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Philippine agricultural corn cob wastes as alternative spawning materials for three *Pleurotus* species

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Abstract In the pursuit of finding cheaper but efficient materials for spawn production, agricultural wastes such as corn cobs were utilized as carriers of mycelia instead of common grains. Cobs of sweet corn cobs, glutinous corn, and yellow corn were evaluated as possible spawning materials for the mother culture of *Pleurotus pulmonarius, Pleurotus florida*, and *Pleurotus sajor-caju.* Among the three varieties of corn cobs tested, sweet corn cob was found to be the best spawning material for *Pleurotus* species with the shortest incubation period, 10.40 days for *P. pulmonarius*; 10.20 days for *P. florida,* and 10.60 days for *P. sajor-caju*. These species of *Pleurotus* had luxuriant mycelial growth, with very thick mycelial density recorded on sweet corn cobs. This is a benchmark study in the utilization of three corn varieties as efficient spawning materials for the mother culture of three *Pleurotus* species.

Keywords: *Pleurotus,* corn cobs, spawn, sweet corn, glutinous corn, yellow corn

Introduction

Pleurotus species, commonly known as oyster mushrooms, are edible fungi cultivated worldwide, especially in countries in Southeast Asia, India, Europe, and Africa (Mandeel *et al.,* 2005). In tropical and subtropical areas, there are large volumes of unused lignocellulosic by-products available and these are just left to rot or disposed of through incineration or burning.However, effective utilization of such by-products for mushroom cultivation using locally available technologies can be one of the solutions to transform such inedible wastes into accepted edible biomass of high market value (Tesfaw *et al.,* 2015).

Initiatives in finding cheaper means of producing planting spawn and improving the yield of oyster mushroom became the focus of recent research

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(Soko *et al.,* 2007). Since corn cobs are considered agricultural wastes and are just dumped elsewhere, in the processfurthering the present environmental problems, it is imperative that other uses of corn cobs be exploredThis study aims to show the feasibility and advantages of using three varieties of corn cobs (sweet corn cobs, glutinous corn cobs, and yellow corn cobs) as possible non-grain carriers of *Pleurotus* mycelia. Consequently, more efficient alternative carriers can be acknowledged and applied in the spawn production of the mother culture of *Pleurotus* species.

Materials and Methods

Corn cob acquisition

The corn cobs of three corn varieties were used for grain spawn production. Different varieties of corn cobs sweet corn cobs; glutinous corn cobs, and yellow corn cobs) were acquired from available farmland and market places. Yellow corn cobs were obtained from corn farms in Umingan, Pangasinan, Philippines. Since there were no available sweet and glutinous corn cobs as these weresold as a whole, sweet corn was bought from the Baguio City public market and glutinous corn was acquired from Asingan, Pangasinan, Philippines. Sweet and glutinous corn grains (kernels) were removed manually.

Corn cob drying and fragmentation

Corn cobs were sun-dried for a period of 2 weeks. Dried corn cobs were fragmented or dismantled to form smaller, almost uniformly sized corn cob bits using the multi-purpose shredder of the Affiliated Renewable Energy Center of Central Luzon State University, Philippines.

Corn cob spawn preparation, sterilization and inoculation

To prepare the mother spawn, 100 grams of each type of corn cobs was weighed. Water was added to the separated corn cobs to maintain 65% moisture. Fifteen grams of each corn cob (corn cobs were more bulky than common grains) was dispensed in a clean bottle; plugged with cotton and wrapped with a clean paper, and sealed tightly with a rubber band. Thereafter, sterilization was done by autoclaving at 120 ℃ at 15 psi for 45 minutes. After sterilization and partial cooling, 10 mm-mycelial disc of the 7-day-old pure culture of each *Pleurotus* species (*Pleurotus pulmonarius, P. florida,* and *P. sajor-caju*) was inoculated in each sterilized bottle containing the corn cobs. The inoculated spawn was incubated at room temperature.

Statistical analysis

The incubation period of the three *Pleurotus* species grown on different varieties of corn cobs as spawning material was laid out in a completely randomized design (CRD). Analysis of variance (ANOVA) was employed to test the overall significance of data, while the least significance difference (LSD) test was used to compare differences among treatment means.

Results

The feasibility of using corn cobs as spawning materials for three *Pleurotus* species was evaluated in this study. Among the three varieties of corn cobs, the most appropriate spawning material was determined for each *Pleurotus* species. The spawn or "mushroom seed" comprises a pure culture of the desired mycelium on a particular carrier material.

Corn cobs were used instead of the commonly used resources (e.g,. sorghum, unmilled rice, wheat seeds, sugarcane tops, and banana leaves) as grain spawn materials for the mother culture production of three *Pleurotus* species. Three varieties of corn available in the Philippines sweet corn, glutinous (waxy or white) corn, and yellow corn were used. Growth performance in terms of incubation period and mycelial density of the three *Pleurotus* species in three corn cob spawning materials were evaluated. Among the three varieties of corn cobs utilized as spawning materials, sweet corn cobs recorded the shortest incubation period (10.40 days). *P. florida* was 10.20 days and *P. sajor-caju* was 10.60 days). Meanwhile, the longest incubation period was noted in yellow corn cobs. *P. pulmonarius*, *P. florida*, and *P. sajor-caju* were averaged 14,13.60 and 14.60 days, respectively.

Table 1. Mycelial density and mean incubation period of *Pleurotus* species on different corn cob spawning materials

Mushroom species	Spawning material	Incubation period (days)	Mycelial density
Pleurotus pulmonarius	SCC	10.40 [a]	++++
	GCC	11.60 [b]	++++
	YCC	14.00 [c]	+++
Pleurotus florida	SCC	10.20 [a]	++++
	GCC	12.60 [b]	+++
	YCC	13.60 [b]	++
Pleurotus sajor-caju	SCC	10.60 [a]	++++
	GCC	12.40 [b]	+++
	YCC	14.60 [c]	++

SCC – sweet corn cobs; **GCC** – glutinous corn cobs; **YCC** – yellow corn cobs.
Means having the same superscript in a column are not significantly different at 5% level using LSD.
Mycelial density: very thin (+); thin (++); thick (+++), very thick (++++)

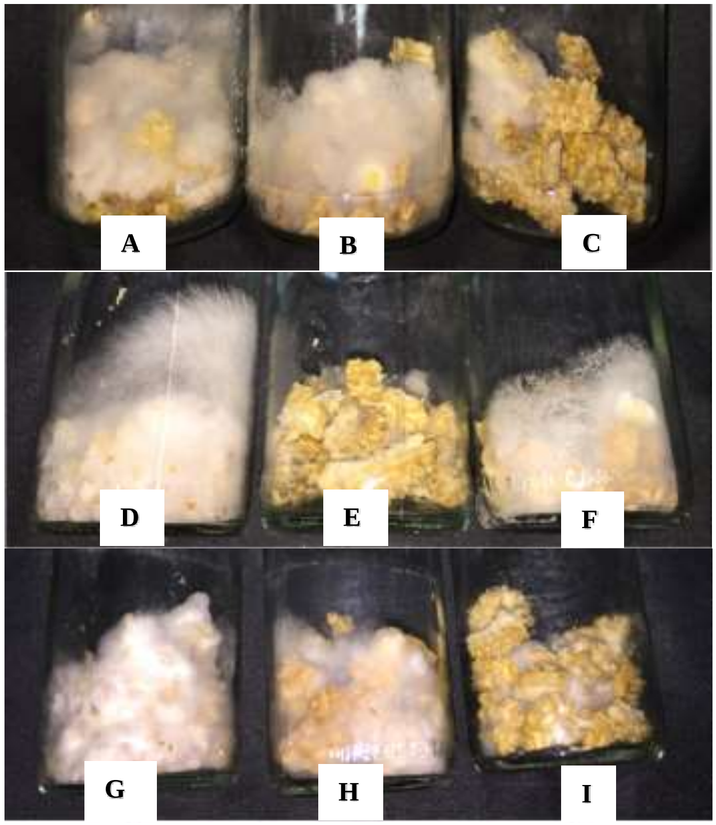

Figure 1. Mycelial ramification of *Pleurotus* species on different varieties of corn cob spawning material. *P. pulmonarius* grown in (A) sweet corn cobs, (B) glutinous corn cobs, (C) yellow corn cobs. *P. florida* grown in (D) sweet corn cobs, (E) glutinous corn cobs, (F) yellow corn cobs. *P. sajor-caju* grown in (G) sweet corn cobs, (H) glutinous corn Cobs, (I) yellow corn cobs

Discussion

The ANOVA showed the significant effect of type of spawning material on the mycelial growth of the three *Pleurotus* species. In addition, very thick mycelial density was evident on sweet corn cobs compared with those seen in glutinous and yellow corn cobs for all species of *Pleurotus*.. The mycelium can acquire nutritious elements from the substrate it was thriving on and, relatively, corn cobs as compared witho corn grains or kernels contained only less amount of nutrients and other nourishing compositions for the growth of *Pleurotus* mycelia. Nutrients were usually concentrated on the grains of corn; however, on corn cobs, only trace elements can be found. The rapid and thick mycelial growth of the three *Pleurotus* species on sweet corn cobs can be attributed to the high amount of sugar content present in the corn cobs (Wright, 2014). However, this high sugar composition can be lacking or limited in the other two corn cob varieties, which is why mycelial growth of *Pleurotus* was evidently not that exemplary because glutinous corn and yellow corn contain mostly starch and amylose (Bao *et al.,* 2012; Bunge, 2011). It is also probable that the high sugar content of sweet corn cobs were consumed by the *Pleurotus* species, enabling them to grow luxuriously with shorter incubation period as possible.

However, only thicker mycelial density and slower incubation time as compared with sweet corn cobs were noted on *Pleurotus* species grown in glutinous corn cobs. This can also be ascribed to inadequate nutrients that are present in the substrate. Unlike sweet corn cobs, glutinous corn cobs were noted to have starch and amylose contents, which can somehow support mycelial growth, though not as efficient as that in sweet corn cobs. Meanwhile, thin mycelial density was also observed with very slow mycelial colonization in yellow corn cobs on all *Pleurotus* species, which might be due to scarce nutrients available in corn cobs. Also, due to limited nourishing elements found in yellow corn cobs, proper growth and faster mycelial ramification of each *Pleurotus* species are not supported completely. Nutrients available in yellow corn cobs were noticeably not as great as those seen in sweet and glutinous corn cobs, so the performance of *Pleurotus* mycelia is not that quite distinctive. Poor growth was achieved in all *Pleurotus* species when grown in yellow corn cobs. Also, among all the corn cobs used as spawn material, yellow corn cobs were the most difficult to dismantle due to their hardness. This can also explain why mycelial growth was not proficient enough in yellow corn cobs as mycelia cannot penetrate the substrate completely and consume the nutrients available.

Sweet corn cobs were found to be the best spawning material for the three species of *Pleurotus* with their very thick mycelial density and shortest incubation period. Glutinous corn cobs can also support mycelial growth but not as efficiently as sweet corn cobs do. Yellow corn cobs resulted in very poor growth of mycelia. Hence, among the three corn varieties, the feasibility of using sweet corn cobs, which can support luxuriant mycelial growth on *P. pulmonarius*, *P. florida* and *P. sajor-caju* with relatively shorter incubation period, was established effectively in this study.

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