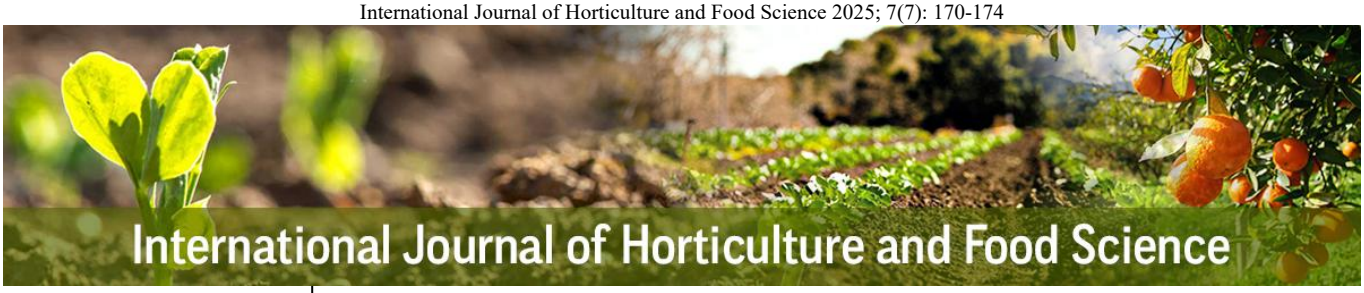

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Effect of different agricultural substrate on growth parameter of *Macrocybe gigantea* mushroom

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Abstract
Eight different agricultural substrates (arecanut leaves and sheath, Coconut leaves, Soybean straw, Sugarcane trash, Sugarcane bagasse, Banana pseudo-stem, Paddy straw, and Wheat straw) were evaluated for their effects on growth performance (days required for spawn run, case run, pinhead initiation, fruiting, and harvest) and morphological characters (pileus diameter, stipe length, and stipe girth.) of *Macrocybe gigantea* with cocopeat and soil (80:20) as casing material during December 2024. The results showed that soybean straw and paddy straw reported minimum days for spawn run (16 and 16.33 days, respectively), case run (5.33 and 6.99 days, respectively) and total days for fruiting (39.52 and 44.09 days, respectively). Whereas arecanut leaves and sheath reported maximum days for spawn run (28.33 days) and fruiting (86.33 days) with regards to morphological characters, banana pseudo stem yielded the best result with maximum stipe length of 11.60 cm, 6.65 cm of stipe girth and substantial pileus diameter of 5.82 cm. although arecanut leaves and sheath yielded largest pilus diameter of 6.65 cm, due to its larger cultivation duration, it is less efficient. Sugarcane bagasse is least efficient in all aspects. Thus, soybean straw and paddy straw are recommended for faster cultivation and harvesting, while Banana pseudo stem is ideal for better morphological traits of *Macrocybe gigantea*.

Keywords: *Macrocybe gigantea*, substrates, pinhead, stipe, stipe girth, pileus

1. Introduction
Due to its unique taste and nutritional value, mushroom is popular in the world. A mushroom is a form of life known as a fungus, group of organism separate from plants and animals. According to Chang and Miles [1], historically, mushrooms were foraged from the wild for consumption and medicinal purposes. They have been consumed or used as food since antiquity and are believed to be a culinary wonder [2]. Mushrooms are used in Ayurveda and traditional medicine in India [3, 4].

Macrocybe belongs to Kingdom-Fungi, Phylum-Basidiomycota, Class-Agaricomycetes, Order-Agaricales, and Family-Tricholomataceae [5, 6]. This edible mushroom was reported for the first time in West Bengal [7]. Due to these nutritional and therapeutic attributes [8], growing this mushroom on a commercial scale could offer significant advantages for maximizing its benefits. For optimal growth, *Macrocybe gigantea* typically thrives in temperatures between 25 to 35 °C, with 70-80% relative humidity and 8-10 hours of light daily [9, 10, 11]. Along with being a good source of nutrients, mushrooms play important role with regard to biological activities as saprophytes and provide economical support to farmers. In India, the availability of large agricultural waste biomass like paddy straw, wheat straw, banana pseudo stem, coconut waste, etc. creates great scope for mushroom cultivation. Thus, the present work was carried out with an aim study effect of various treatment substrates like, arecanut leaves and sheath, banana pseudo stem and leaves, coconut leaves, sugarcane bagasse, sugarcane trashes, wheat straw, soybean straw and paddy straw on morphology and various growth parameter of *Macrocybe gigantea* mushroom.

2. Materials and Methods
The study was carried out at All India Coordinated Research Project on Mushroom (AICRP), College of Agriculture, Pune (MS), Maharashtra, India during 2024. The experiment was

laid out in the Completely Randomized Design (CRD) with eight treatments (T_1: Areca nut leaves and sheath, T_2: Coconut leaves, T_3: Soybean straw, T_4: Sugarcane trash, T_5: Sugarcane bagasse, T_6: Banana pseudo stem, T_7: Paddy straw and T_8: Wheat straw (control)) and replicated three times to Cultivate *Macrocybe gigantea*.

2.1 Preparation of commercial spawn

For spawn preparation, wheat grains that were healthy and bold were used as base material in spawn bottles and polypropylene bags. Wheat grains were used as the base material for multiplying the mycelium in the spawn bottles and polypropylene bags. The bold and healthy disease free wheat grains were used for substrate purpose. Wheat grains were washed twice to remove the suspended dust particles or foreign materials, and then the wheat grains were boiled in the container with water till they softened. Care was taken that the starch should not ooze out of the grains. The boiled grains were spread in thin layer on a jute sheet under shade for draining out excess water from grains surface to avoid greasiness, and calcium carbonate powder ($CaCO_3$) at three per cent of the dry substrate was thoroughly mixed with the grains for maintenance of proper pH (6.5 to 7.0) in the spawn substrate.

The grains were filled up to ¾ of polypropylene bags of 100 gauge thickness and were plugged with non-absorbent cotton and sterilized in an autoclave at 20 psi for 2 hrs. After sterilization, bags were allowed to cool overnight and then transferred to the inoculation chamber. Sterilized bags were inoculated with master spawn, which was 15 days old @10g/Kg and were incubated at 27 ± 1 °C for 15 days. The mycelium covered the grains in 15 to 20 days and the commercial spawn was ready for further studies.

2.2 Preparation of substrate

All substrates were chopped into small pieces of 2-3 cm size, and then each substrate was soaked separately in the solution of Formalin (125 ml) and Bavistin (7.5 g) mixed in 100 liters of water for 18 hours. Then excess water was drained out.

2.3 Bed preparation and crop management

For the cultivation of *Macrocybe gigantea*, polythene bag method of cultivation was followed. The polythene bags of size 35x55 cm. were disinfected with 5 per cent formalin solution. The beds were prepared by the layer method of spawning @ 4 per cent on wet weight basis of straw, the neck of bags were tied with thread tightly. About 35-40 pinholes were made on all over the surface of the bags. Three replications for each substrate treatments were kept for incubation (spawn run) in the incubation room. After complete spawn run in the substrate the polythene bags were opened mouth of bag fold and stacked in well-ventilated growing room on iron racks. Afterward carried out casing of 3 - 5 cm thickness with pre sterilized casing material (cocopeat + Soil (80:20)) of. Provision for better light and humidity was made. Spraying of water was done 1-2 times a day. The temperature of growing room was maintained in range 25-35 °C and relative humidity of more than 80 percent with the help of a humidifier throughout the cropping period.

2.4 Harvesting

Harvesting of fruit bodies was done by twisting. The observations before harvesting like days required for spawn run, case run and days to attend maturity were recorded. Similarly for morphological features like average stipe length, average girth of fruit body, and average diameter of sporocarp, were recorded immediately after harvesting.

2.5 Statistical analysis

The data for various observations was analysis using CRD. The statistical standard method as described by Panse and Sukhmate[12] and on online OPSTAT application were followed for statistical significance

3. Results & Discussion

3.1 Days required for spawn run, case run pinhead initiation, fruiting and harvest

Days required for spawn run, case run, pinhead initiation, fruiting and harvesting for *Macrocybe gigantea* on different substrates were presented in Table. 1 and. Fig. 1 and Fig. 2. Average days required for spawn run ranged from 16 to 28.33 where, soybean straw and paddy straw required minimum 16 days followed by paddy straw with 16.33 days. While arecanut leaves and sheath reported maximum of 28.33 days. Average days required for case run ranged from 5.33 to 24.50. Minimum number of days case run (5.33 days) were reported on Soybean straw, followed by coconut leaves (5.44 days) and paddy straw (6.99 days). While arecanut leaves and sheath reported maximum of 24.50 days. Average days required for harvest after pinhead become ready for harvest ranged from 7.67 to 10.55 days. Banana pseudo stem required minimum 7.67 days, followed by paddy straw (7.99 days) and arecanut leaves and sheath reported maximum days of 10.55 days. The present findings on spawn run, pinhead initiation, and harvesting in *Macrocybe gigantea* were consistent with earlier reports by Devi and Sumbali (2021) [11], Kushwaha *et al*., (2016) [13], Akhtar *et al*., (2018) [10], Selvaraju *et al*., (2015) [14], and Galappaththi *et al*., (2022) [15], showing spawn run completed within 12-22 days, pinhead formation in 13-21 days, and harvesting within 4-10 days after primordia emergence.Total days required for fruiting ranges from 39.52 to 86.33 days. Minimum days were observed on Soybean straw (39.52 days) followed by Coconut leaves and sheath (41.10 days), paddy straw (44.09 days), wheat straw (45.43 days) and banana pseudo stem (46.54 days). The longest time period was observed in arecanut leaves and sheath (86.33 days). Here, the results obtained for total days were in conformity with the results obtained by Hossian (2024) [16], who reported that for substrates like paddy straw, coconut coir and sugarcane bagasse total days required for complete maturity of *Macrocybe gigantea* ranges between 42 to 49.30 days.

3.2 Morphological characteristics of *Macrocybe gigantea* on different substrates

The data in Table. 2 and Fig. 3 revealed that the maximum pileus diameter was recorded on arecanut leaves and sheath of 6.65 cm followed by coconut leaves (5.86 cm) and banana pseudo stem (5.82 cm.) minimum pileus diameter of 3.75 cm was observed in treatment sugarcane bagasse. The data on stipe length revealed that the banana pseudo stem shows maximum stipe length treatment (11.60 cm) while the minimum stipe length was observed in sugarcane bagasse (7.72 cm) banana pseudo stem showed maximum average stipe girth of 6.65 cm and the minimum stipe girth of 6.76

cm was recorded in sugarcane bagasse. Above results are in agreement to those of Akhtar *et al*., (2018) [10], Galappaththi *et al*., (2022) [15] and Selvaraju *et al*., (2015) [14], who reported average pileus diameter ranged from 8.46-11.63 cm, 4- 7 cm, and 7.1 cm in paddy straw respectively. Similarly, stipe length ranged from 7.6 to 17 cm respectively.

4. Tables and figures

Table 1: Number of average fruit bodies, average fruit body weight of *Macrocybe gigantea* mushroom on different substrates

Treatment no.	Substrate used	Average days required to complete spawn run*	Average days required for case run*	Average days required for pinhead initiation*	Average days required for harvest after pinhead initiation*	Average total days required for fruiting*
T_1	Arecanut leaves and sheath	28.33	24.50	25.50	8.00	86.33
T_2	Coconut leaves	17.33	5.44	9.11	9.22	41.10
T_3	Soybean straw	16.00	5.33	7.66	10.53	39.52
T_4	Sugarcane trash	17.33	9.78	13.66	8.66	49.43
T_5	Sugarcane bagasse	20.67	11.55	14.11	10.55	56.88
T_6	Banana pseudo stem	18.00	8.56	11.98	7.67	46.54
T_7	Paddy straw	16.33	6.99	12.78	7.99	44.09
T_8	Wheat straw	16.00	7.55	13.77	8.11	45.43
	SE(±)	0.49	0.86	0.79	0.76	1.89
	CD(0.05)	1.47	2.61	2.39	2.29	4.01

*: Mean of three replications CD: Critical Difference at 0.05 SE: Standard Error

Table 2: Morphological characteristics including pileus diameter, stipe length and stipe girth of *Macrocybe gigantea* mushroom on different substrates

Treatment No.	Substrate used	Average pileus diameter (cm) *	Average stipe length (cm)*	Average stipe girth (cm)*
T_1	Arecanut leaves and sheath	6.66	9.85	7.37
T_2	Coconut leaves	5.86	11.57	9.13
T_3	Soybean straw	4.89	10.87	8.89
T_4	Sugarcane trash	4.86	10.86	8.92
T_5	Sugarcane bagasse	3.75	7.72	6.76
T_6	Banana pseudo stem	5.83	11.60	9.38
T_7	Paddy straw	5.13	9.61	8.92
T_8	Wheat straw	5.61	9.86	8.03
	SE(±)	0.07	0.31	0.14
	CD(0.05)	0.20	0.94	0.41

*Mean of three replications; CD: Critical Difference; SE: Standard Error; cm: Centimeter

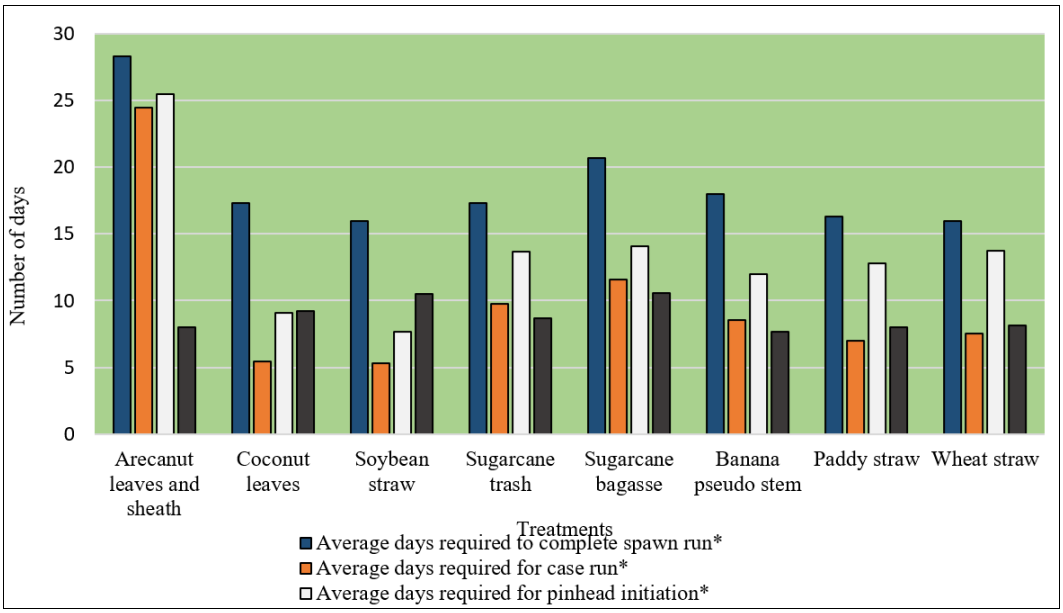

Fig 1: Average number of days required for spawn run, case run, pinhead initiation and average days required for harvest after pinhead formation of *Macrocybe gigantea* mushroom on different substrates

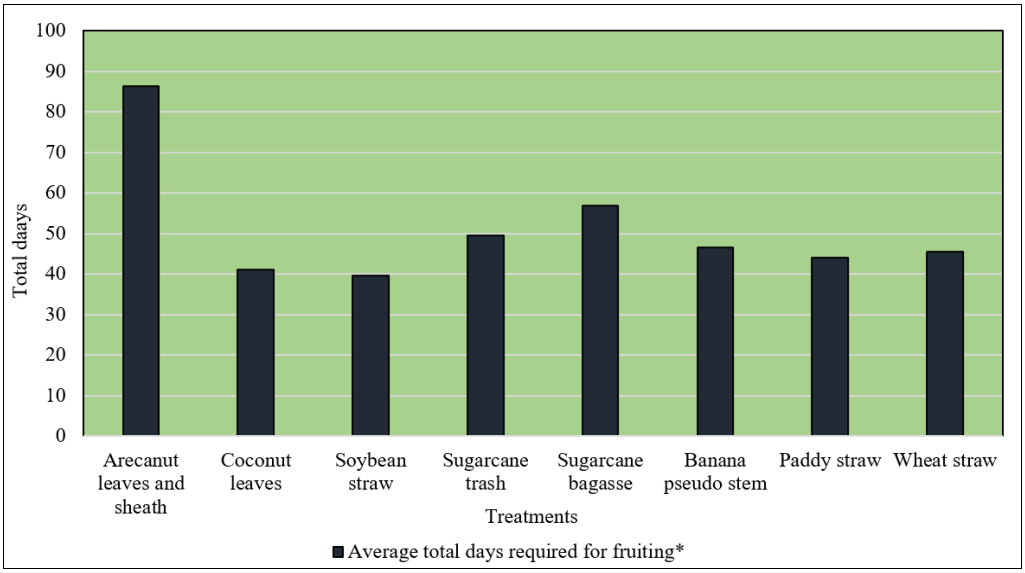

Fig 2: Average total number required for required for fruiting of *Macrocybe gigantea* mushroom on different substrates

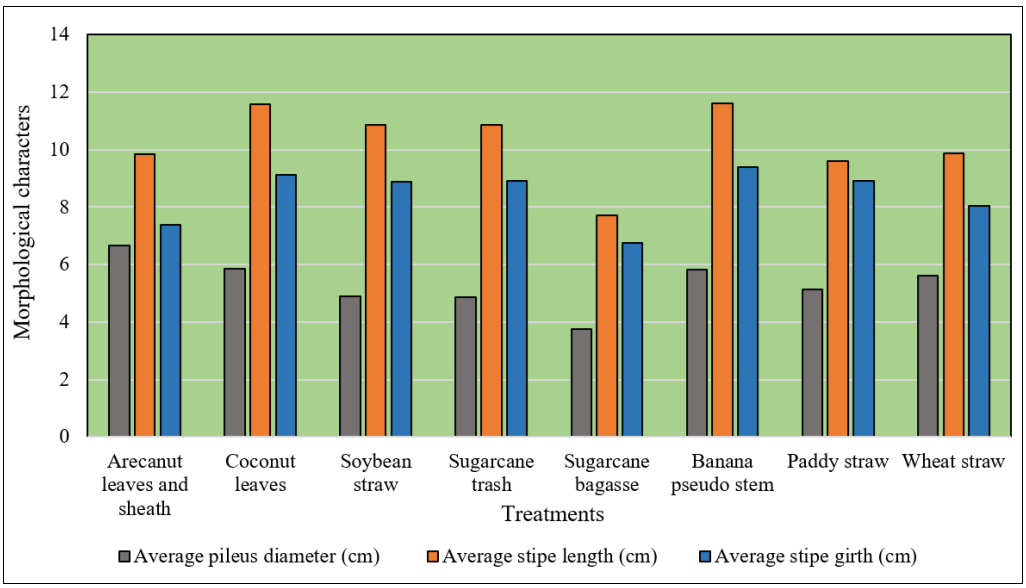

Fig 3: Average pileus diameter, stipe length and stipe girth of mushroom *Macrocybe gigantea* (cm) on different substrates

5. Conclusions

From present study it can be concluded that soybean straw and paddy straw required minimum time for spawn run and fruiting, whereas arecanut leaves and sheath was reported for maximum days for spawn run and fruiting. Morphologically banana pseudo stem as a substrate yielded larger fruit bodies with regards to its pileus diameter, stipe girth and stipe length over other. Thus, soybean straw and paddy straw are more efficient substrate in terms of days required for fruiting, while banana pseudo stem gives morphologically superior fruits.

6. Acknowledgement

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