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Najmu Sakib

Division of Plant Pathology,
Sher-e-Kashmir University of
Agricultural Sciences and
Technology, Shalimar, Srinagar,
Jammu and Kashmir, India

Farahanaz Rasool

Division of Plant Pathology,
Sher-e-Kashmir University of
Agricultural Sciences and
Technology, Shalimar, Srinagar,
Jammu and Kashmir, India

Shaheen Kousar Jan

Division of Plant Pathology,
Sher-e-Kashmir University of
Agricultural Sciences and
Technology, Shalimar, Srinagar,
Jammu and Kashmir, India

Amreena Sultan

Division of Vegetable Science,
Sher-e-Kashmir University of
Agricultural Sciences and
Technology, Shalimar, Srinagar,
Jammu and Kashmir, India

Corresponding Author

Najmu Sakib

Division of Plant Pathology,
Sher-e-Kashmir University of
Agricultural Sciences and
Technology, Shalimar, Srinagar,
Jammu and Kashmir, India

Cultivation of paddy straw mushroom (*Volvariella volvacea*) under Kashmir conditions

Najmu Sakib, Farahanaz Rasool, Shaheen Kousar Jan and Amreena Sultan

Abstract

In the present study, Studies on Cultivation of Paddy Straw Mushroom (*Volvariella volvacea*) under Kashmir conditions was conducted to assess the physiological requirements, yield and other quality parameters of *V. volvacea* under traditional bed method. The grains viz., jowar, wheat, rice and oats were evaluated for spawn run on selected strains of *V. volvacea* viz., VV3, VV11, VV12 where in, jowar grain proved to be the best completing the spawn run in (08 days) in strain VV3. The strains of *V. volvacea* viz., VV3, VV11, VV12 evaluated under traditional bed method using paddy straw as substrate and wheat grain as spawn @ 200gm/10kg substrate and gram flour @ 200gm/10kg substrate showed VV3 as the best strain, completing the full spawn run (08days), pin head formation (15 days), yielding maximum number of fruit bodies/1000g (10.81), average fruit body weight (30.20g), maximum yield (2.08kg/10kg substrate) and biological efficiency (20.8%) recording lowest incidence of diseases/moulds (2%).

Keywords: *Volvariella volvacea*, wheat grain, traditional bed method, yield

Introduction

Mushrooms are large reproductive structures of edible fungi which belong to Divisions of Ascomycotina and Basidiomycotina. Mushrooms have been in existence for millions of years even before the origin of man (Kohli, 1990) [3]. There are 10,000 species of fleshy fungi (Kohli, 1990) [3] of which 2000 species are prime edible, 80 are grown experimentally, 20 are grown commercially. Though, the domestication of mushroom started around 1700 A.D the commercialization of mushrooms especially *Agaricus bisporus* took place in 20th century. Cultivated mushrooms have now become popular and over 200 genera of macro fungi are useful for the people in the world. The most acceptable varieties among the cultivated mushrooms are *Agaricus bisporus*, *Auricularia* spp. *Flamulina velutipes*, *Lentinus edodes*, *Tramella* spp, *Volvariella* spp. and *Pleurotus* spp. The production of mushrooms has increased over 28% during the last few decades. Paddy straw or grass mushroom is so named for its cultivation on rice straw. It is a valuable component in the diet due to its rich taste, aroma and nutritional value. *Volvariella volvacea* is a Holobasidiomycete, belonging to the family Plutaceae. It contributes to 6% of total world mushroom production, mostly used in the South Asian region. More than 100 species of *Volvariella volvacea* (Bull.ex.Fr) Singh have been reported from all over the world (Kurtzman and Yang, 1982) [4]. Paddy straw mushroom is a high temperature loving mushroom and so grown largely in the tropical and sub-tropical regions of Asia e.g., China, Taiwan, Thailand, Indonesia, India and Madagascar. *Volvariella volvacea* comprises of six maturity stages which are pinhead, tiny, button, egg, elongation and mature stages.

The harvesting of the mushrooms is usually done before it reaches to its maximum size i.e., at the button stage. The first flush lasts for 4-5 days followed by a second flush, a week later. The first flush accounts for major portion of the yield while as the second flush contributes only 10% to the yield of rice straw mushroom. The cultivation of the mushroom is easy but it is very difficult to obtain high and constant yield (Khanna, 1995) [2].

Material and Methods Preparation of Mother spawn

Mother spawn was prepared separately, for different strains of *Volvariella volvacea* from their pure cultures using wheat grains as a substrate. The grains were half boiled for 10-15 minutes, till they become soft without rupturing the epidermis and then these grains were spread on a clean table top to remove the excess moisture.

The grains were mixed with 3.5% calcium carbonate + 2.5% calcium sulphate on dry weight basis and were filled up to half. The glass bottles were sterilized in an autoclave for 2 hours. After cooling the bottles were inoculated with 5mm disc of pure cultures of selected strain VV3, VV11 and VV12 of *Volvariella volvacea* and incubated at 30±2 °C till the spawn run, which took about 8 days.

Spawn preparation on different types of grains

The grains viz., jowar, wheat, rice and oats as substrates were prepared. Three replications of each substrate per strain were maintained. The linear growth of *V. volvacea* mycelium on the substrates inoculated with each strain were observed for days taken for half and full spawn run, to get the best suited substrate for the spawn preparation of the *V. volvacea*.

Cultivation of *Volvariella volvacea*

The cultivation of *Volvariella volvacea* was taken under indoor conditions on paddy straw and the influence on yield parameters viz., spawn run, pin head formation, number of fruit bodies/1000g, average fruit body weight (g), yield/10kg substrate, biological efficiency and incidence of diseases and moulds were studied.

Fruiting and Harvesting

In about 20 days after spawning, pin-head started appearing. Since the straw mushroom is usually not left to grow to its maximum size, but is picked before the volva enclosing the cap breaks just after rupture i.e., at the button stage and later the egg stage. The first flush lasted for about 4-5 days and was followed by a second flush about a week later. However the yield of 2nd flush was only 10% of the first one. The total harvesting time lasted up to 2 months.

Biological efficiency

The biological efficiency was calculated taking fresh weight of all the mushrooms divided by weight of dry substrate and multiplied by 100 as below.

$$\text{B.E \%} = \frac{\text{Fresh weight of mushroom}}{\text{Dry weight of substrate}} \times 100$$

3.6.8 Incidence of diseases

Disease incidence was calculated by taking number of infected fruiting body divided by total number of fruiting body and multiplied by 100

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected fruiting body}}{\text{Total number of fruiting body}} \times 100$$

Yield

The yield was calculated by taking the fresh weight of 2-3 flushes which represented as weight (g) per unit of dry substrate.

$$\text{Yield (kg)} = \frac{\text{Fresh weight of 2-3 flushes}}{\text{Dry substrate (kg)}} \times 100$$

Results and Discussion

Effect of different strains on yield and yield attributing parameters of paddy straw mushroom (*Volvariella volvacea*) is presented in Table 1. Among the different grains used in the study on different strains of *V. volvacea*, jowar was found to be the best which was statistically at par with wheat. This work is in conformity with the reports from Zakhary *et al.* 1984^[10] and Tripathy *et al.* (2009)^[9] on *Volvariella diplasia*. Paddy straw mushroom was evaluated on wheat, jowar, oat and rice and found that jowar resulted in faster growth showing full spawn run on strain VV3 in 08 days; VV11 in 11 days and 10days for strain VV12 respectively, which was similar to the results obtained for full spawn run in wheat on the strains evaluated. This is in conformity with the findings of Kumar *et al.* (1975)^[5]. Mahanta *et al.*, (1994) who observed that yield of *V. volvacea*, *V. dysplasia* were found to increase by 5-10% on wheat grain spawn rather than other substrates. Maximum growth and productivity has been reported from spawn raised on wheat grains showing not only maximum growth but higher biological efficiency (Purkayastha, 1980)^[7]. The experiment conducted to study the effect of paddy straw as substrate on yield parameters of *Volvariella volvacea* revealed that it showed luxuriant mycelial colonization and earlier pinhead formation on paddy straw as compared to other substrates. This is in agreement with Gupta *et al.* (1970)^[1] who reported paddy straw as the most suitable substrate for cultivation of *V. volvacea*. The effect of the straw quality on mushroom productivity indicated the superiority of hand threshed straw which is compactly packed in the beds and possibly restricts movement of air, light in to the bed necessary for the fungus to grow and primordial formation (Munjal, 1975)^[6].

The pin head formation was observed to be faster in strain VV3 i.e., 15 days with an average number of fruiting bodies/1000 g equaling to 10.81g and a fruit body weight of 30.20g, which was significantly greater than the other two strains revealing that VV3 was the best strain in terms of yield (2.08 kg/10 kg substrate and biological efficiency (20.8%). In the present study significantly higher yield were obtained when the beds were prepared during the months of July-September where the temperature range from 24-36 °C and relative humidity of 80-90% showing a bio efficiency of 14.9% to 20.80%. Among the competitor moulds inkcap (*Coprinus* sp.) and green mould (*Trichoderma* sp.) was recorded as the major mould and they appeared during the later stages of crop mainly on lower shelves. Their appearance can be attributed to improper pasteurization of substrates and cropping conditions which existed in and around the lower shelves rather than the strains used (Kumar *et al.*, 2009)^[5]. The incidence of competitor moulds viz., Green mould and *Coprinus* sp. was found to be less in the present investigation showing a highest range up to 6%. It is attributed to the chemical pasteurization of the straw along with suitable temperatures and humidity during the cropping period which is in conformity with the work of (Quimio, 1993)^[8].

Table 1: Effect of different strains on yield and yield attributing parameters of paddy straw mushroom (*Volvariella volvacea*)

Strain	Spawn run (days)	Pin head formation (days)	No. of fruit bodies /1000 g	Av. Fruit body weight (g)	Yield (kg)/10kg substrate	Biological efficiency (%)	Incidence of diseases (%)	
							Green mould	<i>Coprinus</i> sp.
VV3	8.00	15.00	10.81	30.20	2.08	20.80	2	2
VV11	12.00	19.00	9.46	22.10	1.72	17.29	5	4
VV12	10.00	17.00	7.07	20.89	1.48	14.89	7	6
SE(d)	0.414	0.697	0.386	1.01	0.073	0.728	-	-
CD(p≤0.05)	1.032	1.739	0.963	2.52	0.182	1.816	-	-

Mean of 7 replications

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