energy.

Factors that affect mycelium growth, according to Sanchita (2006), are the size and texture of the seeds used, mushroom seeds made using medium in the form of small seeds give better results than when using large seeds. This is comparable to the results of the study, namely smaller milled corn has the best growth of mycelium. The size of sorghum and corn seeds which are relatively larger than ground maize and its hard texture, are likely to be the cause of the slow growth of the *Pleurotus* sp tested. According to Donoghue (1995) that the availability of oxygen in the seedling medium influences the growth of fungal mycelium

The growth rate of mycelium isolates *Pleurotus* sp. on cereals medium was also comparable to the results of observations on the quality of mycelium growth (Fig. 2 and Table 2). Dense mycelium growth occurs in ground maize. *Pleurotus* sp. mycelium growth in the sorghum cereal medium was not as good as in millet and milled corn. According to Sastre-Ahuatzi *et al.* (2007), such a thing probably happened because the protease enzyme from *Pleurotus* sp. isolates was low in the sorghum medium.

Conflict of interest

The authors state no conflict of interest from this manuscript.

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