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Effect of different substrates on nutrient and biochemical constituents of mushrooms

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Abstract
Mushrooms are rich in nutritional values mainly due to the substrates which are used for cultivation/growing. Hence an investigation was carried out with different substrates (paddy straw and red gram husk) with two mushrooms (*Hypsozygous ulmarius* and *Pleurotus florida)* at college of sericulture, Chintamani in the year 2020. The results reveal that maximum nutritional and biochemical constituents were recorded in paddy straw used as a substrate as compare to red gram husk in both the mushrooms.

Keywords: Paddy straw, Red gram husk, *Pleurotus florida*, *Hypsozygous ulmarius*, Mushroom.

Introduction
Mushrooms are rich source of protein, vitamins, fats, carbohydrates, amino acids and minerals (Jiskani 2001 and Buigut SK 2001) [8, 1]. Mushrooms are low in nucleic acids content which makes them an ideal food for patients suffering from diabetes, obesity and hypertension (ICAR 2003). Apart from its mineral and biochemical constituents mushrooms are also the source of anti-cancer, anti-cholesterol and anti-tumours.
The qualities of mushrooms are mainly due to substrates which are used for cultivation/growing of mushrooms. As saw dust produced highest yield, biological efficiency and number of fruiting bodies was recommended as best substrate for oyster mushroom cultivation (Shah *et al*., 2004) [15]. Another case study states that the growth of mushrooms on wheat straw and other substrates, the paddy straw was consider as the best substrate in terms of relative digestibility and nutrient status (Calzada *et al*., 1987) [2].
In dry land conditions it's difficult to obtain paddy straw as a substrate to grow mushrooms, an alternative substrate used in for mushroom cultivation is red gram husk. Farmers are burning red gram husk and used as compost material. Burning of these substrates leads to environmental pollution. Apart from burning it can be used as substrate for mushroom cultivation.
After harvesting mushroom, the spent mushroom substrate can be used as manure and its decomposition process of different substrates hence the present investigation was carried out with an aim of effect of different substrates on nutritional and biochemical constituents of mushrooms.

Materials and methods
Mushroom cultivation was carried out in the Department of Agricultural Microbiology, College of Sericulture, Chintamani (UASB). Different substrates i'e paddy straw (Fig.1) was collected from farmer field in humid and sub-humid climatic paddy growing area and red gram husk (Fig.2) was collected from Agricultural Research station, Chintamani comes under Eastern dry zone of Karnataka.

Fig 1: Paddy Straw

Fig 2: Red Gram Husk

Pure culture of *Pleurotus florida* and *Hypsozygous ulmarius* was obtained from Department of Agricultural Microbiology, Chintamani. The half cooked sorghum grains were used as a substrate for mushroom spawn. Sorghum grains were filled in ploy propylene bag and sterilized in a pressure cooker at 15 lbs pressure for 15-20 minutes and stored in a laminar flow. The mycelium of *Pleurotus florida* and *Hypsozygous ulmarius* which appeared in Petri plates was inoculated in the bottle containing sorghum grains that were closed with non-absorbent cotton plug and stored in room temperature for 15 days.

The method followed for cultivation of mushrooms was Desai and Shetty (1982) [3]. The substrates were soaked in fresh water for 10 hrs. In a container. The pasteurized substrate was spread on a clean cement floor in shade condition allow to cool in room temperature.

Substrates were filled to polythene bag of size 30cm x 45 cm of 150 gauge thickness. Substrates and spawn was filled at 5% of spawn wet basis and kept at shade area to maintain 70-80% humidity. After completion of mycelium growth (Fig 3, 4, 5, 6) the fruiting bodies were harvested and fresh weight was recorded. Primary biochemical analysis was carried out in fruit bodies of mushrooms which are harvested from different substrates. The following biochemical parameters were analyzed by using standard procedure, total protein content in mushroom substrates by using Lowery *et al.*, 1951, method, amino acid by Ninhydrin's test method and total carbohydrate by Dubois *et al.*, 1956.

Similarly mineral composition of mushrooms and substrates are estimated by Kjeldhal digestion and distillation method used for estimation of percent content N (piper 1966) [13], vanadomolybdate method for percent content P estimation (Piper 1966) [13] and Atomic emission spectrophotometry for percent of K estimation (Jackson 1973) [6].

Secondary and micronutrient content by Versanate titration method for Ca & Mg, turbidometry for S estimation and Atomic absorption spectrophotometry for Zn, Fe, Cu, Mn estimation (Jackson 1973 and Piper 1966) [6, 13].

Fig 3: *Hypsozygous ulmarius* grown on Paddy Straw

Fig 4: *Pleurotus florida* grown on Paddy Straw

Fig 5: *Pleurotus florida* grown on Red gram husk

Fig 6: *Hypsozygous ulmarius* grown on Red gram husk

Results and discussion

Effect of different substrates on biochemical constituents on mushrooms

Effect of paddy straw and red gram husk on protein, Amino acids and carbohydrate content of mushrooms are presented in Table 1 and Fig-7, 8.

Table 1: Effect of different Substrates on Biochemical Constituents of mushrooms.

Biochemical parameter	*Pleurotus florida*		*Hypsozygous ulmarius*	
	Paddy Straw	Red gram Husk	Paddy Straw	Red gram Husk
Protein (%)	58.71	28.65	64.10	24.14
Carbohydrates (%)	36.83	29.31	51.76	38.00
Amino Acids (%)	18.83	12.76	19.08	08.53

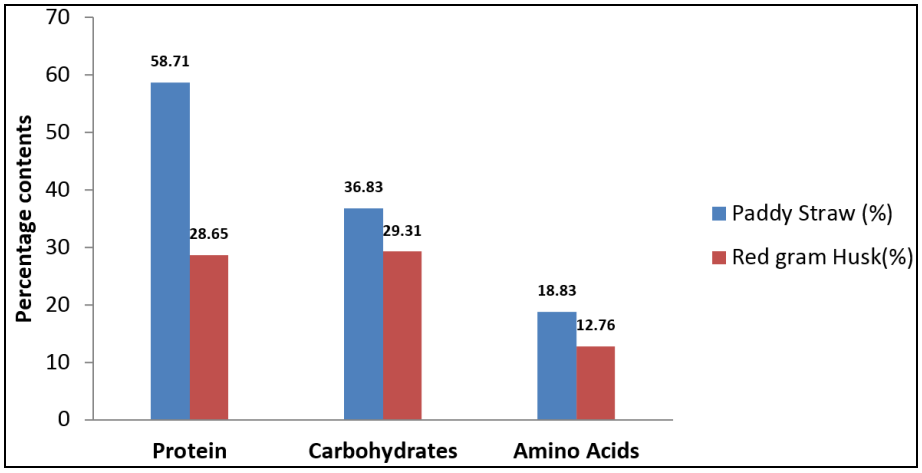

Fig 7: Effect of different Substrates on Biochemical Constituents of *Pleurotus florida* mushrooms.

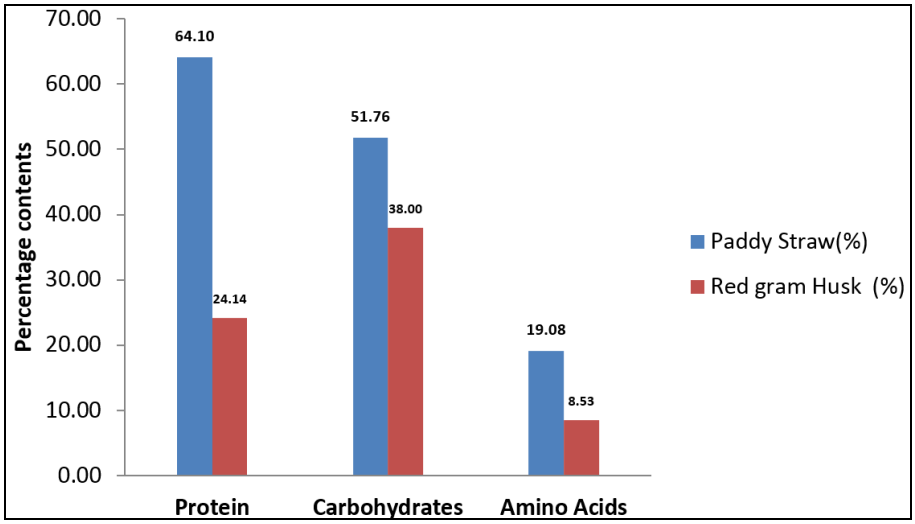

Fig 8: Effect of different Substrates on Biochemical Constituents of *Hypsozygous ulmarius* mushrooms.

The result revel that higher biochemical constituents i,e protein, carbohydrates, amino acids were found with paddy straw as a substrate in *Hypsozygous ulmarius* mushroom (64.10, 51.76 and 19.08 %) respectively. Whereas lowest biochemical constituents were recorded in Red gram husk of 24.10, 38.00 and 8.53 % for protein, Carbohydrates and Amino acids respectively. It may be due to chemical composition of paddy straw and faster rate of mineralization leads to faster of nutrients where as in Red gram husk having complex structure in its composition release slow nutrients.

Effect of different substrates on nutritional composition of *Pleurotus Florida* and *Hypsozygous ulmarius.*

The Table-2 represents effect of different substrates on nutritional composition of mushrooms. The results show that higher nutrients were recorded in paddy straw in both the mushrooms when paddy straw used as a substrates. Whereas lowest nutritional values were recorded in Red gram husk in both the mushrooms.

Table 2: Nutritional values of *Pleurotus Florida* and *Hypsozygous ulmarius* mushrooms grown on different substrates

Nutritient composition	*Pleurotus Florida*		*Hypsozygous ulmarius*	
	Paddy straw	**Redgram Husk**	**Paddy straw**	**Redgram Husk**
N %	3.10	1.97	2.80	2.62
P %	1.68	1.59	2.08	1.33
K %	29.25	33.90	28.90	23.08
S%	0.56	0.40	0.44	0.37
Ca%	1.42	1.78	1.22	1.04
Mg%	0.28	0.19	0.53	0.53
Zn ppm	133.60	100.80	128.60	106.00
Cu ppm	40.60	38.00	36.00	50.00
FePpm	622.00	466.0	694.0	428.00
Mn ppm	22.20	17.80	32.00	16.00

This may be due to slow release of nutrients by Red gram husk and its complex structure. However in dryland condition where the scarcity of paddy straw availability one can use alternative substrate for cultivation of mushrooms by using Red gram husk, Even though the elemental and biochemical constituents are low in Red gram Substrates but it's a promising alternative substrate can be used in dryland condition. Nature and chemical composition of the substrate. Similar results were also observed by Kamugisha., 2004 and Raj 2001 [9].

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