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Impact of Different Substrates on Growth and Yield of *Schizophyllum commune* Fr.

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

*Schizophyllum commune*Fr. is an edible medicinal mushroom also known as white rot fungus that develops naturally on dead woods which belongs to the phylumBasidiomycota, order Agaricales, family Schizophyllaceae.To find out most suitable growing substrates, mushroom was cultivated on 6 locally available substrates including different saw dust *i.e.*Babool (*Vachellianilotica*),Bija (*Petrocarpus marsupium*),Sal (*Shorea robusta*),Sagwan (*Tectona grandis*) and different straw*i.e.* Paddy straw(PS) and Wheat straw(WS). Among the different substrates,on an average,WS took shortest time for mycelial run (6.50 days), longest time(8.62 days) taken by Bija (*P. marsupium*). Pinhead initiation was fastest (8.50 days) in WS while, Bija (*P. marsupium)*took more time period(10.62 days) for pinhead initiation. The Maximum yield was obtained from WS (148.37gm) with biological efficiency (29.6%) followed by PS(116.12 gm) with biological efficiency (23.2%). The lowest yield was obtained from saw dust of Bija (*P. marsupium)*(60.50gm) with biological efficiency (10.40%).There was significant difference in yield when supplement (wheat bran)was mixed with substrates, however there was no significant difference observed in mycelial run and pinhead initiation.

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1. INTRODUCTION

Mushroom cultivation is a promising business with monetary benefits in very short time span, which require no more land and space with less labor intensive. The *S. commune* fruiting body is a small flabelliform (fan-shaped), hairy, stipe less white cap, which belong to the phylum Basidiomycota, order Agaricales, family Schizophyllaceae. It is derived from "*Schiza"* meaning split because of the appearance of radial, centrally split, gill like folds,"*commune*" means common or shared ownership or ubiquitous Mahajan, M., [1]. Takemoto *et al.* [2] reported that this mushroom grows abundantly during the raining season, found in the dead tree bark and on the branches of living trees, but as it spreads, the tree will no longer be able to survive. According to Yim *et al.,* [3] this fungus can be found in both sub-tropical and tropical woods. It is frequently used as a food ingredient, particularly in Asian nations because it contains nutrients that are good for the body like protein, fiber, and carbohydrates Krupodorova&Barshteyn, [4]. Additionally, *S. commune* extract has the ability to treat diseases caused by bacteria and fungi, making it a potential antibacterial agent, according to Mirfat*et al.* [5]. but due to its potent therapeutic qualities like Schizophyllan, an anti-cancer chemical and immune-stimulant, is another ingredient found in this fungus Oi and Liu, [6]. Due to their easy cultivation, rising popularity, and nutritional value, *S. commune* and other therapeutic mushrooms are now produced in greater quantities [7,8]. Therefore, the study was undertaken to cultivate *S. commune* on locally available different substrates like different wood saw dust and agricultural residues and their effect on production of the mushroom.

2. MATERIALS AND METHODS

2.1 Experimental Site

All research experiments were carried out at the Mushroom Research Laboratory, Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur (C.G.).

2.2 Preparation of Planting Spawn

It was preparedby using 250 g of wheat grains in empty 500 ml glucose bottles or flasks. Boiledwheat grains were placed in bottles/flasks and sterilized at 121.6°Cunder 15 lb/inch^2. After cooling, they were aseptically inoculated with mycelial disks(1cm^2) of pure culture of *S. commune* which was prepared on PDA medium by inoculating tissue of *S. commune*fruiting body and incubated at room temperature. The inoculated bottles were frequently checked for contamination; those that revealed contamination were promptly rejected, while those that shown uniform, silky, smooth mycelial growth covering all grains were put to use in experiments.

2.3 Substrate Evaluation for Growth and Yield

2.3.1 Preparation of cultivation substrate

In order to prepare growing medium, different substrates *viz*. saw dust (babool, bija, sal, sagwan), wheat straw, paddy straw, were used to see their effect on mycelial run, primordial initiation, and yield. Wheat straw and paddy straw was dipped in plain water for 6-7 hours then excess water was drained and spread on sloppy cemented floor until the moisture content of the substrate was approximately 65-70%.Thereafter, appropriate amounts of wheat bran, $CaCO_3$ and $MgSo_4$ were mixed in each substrate. Saw dust were well mixed with appropriate amounts of wheat bran, $CaCO_3$ and MgSo4 and then sprinkled with1liter of water and leftfor 20 minutes for maintainingmoisture then used for spawning.

The prepared substrate (500 g dry weight) was filled in poly propylene bags (12 " x 18" -150 gauges) and plugged with non-absorbent cotton by ring. The bags were sterilized at 121.6ºC for 2 hours. After sterilization bags were allowed for cooling overnight and the next day sterilized bags were inoculated aseptically by grain spawns of *S. commune* @ 10% dry weight basis of substrate. After inoculation each bag was sealed with non-absorbent cotton and shaken for 03 minutes and placed in growing room. Five replications for each substrate were maintained and observations for number of days required for mycelial run, primordial initiation, yield per bag(g) and B.E. (%) was recorded.

2.3.2 Effect of wheat bran supplement on yield

Wheat bran was used as supplement at 2:1 ratio and mixed with cultivation substrate to obtain better yield.

2.4 Statistical Analysis

Completely randomized design was used to conduct the present experiment and obtained data for results were calculated using OPSTAT online software.

3. RESULTS

3.1 Mycelial Run

It is clearly evident from Table 3 that time required for mycelial run by *S. commune* on different substrate was differed significantly in both years (2020-2021).During 2020-21, significant fastest mycelial run was recorded on wheat straw (6.75 days) followed by paddy straw (7.00 days), saw dust of babool (7.00 days), saw dust of sagwan (7.50 days), saw dust of sal (7.75 days) which were at par with each other while it was delayed on saw dust of bija (8.25 days) and mycelial run period did not differ with sagwan and sal. During 2021-22, result was same as 2020-21 for mycelial run, wheat straw took faster time (6.25 days) as compared to other substrate followed by paddy straw (7.00), saw dust of babool (7.00days), saw dust of sal (7.50) and sagwan (7.50) which was at par. However slower mycelial run was observed in saw dust of bija (9.00 days). On an average of 2 years data showed that wheat straw required less (6.50 days) period for mycelial run whereas (8.62 days) time period taken by saw dust of bija. In other substrate mycelial run period were at par with each other.

3.2 Primordial Initiation

During 2020-21, earlierprimordial initiation was found on saw dust of babool tree and wheat straw (8.75 days) followed by paddy straw (9.00 days), saw dust of sal (9.50 days) and saw dust of sagwan (9.25 days) which were at par with each other while more (10.25 days) days taken by saw dust of bija. The time required for primordialinitiation during 2021-22 was also similar as 2020-21 on different substrates. Quickest primordial initiation was noted on wheat straw (8.25 days) followed by babool tree (8.75 days), paddy straw (9.00 days), sal tree (9.25 days) and sagwan tree (9.25 days) while bija tree took more (11.00 days). On an average of 2 years of data indicate that the time required for primordialinitiation varied from (8.50-11.00 days) on different substrates and note lesser time (8.50 days) taken by wheat straw while more (11.00 days) time period recorded in saw dust of bija tree.

3.3 Yield

The fresh yield of *S. commune* was significantly influenced by different substrates during both years. During 2020-21 significantly higher yield was obtained from wheat straw (150.50gm) as compared to other substrates while lower (57.25gm) procured from saw dust of bija tree. The other substrate *i.e.* babool, sal, sagwan and paddy straw gave 94.74,71.50, 67.00 and 102.25 gm fresh yield. The yield obtained from babool, sal, sagwan saw dust and paddy straw was statistically at par with each other. During 2021-22 it was noticed that the pattern was same as 2020-21. Fresh yield of *S. commune* was higher in wheat straw (146.25gm) followed by paddy straw (130.00 gm), babool (97.75) gm, sal tree (81.50gm) and sagwan (71.25gm) while lower (63.75gm) yield was obtained from saw dust of bija tree. The yield obtained from babool, sal, sagwan did not differ from each other but differed from paddy straw. The average data of two years indicate that wheat straw produced higher yield (148.37 gm) as compared to other substrates.

3.4 Biological Efficiency

The biological efficiency of *S. commune* in different substrates was similar in accordance with that of fresh yield and it was highest (30.10%) recorded in wheat straw followed by paddy straw (20.45%) saw dust of babool (18.95%) sal (14.30%) sagwan (13.40%) while lowest B.E. was noticed in bija (11.45%) during year 2020-21.During 2021-22, biological

Table 1 Collection of saw dust of different woods

S.n.	English name	Local name	Scientific name	family
1.	Acasia nilotica	Babool	*Vachelianilotica*	Fabaceae
2.	Indian kino tree	Bija	*Petrocarpus marsupium*	Fabaceae
3.	Shorea robusta	Sal	*Shorea robusta*	Dipterocarpaceae
4.	Teak wood	Sagwan	*Tectona grandis*	Lamiaceae

Table 2. Composition of different wood saw dust substrates

Particulars	Quantity
Saw dust	500g
Wheat bran	250g
$CaCo_3$	10g
$MgSo_4$	1g
water	1liter

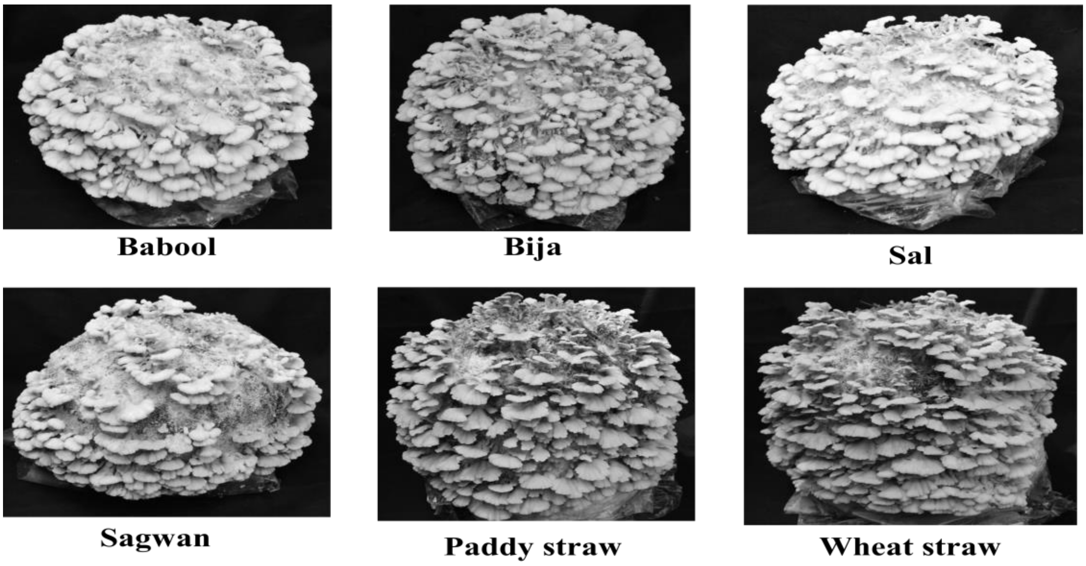

Fig. 1. Impact of different substrates on fruiting bodies of *S. commune*

efficiency on different substrate varied from 12.75 to 29.25%. Maximum (29.25%) B.E. of *S. commune* was obtained from wheat straw next were paddy straw (26%), sal (16.30%), sagwan (14.25%) while minimum was found on sawdust of bija (12.75%). The pooled data of two-year biological efficiency is similar to fresh yield and it was highest (29.67%) recorded on wheat straw followed by paddy straw (23.22%), saw dust of babool (19.25%), sal (15.30%), sagwan (13.22%) while lower biological efficiency was observed in bija (12.10%).

4. DISCUSSION

In the present investigation locally available different agricultural residues and saw dust of different trees were evaluated to see their impact on growth and yield parameters of *S. commune*. Among them wheat straw, babool saw dust and paddy straw took less time for mycelial run, pinhead initiation and also were found as highest yielder, followed by saw dust of sal, sagwan while bija tree saw dust took more days to complete mycelial run and gave lowest yield.The significant variation was recorded in the biological efficiency of *S. commune* mushroom grown on sawdust of different wood saw dust and other agricultural residues *i. e.*paddy straw and wheat straw. This result findings shows similarities to Singh *et al.* [9] their cultivation trial recorded paddy straw supplemented with wheat bran as the best substrate for growing of *S. commune* with highest fresh weight yield of 91.9 gm/bag, and bio- logical efficiency of 18.33%, reduced spawn run days and days to harvesting.Similarly, the results arein accordance with the findings of Upadhyay [10] who grew*S. commune* on paddy straw, wheat straw and saw dust and found paddy and wheat straw gave higher yield. Patil [11] cultivated *S. commune* on chopped rice straw supplemented with wheat bran.In contrast to our results Dsanayaka and Wijeyaratne [12] suggested jack fruit saw dust for higher yield of *S. commune*.Debnath *et al.* [13] stated that cultivation on saw dust gave higher yield of *S. commune.*Coconut leaf and coir dust containing mixtures was found more appropriate for yield maximization Ediriweera *et al.* [14]. Approximately 150 genera of woody plants, soft wood plants, graminaceous plants have been reported as substrate for cultivation of *S. commune* by other works Ohm *et al.,* [15]. Takemoto *et al.,* [2].

Table 3. Impact of different substrates on growth and yield attributing parameters of *S. commune*

S. N.	Substrate	Spawn run (days) *			Pinhead initiation (days) *			Yield (g) *			BE (%)		
		2020-21	2021-22	Average	2020-21	2021-22	Average	2020-21	2021-22	Average	2020-21	2021-22	Average
1.	Babool	7.00	7.00	7.00	8.75	8.50	8.62	94.75	97.75	96.25	18.95	19.55	19.25
2.	Bija	8.25	9.00	8.62	10.25	11.00	10.62	57.25	63.75	60.50	11.45	12.75	12.10
3.	Sal	7.75	7.50	7.62	9.50	9.25	9.37	71.50	81.50	76.50	14.30	16.30	15.30
4.	Sagwan	7.50	7.50	7.50	9.25	9.25	9.25	67.00	71.25	69.12	13.40	14.25	13.82
5.	PS	7.00	7.00	7.00	9.00	9.00	9.00	102.25	130.00	116.12	20.45	26	23.22
6.	WS	6.75	6.25	6.50	8.75	8.25	8.50	150.50	146.25	148.37	30.10	29.25	29.67
	SE(m) ±	0.27	0.30		0.28	0.27		16.47	6.62				
	CD (5%)	0.80	0.91		0.86	0.80		49.33	19.83				

**Average of four replication, PS-Paddy straw, WS-wheat straw*

5. CONCLUSION

Based on present study,it can beconcluded thatwheat straw and paddy strawgave highest yield among tested substrates followed by saw dust of babool*(Vachelianilotica)*. Wheat bran enhanced the production of mushroom and quality of fruiting body.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mahajan M. Schizpphyllum commune Emerging infectious diseases. www.cdc.gov/eid. 2022; 28(3):125.
   Available:https://dio.org/10.3201/eid2703.211051.
2. Takemoto S, Nakamura H, Imamura EY, Shimane T. Schizophyllum commune as aubiquitous plant parasite. Jpn. Agric. Res. Q. 2010;44:357–364.
3. Yim HS, F. Yee Chye, V. Rao, J. Yin Low, P. Matanjau, S. Eng How, C. Wai Ho. Optimization of Extraction Time and Temperature on Antioxidant Activity of Schizophyllum commune Aqueous Extract Using Response Surface Methodology. J Food Sci. Technol. 2013; 50(2):275–283.
4. Krupodorova TA, &Barshteyn VY. Amaranth Flour as a New Alternative Substrate for Schizophyllum commune Fr.: Fr. and Cordyceps sinensis (Berk.) Sacc. Growth. Journal of Siberian Federal University. 2015;1:32–44.
5. Mirfat AHS, Noorlidah A, Vikineswary S. Antimicrobial activities of split gill mushroom Schizophyllum commune Fr. American Journal of Research Communication. 2014;2(7):113-124.
   Available:www.usa-journals.com,
   ISSN: 2325-4076.
6. Ooi VEC, Liu F. A review of pharmacological activities of mushroom polysaccharides. Int. J. Med. Mushrooms. 1999;1:195–206.
7. Chang ST, Buswell JA. Mushroom nutriceuticals. World Journal of Microbial Biotechnology. 1996;12:473-476.
8. Wasser SP. Review of medicinal mushrooms advances: good news from good allies. Herbal Gram. 2002;56:28-33
9. Singh, Shweta & Raj, Chandramani & Sharma, Susheel &Avasthe, Ravikant & Balusami, Arumugam & Lepcha, Sangay & Said, Prashant. Characterization and development of cultivation technology of wild split gill Schizophyllum communemushroom in India. Scientia Horticulturae. 2021;289.
   DOI:10.1016/j.scienta.2021.110399.
10. Upadhyay S. Studies on split gill mushroom (Schizophyllum commune Fr.) M.sc. (Ag) Department of Plant Pathology. College of Agriculture, Raipur (C.G.); 2022.
11. Patil A. Genitics of fertility and mating type status in Schizophyllum Spp.M.sc. (Ag) Department of Plant Pathology. College of Agriculture, Raipur (C.G.); 2023.
12. Dasanayaka PN, Wijeyaratne SC. Cultivation of Schizophyllum commune mushroom on different wood substrates. Journal of Tropical Forestry and Environment. 2017;07(01): 65-73.
13. Debnath, Sanjit & Bhattacharya, Sanchita & Das, Panna & Saha, Ajay. Cultivation of a wild strain of Schizophyllum commune on agro-industrial wastes. Kavaka. 2020;55:77-83.
    DOI:10.36460/Kavaka/55/2020/77-83.
14. Ediriweera S, Wijesundera R, Nanayakkara C, Weerasena O. Comparative study of growth and yield of edible mushrooms, Schizophyllum communeFr.,Auriculariapolytricha (Mont.) Sacc. and Lentinus squarrosulus Mont. on lignocellulosic substrates. Mycosphere. 2015;6(6):760–765.
    Available:https://doi.org/10.5943/mycosphere/6/6/10.

15. Ohm RO, Jong JFD, Lugones LG, Aerts A, Kothe E, Bartholomew KA. Genome sequence of the model mushroom Schizophyllum commune. Nat. Biotechnol. 2010;28:957–963.

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