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Domestication of *Pleurotus sajor-caju, P. ostreatus* and *Laetiporus sulphureus* from the Abongfen gallery forest of Kedjom-Keku, Northwest Region of Cameroon

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Abstract

This study aimed to conserve the rich biodiversity of wild mushrooms in Abongfen Forest by domesticating selected species for year-round availability and protection from extinction. Six mushrooms collected (*Laetiporus sulphureus, Phellinus* sp*, Inonotus obliquus*, *Pleurotus sajor-caju, Stereum* sp. and *Pleurotus ostreatus*) were cultured in Potato Dextrose Agar (PDA) to obtain pure cultures and mother spawn which was subsequently domesticated. Each mushroom species was cultivated in a completely randomized design with four treatments: sawdust (50%) mixed with maize cobs (50%), palm cones (100%), sawdust (100%) and beans straw (100%), all supplemented with rice bran (10%) and quick lime in eight replication. Maize cobs were ground in an electric mill while palm cones and bean straws were reduced with a sharp knife to smaller sizes (1-3cm long) and soaked overnight in tap water. Excess water was drained using a sieve to 65% moisture content. Each portion was well mixed on a clean, cemented floor using a clean spade. 2.0 kg of each composition was filled into 25 x 15 cm polypropylene bags and sterilized in a drum for 4 hours. After cooling, each bag was inoculated with three table spoonsful of spawn, incubated at room temperature 25±2 ^{o}C and the spawn run was observed until fully colonized. The days of colonization, primordial initiation and harvesting were noted. The fruit bodies on each bag were counted and weighed (in g) after harvesting to determine the yield. *Pleurotus sajor-caju, Pleurotus ostreatus* and *Laetiporus sulphureus* colonized the substrate, but only *Pleurotus* grew and produced fruit bodies. Mycelial colonization was higher on beans straw (31.60 ± 2.46 days). The mean diameter of pileus (24.70±0.94 cm) and, average number of fruiting bodies (4.5±1.2) and weight of fruit bodies (95.20 ± 2.58 g) were best on maize cobs mixed with sawdust. Wild edible mushrooms need to be domesticated to ensure their availability for food and medicine and to provide a source of income.

Key words: Biodiversity, conservation, pure culture, spawn, wild mushrooms

Introduction

Mushroom, a fruiting body of macro-fungi, has been valued worldwide as either food or medicine for more than three thousand years (Kinge *et al.*, 2016). Their mode of nutrition has been well exploited by countries such as China, United States of America and the Netherlands for large-scale production of highly nutritive and medicinal mushrooms (Onyeka *et al.*, 2023). These countries are now the world's leading mushroom producers (FAO, 2022). Its cultivation is thus a profitable agribusiness worldwide, with more than 5000 mushroom varieties that could be employed as food and medicine (Dung *et al.*, 2012). Farmers require mushroom varieties with a fast maturity period, increased resistance to pests and diseases, and high yields (Ajonina and Tatah, 2012). Cultivated mushrooms are edible fungi that grow on decaying organic matter, known as substrates, which are obtained from different agro-industrial residues because they can decompose organic matter (Alemu, 2014; Assan and Mpofu, 2014) and possess varied properties for supporting the growth of mushrooms. Organic matter such as cellulose, hemicellulose, and lignin, which contain carbon, can be used for mushroom cultivation. Some common substrates used for mushroom cultivation are sugar cane leaves, sawdust, maize stover, banana leaves, palm cones, coffee husk, cotton waste, sorghum stover, cocoa bean shell, wheat bran and soya beans straw, wood shaving and barley straw (Ajonina and Tatah, 2012), supplemented with rice bran, soya bean cake or kernel cake (Kinge *et al.*, 2016). Patil *et al.* (2010) reported that the quality of mushroom, growth, yield and nutritional value are affected by the type of substrate used in cultivation. Unlike vegetables, mushroom do not rely on sunlight to grow. Mushrooms start as very small spawns. The spawns will grow in the substrate to produce a fine white fibrous structure called mycelium. From the mycelium the mushroom fruit is produced. This is the harvested part (Borah *et al.*, 2019). Kinge *et al.* (2016) reported that mushroom thrive best in an alkaline medium, so $CaCO_3$ must be added to all mushroom substrates to adjust its pH to fall between 6-8.

Mushroom cultivation provides a source of nutritious foods, medicines and generates income (Shivute, 2020). Some mushroom species used as food include *Pleurotus* sp. *Amylosporus* sp. *Laetiporus* sp.*, Lentinus sajor-caju, Auricularia polytricha, Amylosporus* sp.*, Polyporus tenuiculus* (Juma *et al.*, 2015; Kinge *et al.*, 2016); as a source of medicine for example *Laetiporus*

sp., (Ming and Wei, 2012), *Ganoderma* (Mshandete, 2014) and when sold serves as a source of income. Indigenous mushroom species successfully domesticated include *Pleurotus sajor-caju* (Hussein *et al.*, 2016); *Amylosporus* sp., *Polyporus tenuiculus* (Juma *et al.*, 2015); *Lentinus squarrosulus* (*Onyeka et al., 2023); Pleurotus ostreatus* (Onyeka *et al.*, 2018). *Pleurotus* is the only genus currently successfully domesticated in Cameroon for commercial purpose.

The Abongfen forest contains woody flora, including trees, shrubs and lianas (Fungwa *et al.,* 2021) and diverse mushroom species growing on living and dead trees and forest floor. Mushrooms, members of Basidiomycota, form one of the universe's richest and most diverse organisms (Teke *et al.*, 2017). Mostly, exotic mushroom species and a few indigenous mushroom species have been successfully cultivated. The local people know the edible species and have made them known to the public, so domesticating them is necessary; otherwise, they will remain hidden in the forest and become extinct (Srivastava *et al.*, 2012). Thus, there is a need to domesticate more indigenous species and introduce them to mushroom farmers. This study aims to domesticate some indigenous species from the forest and introduce them to mushroom farmers.

Materials and methods

Sample collection and identification: Samples of mushroom were collected from the Abongfen forest (Fig. 1) with the help of forest guards. Fresh mushroom fruit bodies were either hand-picked or collected using a knife from decaying logs of wood and tree trunks. The collected mushroom specimens were identified based on morphological characteristics, mainly on literature on tropical African mushrooms and the fungus flora of Tropical Africa website (FFTA-online). Literature used included Mortimer *et al.*, 2014; Niemela *et al.,* 2021 and Ostry *et al.*, 2011. The ecological and morphological characteristics of the fruiting bodies, such as cap shape, stipe length, size and color were recorded and the mushroom species were photographed in their natural habitats. The samples were wrapped in aluminium foil, put in labelled zi*P*-lock bags, placed in a cool box and transported to Mushroom Production, Training and Research Centre (MUPTAREC) Ntarinkon, Bamenda, the cultivation site

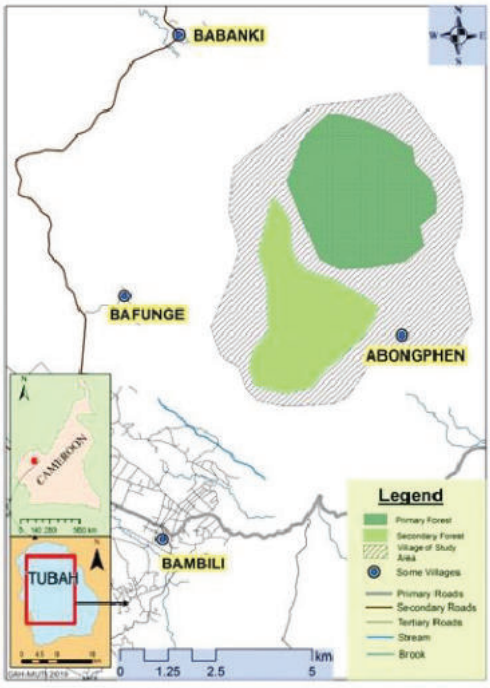

Fig. 1. Map of Abongfen, the study area. Source: Fungwa *et al.,* 2021.

Mushroom tissue culture: Mushroom tissues obtained from the wild were cultured under aseptic working conditions at 27°C on potatoe dextrose agar (PDA) in a sterilized inoculation box according to the protocol of Ilyas and Avin, 2018. The mushroom basidiocarps was torn apart, the inner tissue was removed using a sterile blade and sterilized by dipping in 10% Sodium Hypochlorite for 30 seconds and rinsing in three successive changes of distilled water for 3 minutes. In an inoculating box the sterilized mushroom tissue was inoculated into the PDA slants in 4 mL test tubes. This was done close to the burner to avoid contamination. The test tube was rapidly corked, sealed with masking tape, and identified with a number tag, the same as in the field notebook. The masking tape prevented the entry of air, which could have caused contamination. The inoculated tubes were placed in an incubator at room temperature in the dark and monitored for mycelia growth for fourteen days. The mycelia produced was subcultured onto a new agar medium until pure cultures were obtained.

Preparation of agar slants: PDA used was prepared using the manufacturer's instructions. Using an electronic wind balance, 10.5 g PDA was measured into a beaker and 250 mL distilled water was added and stirred to obtain a homogenous mixture. 1mL of the mixture was put into a 4 mL test tube, properly corked and the media sterilized for 30-40 min. When the autoclave was switched off, the test tubes were transferred to an inoculation box and sterilized by swabbing with 70% alcohol. To sterilize the internal surface, a burner was lit and placed in the closed inoculation box 2 h. When the media had cooled to about 40 °C, 10mg/mL of Streptomycin was added and mixed well to prevent the growth of bacteria. The sterile PDA was in a slanting position to give an agar slant after solidification.

Spawn production: The incubation period for the tissue culture isolation varied from 10 to 15 days—initially, the primary mycelium of the six mushroom specimens successfully formed in test tubes. Mother spawn was done using the protocol proposed by Itelima (2012) with slight modifications. Dry guinea corn (*Sorghum bicolor*) grains were used as the mother spawn substrate. Five kilograms of guinea corn grains were washed thoroughly with clean tap water and soaked for 4 hours. The soaked grains were drained to remove chaffy and damaged grains. It was then boiled for 10 mins in a pressure cooker to soften them. The cooked grains were spread on a platform and allowed to cool and reduce the moisture content to about 50%. Chalk ($CaCO_3$) was then thoroughly mixed with the cooked grains, 20 g/kg so that the pH of the grains was at maintained at 5 to 8 for optimum mycelial colonization (Salami *et al.,* 2016) and to avoid caking the grains after sterilization to remove excess moisture present in the cooked grains. The grains were filled in 750 mL glass jars up to 3/4th height, approximately 250-300g/jar and their covers plugged with absorbent cotton wool to serve as openings through which the fungus breaths. Aluminum foil was used to seal the covers of the grain-containing jars, sterilized locally in a drum for 4 hours, and allowed overnight. Before inoculation with the desired mushroom species, the sterilized glass jars were left to cool in the culture room identified. The fungal culture was cut into two halves and transferred into two other glass jars. The inoculated jars were incubated at 25°C in a dark cupboard. The whole jar containing the grain substrate became white for each species due to fungal mycelia proliferation within 15 to 40 days. This formed the mother spawn for each species. Secondary mycelium for spawn production started colonizing the guinea corn grain but failed to grow.

Multiplication of spawn: Mother spawn of the *Laetiporus sulphureus, Pleurotus sajor-caju* and *Pleurotus ostreatus* were multiplied on sawdust to obtain enough sawdust spawn using the protocol of Nsoh *et al.* (2022) with slight modifications. 10 kg bag of sawdust, 2.5 kg bag of rice bran, 5 kg bag of rice husk and 50g of slake lime (Calcium Carbonate) were mixed using clean spades and 30 L of water added to obtain 65% moisture content. All was mixed manually for 30 minutes to obtain a homogenous mixture. This mixture was put in jars and closed with lids perforated at the centre using a nail and cotton fitted on the perforated area to permit oxygen supply to the growing mycelium. These glass jars were sterilized in a sterilization drum for 4 hours. Cooling was allowed to take place for an hour followed by inoculation of the bottles in an inoculator for 90 min. Substrate was planted in glass jars with seeds obtained from mother spawn that had already been prepared three weeks before. The bottles were then placed in an already prepared and sterilized spawn room for colonization for 3weeks, after which they were suitable for planting substrates.

Substrate preparation: Culturing the indigenous mushroom species on different substrates was done using the protocol of Kinge *et al.* (2014). The substrates used were sawdust (50%) mixed with maize cobs (50%), beans straw (100%), palm cones (100%), sawdust (100%) and the supplement was rice bran (10%) to increase the nutrients available for mycelia of the mushroom being cultivated to feed on (Siwulski *et al.,* 2019). Sawdust was obtained from a carpentry workshop at Ntarinkon, Mankon-Bamenda, rice bran from animal feed store at Ntarikon. Maize cobs, beans straw and palm cones from farmers in the Mile 8 Mankon-Bamenda neighbourhood. The maize cobs were sun-dried and reduced to smaller sizes in an electric mill, while the palm cones were chopped to pieces using a cutlass. The substrates were mixed separately on a clean surface with equal quantities of rice bran (10%) and $CaCO_3$ (500g) using a clean spade. Water was added and mixed to obtain a homogenous mixture with 65% moisture content. Polypropylene bags (25x18 cm) were filled with one of the substrates, each with eight replicates, making a total of ninety-six bags. The substrate bags were tagged for clear identification and differentiation, tied and sterilized in a 250 mL metallic drum for 4 h and allowed in the drum for continuous gradual sterilization overnight to eliminate microbes (Haukongo *et al.,* 2021).

Inoculation: The sterilized bags were removed the next day and cooled. Spawning was done by aseptically adding three tablespoons of spawn on the surface of the substrate, and the substrate was packed tightly. The bags were incubated at room temperature, on shelves in a dark room with relative humidity of 70-80% and allowed for colonization. Daily, 15 L of water was poured on the floor to maintain humidity (Onyeka *et al.,* 2023).

Cropping and Harvesting: The fully colonized bags were transferred to a well-lighted room. This experiment was laid out in a Completely Randomized Design with 4 treatments replicated 8 times, as shown in Table 1. According to Nsoh *et al.* (2022), data for growth parameters like spawn running time (days), pinhead formation (days) after completion of mycelial growth, and time taken from pinhead formation to maturity of fruit bodies were noted daily.

The spawn running time was measured by counting the days it took for the mycelium to colonize the substrate fully. The time required for primordial initiation was measured by counting number of days for the pinhead (about 0.01mm in diameter) to be formed on each substrate. The number of days for the spawn and pinhead to be formed on the different substrates and the time of harvesting the fruitbodies formed were measured by counting. The average of five bags of fruiting bodies per treatment, randomly selected, after harvest were used to calculate the different growth parameters.

Table 1. Substrates and composition used in the cultivation of indigenous mushroom species

Treatment	Substrate and composition
Treatment A	Sawdust + maize cobs +rice bran +control (*Pleurotus ostreatus*)
	Sawdust + maize cobs +rice bran + *Pleurotus.sajo-caju*
	Sawdust + maize cobs +rice bran + *Laetiporus sulphureus*
Treatment B	Beans straw +rice bran +control (*Pleurotus ostreatus*)
	Beans straw +rice bran + *Pleurotus sajor-caju*
	Sawdust + corn cobs +rice bran + *Laetiporus sulphureus*
Treatment C	Palm cones + rice bran +control (*Pleurotus ostreatus*)
	Palm cones + rice bran + *Pleurotus sajor-caju*
	Palm cones +rice bran + *Laetiporus sulphuerus*
Treatment D	Saw dust +rice bran +control (*Pleurotus ostreatus*)
	Saw dust + rice bran + *Pleurotus.sajo-caju*
	Saw dust +rice bran + *Laetiporus sulphureus*

When the fruit bodies were matured, they were held on the stipe close to the substrate bag and gently pulled and removed without destroying the substrate bag. Data on mushroom yield, like size of the pileus, the diameter of the pileus, the length of the stipe and the weight of fruit bodies, were recorded for each substrate bag (Kinge *et al.,* 2016).

The length of the stipe of individual fruiting bodies per treatment was measured in centimetres using a tailor's tape beginning from where the stalk gets attached to the substrate to the pileus. The mean distant around the pileus (diameter) of individual fruiting bodies was measured with a tailor's tape and the figures were recorded in centimetres. The mean number of individual fruiting bodies per treatment was recorded by counting. The highest mean fresh weight of individual fruiting bodies was measured in grams using an electronic scale. The total weight of the fruiting bodies per packet was obtained by adding the individual weights. The average weight of individual fruiting body was obtained by dividing the readings from the scale balance by the total number of fruiting bodies per packet.

Data analysis: Data on spawn running time, pin head formation, pin head to harvest time, spawning to harvest time, length of stipe diameter of pileus, diameter of pileus, number of fruiting bodies and mushroom weight were log (x + 1) transformed to homogenize the variance. The transformed data were subjected to ANOVA procedure using the Statistical Analysis System (SAS). Turkey (HSD) test ($P = 0.05$) was applied for mean separation.

Results and discussion

Spawn production and cultivation: Guinea corn (Sorghum) grains were used to produce the spawn, and successful growth was observed on all the substrates. The days for colonization varied from 11-38 days. Of the six mushroom species *Pleurotus sajor-caju, Pleurotus ostreatus* and *Laetiporus sulphureus* successfully colonized the grain; the rest failed to produce spawn.

Guinea corn (Sorghum) grains successfully produced the spawn, possibly because it is rich in carbon (Salami *et al.,* 2016). The rich fibers in the different substrates which was easily broken down by the fungi, could account for the difference in growth rate (Stanley and Awi-Waadu, 2010).

No results were obtained for *Laetiporus sulphureus,* possibly because the substrate used for cultivation of this species did not have suitable nutrients to support fructification. Also, adaptation to the environment for the domesticated species could be the reason for failure to grow. Since the mushroom was collected from the forest and brought home for domestication, it could face difficulty adapting to the environmental conditions. Juma *et al.* (2015) also reported that *Laetiporus sulphureus* formed spawn in 24 days but failed to produce fruit bodies. The agricultural residue used might not be suitable for fruiting. Therefore, findings are needed to obtain suitable substrates for cultivating *Laetiporus sulphureus.*

Spawn running time: The spawn running time ranged from 13 – 25 days on the four different substrates on both domesticated species (Tables 3 and 4). The shortest time was recorded in Treatment C (palm cones), 13.00 ± 0.45 days, followed by treatment A (maize cobs), 15.60 ± 0.45 days.

The results of the spawn running time are similar to the findings by Nsoh *et al.* (2022), who also reported the shortest spawn running time on palm cones, (14.4 ± 0.8 days), and on maize cobs mixed with sawdust (18.4 ± 0.9 days). The excellent mycelial growth shown by palm cones could be due to the right proportion of alpha-cellulose, hemicellulose, pectin, lignin and a suitable carbon-to-nitrogen ratio (Onyeka *et al.,* 2018). The vigor of mushroom mycelium is due to the ability of the mushroom to grow on lingno-cellulosic substrates (Hoa *et al.,* 2015).

Pinhead formation: The pinhead formation was least in treatment C (Palm cones) followed by treatment A (Sawdust mixed with maize cobs) for both species (Tables 2 and 3).

There was no significant difference between the days taken for the pin head formation between *P. ostreatus* and *P. sajor-caju*. Onyeke *et al.* (2018) reported that the substrate media influence pin head formation and other growth parameters.

Pinhead to harvest (Days): The number of days counted from pinhead formation to the harvest of fruiting bodies ranged from 5 to 7 days on the four different substrates on both mushroom species (Table 3 and 4). The shortest time was recorded on Treatment C (palm cones), 5.40±0.24 days, followed by treatment B (Beans straw), 5.60±0.24 days for *P. ostreatus* and *P. sajor-caju*.

There was no difference between *P. ostreatus* and *P. sajor-caju* when number of days counted from pinhead formation to the harvest of fruiting bodies was compared with each other; but significant difference when compared with the control; sawdust (6.80±0.20 days). Sawdust was reported to contain poor nitrogen; possible reason why it took longest from pinhead formation to harvest **(**Onyeke *et al.,* 2018). Carbon to nitrogen ratio has been reported to play an important role in mushroom growth (Assan and Mpofu, 2014). These findings are similar to those of Nsoh *et al.* (2022) who reported on average 6.7 ± 0.7 days from pinhead formation to harvest of *P. ostreatus* on sawdust, palm cones and maize cobs and sawdust combination.

Spawning to harvest (Days): The number of days counted from inoculating the spawn onto the substrates through colonization, pinhead formation and the formation of fruit bodies to the harvest of fruiting bodies (Fig. 2) ranged from 38 – 85 days on the four different substrates on both mushroom species (Table 2 and 3). The shortest time was recorded on palm cones (38.80±0.80 days) in both species.

There was no difference between *P. ostreatus* and *P. sajor-caju* when the number of days counted from inoculating the spawn onto the substrates through colonization, pinhead formation, and then formation of fruit bodies to the harvest of fruiting bodies compared with the control, sawdust. Nsoh *et al.* (2022) also reported an average of 39.7 ± 0.7 to 80 days from spawning to harvest of *P. ostreatus* on sawdust, palm cones, maize cobs, and sawdust combination.

Length of stipe (cm): The mean length of stipe (cm) ranged from 8 – 19cm but with little difference between the species (Tables 2 and 3).

There was no significant difference in the mean length of a stipe in *P. ostreatus* and *P. sajor-caju* grown on beans straw. All the three other substrates showed substantial differences in the length of the stipe. These findings are similar to those of Kinge *et al.* (2016), who reported a stipe length of 8.4cm for *Pleurotus ostreatus* on maize cobs.

Diameter of Pileus (cm): The diameter of pileus of the fruiting bodies was lower for *P. sajor-caju* in all substrates when compared to *P. ostreatus.* (Table 3). *P. sajor-caju* on sawdust recorded the highest pileus diameter (18.56±0.35) and palm cones the lowest (9.38 ± 0.37); both lower when compared to *P. ostreatus.*

The findings on the diameter of pileus of the fruiting bodies are contrary to the works of Ajonina and Tatah, (2012) who reported that *P. ostreatus* produced the highest pileus diameter on maize cobs and palm cones. The presence of glucose, fructose and trehalose in the sawdust substrate is likely responsible for the result (Nsoh *et al.,* 2022).

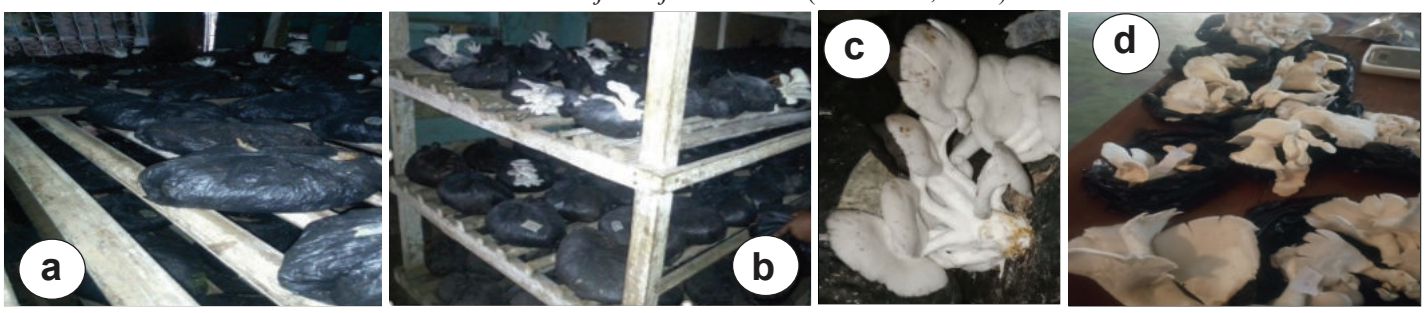

Fig. 2. A) Colonized bags; B) Immature fruit bodies; C) Mature fruiting bodies *of P. sajor-caju* and D) Mature fruiting bodies *P. ostreatus*

Table 2. Growth and yield parameters, of *P. ostreatus* based on treatment levels (Mean ± SD)

Parameter	Mushroom species	Beans Straw	Palm cones	Sawdust/ maize cobs	Sawdust	F-Value	*P* value
Spawn running time (Days)	*P. ostreatus*	31.60 ± 2.46^{a}	13.00 ±0.45^{c}	15.60 ± 0.45^{c}	24.00± 0.77^{b}	34.38	0.0001
Pinhead Formation	*P. ostreatus*	42.20±1.16^{b}	20.40 ± 0.60^{d}	25.00 ± 1.10^{c}	47.00±0.95^{a}	176.04	0.0001
Pinhead to harvest (Days)	*P. ostreatus*	5.60±0.24^{b}	5.40±0.24^{b}	6.40±0.24^{a}	6.80±0.20^{a}	7.94	0.0018
Spawning to harvest (Days)	*P. ostreatus*	79.40±3.23^{a}	38.80±0.80^{b}	46.80±2.52^{b}	77.80±0.68^{a}	98.61	0.0001
Length of stipe(cm)	*P. ostreatus*	8.76 ±0.27^{b}	8.98 ±0.36^{b}	14.90±0.51^{a}	8.16±0.59^{b}	37.71	0.0001
Diameter of Pileus(cm)	*P. ostreatus*	17.72 ± 3.23^{b}	13.82 ± 0.55^{c}	24.70±0.94^{a}	18.56±0.35^{b}	52.35	0.001
Number of fruiting bodies	*P. ostreatus*	3.40 ± 0.51^{b}	5.60 ± 0.24^{a}	3.80±0.58^{b}	4.80±0.20^{b}	5.64	0.0078
Weight (g)	*P. ostreatus*	33.60 ± 4.61^{b}	53.00± 2.55^{b}	101.40±13.11^{a}	100.60±7.30^{a}	18.54	0.0001

Means followed by the same letter are different at 5% level of significance

Table 3. Growth and yield parameters, of *P. sajor-caju* based on treatment levels (Means ± SD)

Parameter	Mushroom species	Beans Straw	Palm cones	Sawdust/ maize cobs	Sawdust	F-Value	*P* value
Spawn running time (Days)	*P. sajor-caju*	31.60 ± 2.46^{a}	13.00±0.45^{c}	16.60 ± 1.17^{c}	24.00± 0.51^{b}	34.96	0.0001
Pinhead Formation	*P. sajor-caju*	47.20 ± 0.66^{a}	20.00 ±0.89^{c}	23.20 ±0.37^{b}	46.40± 0.75^{a}	440.19	0.0001
Pinhead to harvest (Days)	*P. sajor-caju*	5.60±0.24^{b}	5.40 ±0.24^{b}	5.80 ± 0.37^{b}	6.80±0.20^{a}	5.16	0.0110
Spawning to harvest (Days)	*P. sajor-caju*	84.40±2.94^{a}	38.00 ±1.14^{c}	45.60 ± 1.03^{b}	77.60±0.58^{a}	184.51	0.0001
Length of stipe(cm)	*P. sajor-caju*	8.76 ±0.27^{d}	12.28± 0.47^{c}	18.66 ± 0.50^{a}	15.82±0.59^{b}	83.07	0.0001
Diameter of Pileus(cm)	*P. sajor-caju*	12.82 ±0.27^{c}	9.38 ± 0.37^{d}	16.24 ± 0.66^{b}	18.56±0.35^{a}	83.96	0.0001
Number of fruiting bodies	*P. sajor-caju*	27.80 ±3.25^{a}	34.60 ± 0.51^{a}	30.40 ±2.25^{a}	14.20±1.32^{b}	17.69	0.0001
Weight (g)	*P. sajor-caju*	25.60 ±1.36^{c}	33.00 ± 5.60^{c}	95.20 ± 2.58^{a}	53.00 ±3.39^{b}	75.87	0.0001

Means followed by same letter, are different at 5% level of significance

Number of fruiting bodies: The number of individual fruiting bodies was higher in *P. sajor-caju* in all the treatments but highest in treatment C; Palm cones (34.60 ± 0.51) and least in treatment D; 100% sawdust (14.20±1.32) (Table 2 and 3).

The mean number of individual fruiting bodies per treatment was higher in *P. sajor-caju* in all the treatments but highest in treatment C; Palm cones (34.60 ± 0.51) and least in treatment D, 100% sawdust (14.20±1.32), possible due to lack of suitable nutrients in sawdust. Ajonina and Tatah (2012) also reported low numbers of fruit bodies in sawdust.

Fastest spawn run time, primordial initiation, pinhead formation to harvesting, and highest number of fruit bodies per cluster occurred in substrate C (palm cones). Sawdust supplemented with rice bran took longer to start pinning and fruit body formation, likely because of its high-quality lignin and cellulose content (Pokhrel *et al.,* 2013) and low protein content (Girmey *et al.,* 2016). Pokhrel, (2016) reported that the organic supplement rice bran, contributed to increase yield because it increased water-soluble sugars and nutritional value of substrates. Reducing the sizes of all the substrate by either grinding in a mill or chopping with a cutlass made the nutrients in the substrate more accessible for the growth of the mushroom.

Weight of fruiting bodies (g): The highest mean fresh weight of individual fruiting bodies was recorded in sawdust mixed with maize cobs for both *P. ostreatus* and *P. sajor-caju* (101.40±13.11g and 95.20 ± 2.58g), respectively. The least weight in was recorded in beans straw (33.60 ± 4.61 in *P. ostreatus* and 25.60 ±1.36 in *P. sajor-caju*).

Highest mean fresh weight of individual fruiting bodies recorded in sawdust-mixed maize cobs is similar to the findings of Nsoh *et al.* (2022), who confirmed the best yield of *P. ostreatus* when cultivated on this substrate. A significant difference in weight was observed between the mushroom species on the same substrates. The saprophytic mode of life of mushrooms utilizes various lignocellulosic materials to grow. *Pleurotus* species produce enzymes that make them grow on many agricultural residues (Pokhrel, 2016). For successful cultivation, the mycelia must grow to create a suitable internal environment. Thus, excellent growth of the mycelia indicates the yield (Pokhrel *et al.,* 2009).

The weight of each fruiting bodies, diameter of the pileus of individual fruiting bodies and the length of stipe was highest in treatment A (maize cobs + sawdust) for both species; suggesting that maize cobs mixed with sawdust is a good substrate for mushroom cultivation. This is in conformity to the report of Ajonina and Tatah, (2012) and Nsoh *et al.* (2022), who recorded the highest weight of individual fruit bodies on maize cobs mixed with sawdust.

In conclusion, the study revealed that some mushroom species from the wild can be cultivated using different agricultural waste. Among the mushroom species collected from the wild, *Pleurotus sajor-caju, P. ostreatus* and *Laetiporus sulphureus* successfully formed spawns and were subjected to domestication. *Pleurotus sajor-caju* and *P. ostreatus* were successfully cultivated on four agricultural waste; maize cobs mixed with sawdust, beans straw, palm cones and sawdust. The sizes produced from domestication by *P. sajor-caju* were smaller than that from the wild; suggesting that the substrates used did not provide the optimum requirements for growth while the sizes of *P. ostreatus* were larger than that from the wild. Maize cobs mixed with sawdust produced better yield and should be proposed to mushroom farmers. Generally, cultivation of mushroom on agricultural residues should be encouraged as this can be used to produce mushroom for income generation and food at a cheap cost. Further studies should be carried out on optimum growth requirements for *Laetiporus sulphureus*.

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