4.6. MUSHROOM CULTIVATION

SYNOPSIS

- Mushrooms are the earliest known fungal organisms used as food for their taste and aroma and also prasied for their beauty and valued for their medicinal and nutritive properties
- In Latin = To flourish; Greek = Sponge
- The word mykes from which mycology in derived actually meant mushroom to the ancient Greeks.
- Etymologically, mycology is the study of mushrooms
- Mushrooms belongs to order Agaricales and subdivision Basidomycotina Mushroom morphology
- Mushroom is a general term applied to the fruiting bodies of most agaricales fungi
- Mushrooms are mostly lives as saprophytes (or) some times lives as symbionts
- Armillariella mellea (Honey mushroom) is a luminescent fungi grows as a parasite and causes rootrot of apple and in many forest trees.
- The root like structures formed by vegetative mycelium in the soil are known as **Rhizomorphs**
- In the begining tiny white knots are formed on the (branches (hyphae) of Rhizomorphs (secondary mycelium)
- Tiny white knots gradually enlarge into round (or) ovoid structures which break through the surface of soil into tiny ball like structure represents the **button stage.**
- They grow further and developes into the fruiting bodies called **Basidiocarps.**
- The mature basidiocarp consists of a stalk known as **stipe** and terminal broad umbrella shaped cap known as **pileus.**
- Stipe is usually broader and swollen at the base and is centrally attached to the pileus.
- More than half way up the stipe bears membranous ring called **Annulus**.
- Numerous radially arranged thin narrow (or) wide strips of tissue known as gills present on the lower side of the pileus.
- Internally gill differentiated in to there regions trama, sub-hymenium and hymenium
- Trama is the innermost (or) central most region of the gill made up of elongated cells.
- Sub-hymenium is present between trama and hymenium and it is made up of short branches ram obliquely towards the outer surface to form compact mass of hyphae
- Hymenium is the fertile layer borne on the subhymenium
- Two types of cells are present in the hymenium they are large club shaped fertile cells known as **basidia** and short sterile cells known as **paraphysis** (or) **Cystidia**.
- Each Basidium produces four **basidiospores** exogenously

Types of mushrooms

- Number of **edible** species is about **200**
- Number of economically useful species is 40
- Number of **commercially** grown species is 8
- Common and important cultivated mushrooms that are grown in large scale are Agaricus bisporus (white button mushroom (or) European (or) temperate mushroom) Volvariella volvacea (paddy straw mushroom) Pleurotus sojar - caju (Oyster mushroom) Lentinus edodes (shiitake mushroom).
- In India most common cultivated mushrooms are Agaricus bisporus ,Volvariella volvacea and Pleurotus sojar caju.
- Some mushrroms are mild (or) deadly poisonous
- Poisonous mushrooms are commonly known as **Toad stools.**
- Most deadly of all mushrooms belongs to the genus **Amanita.**
- Amanita phalloides (Death cap), A.muscaria (Fly agaric/fly mushroom). A.virosa (Destroying angel) are some of the important species.

Food value of Mushrooms

- They contain **low carbohydrate** and **fat content** hence recommended as diet for people who suffer from diabetic and high cholestrol problems.
- The protein content (19 35%) is much higher than rice, wheat and many vegetables. Moreover, the dry protein obtained from unit area is much higher than the cattle, beef, fish etc. Because of this reason, the mushrooms are considered as a right protein supplement to replace animal protein to overcome malnutrition in developing countries.
- All the amino acids required by adult human beings are present in mushrooms, especially **lysine** and **tryptophan.**
- Mushrooms are reported to be an excellent source of vitamins like **pantothenic acid**, vitamin **B**₁₂, **ascorbic acid etc.**
- *A. bisporus* contains high amounts of **potassium**, **phosphorous**, **copper** and **iron** but calcium percentage is very low.
- Due to their **high potassium sodium ratio** and **high fibre content**, mushrooms are ideal food for those suffering from hypertension and hyperacidity.

CULTIVATION OF WHITE BUTTON MUSHROOM (Agaricus bisporus)

- Two major steps involved in cultivation of white button mushroom are
 - 1) Spawn production 2) Mushroom production.

Spawn production

- The vegetative fungal mycelia of a mushroom grown on suitable sterile organic matter is called **spawn** & it is used as inoculum & often called seed or seed material of mushroom fungi..
- Spawn is grown in bottles or plastic bags containing grains called grainspawn (or) Straw called straw spawn
- Entire spawn production should be conducted in aseptic conditions.

Grain Spawn Production

- Materials used for spawn making are grains like rice, sorghum, wheat etc are used singly (or) in combinations
- Grains are boiled first, then calcium carbonate is added at 20g/kg of grain, now it is filled in bottles and mouth of the bottles are plugged with cotton.

Straw spawn production:

- Straw is cut into 5cm long pieces soaked in water for 5 - 10 minutes and mixed with 2% lime
- The grain spawn (or) straw spawn is now subjected to sterilization in an autoclave at 15 lbs pressure and 121°C for 1 1/2 hour.
- After cooling a small quantity of the fungus is aseptically inoculated into the bottles (containers)
- Inoculated spawn bottles are incubated at 25°C for 2 weeks.
- During incubation the fungal mycelium grows and infects the inoculated material to form a dense growth of mycelia called spawn. It is used for the production of the mushroom.

Mushroom Production

- It consists of four steps in a sequence i) Compost preparation ii) Spawning iii) Casing and iv) Cropping.
- Compost preparation The method of preparation of raw materials for mushroom cultivation is known as 'composting'.
- Composition of the compost Paddy straw, Urea, Rice bran, Cotton seed Gypsum

• Spawning:

The spawn is spread over the compost and a small amount of compost is spread over the spawn. This is called spawning. After spawning, the compost is sprinkled with water so as to maintain the relative humidity between 70 and 80%. Within 15 - 20 days, at 25 + 2C the fungus grows luxuriantly.

Casing of Mushrooms

After spawn running, the mycelial growth is covered by casing materials (thin layer of pasteurised materials like soil) and incubation to be continued for another 8-10 days, i.e. until the white buttons start appearing. At this stage, the temperature is maintained at 16+2 C and 95% relative humidity. Fresh air is passed and beds are wetted with water as and when required.

• Cropping

The crop starts producing mushrooms in third week after casing and cropping continues for 10-12 weeks. Heavy mist of moisture should be applied at pinhead - stage. Mushrooms are produced in periodical intervals. Each crop is called 'flush'.

Mushrooms have short shelf life. the shelf life can be • extended to one week if these are stored at 5 C. To transport them to far off places, the mushrooms are processed specially and preserved in cans containing salt solution and the cans are kept in boiling water for some time. The cans are then sealed and kept dipped in cool water. Such cans can be stored for about six months.

EXERCISE

LEVEL-I

479.	479. Mushrooms are harvested at				
	1) Young stage		2) Old stag	ge	
	3) Button stage		4) Umbrel	la stage	
480.). The mushroom consists of this vitamin				
	1) B ₁	2) B_{2}	$3) B_{6}$	4) B ₁₂	
481.	81. Mushrooms are a good source of				
	1) Folic acid	ł	2) Pantoth	enic acid	
	3)Ascorbic	acid	4) 2 and 3		
482.	2. The mushrooms are good source of				
	1) Copper		2) Phosph	orus	
	3) Iron		4) all the a	bove	
483.	. The amino acid present in a mushroom is				
	1) Valine	2) Lysine 3)	Tryptopha	n 4) 2 and 3	
484.	The mushro	oms are very	valuable die	et/food for the	
	patients who suffer from				
	1) Diabetes		2) Heart a	ttack	
	3) Hyperaci	dity	4) All the a	above	
485.	. The scientific name of white button mushroom is				
	1)Agaricus	campestris	2)Agaricu	ıs bisporus	
	3) Pleurotus	s sojar-caju	4) Volvarie	ella volvacea	
486.	486. The most common type of mushrooms cultivated in				
india is/are					
	1) White button mushroom 2) Oyster mushroom				
	3) Paddy straw mushroom 4) 1, 2 and 3				
487.	487. The seed material of mushroom fungi is called				
	1) Milt 2) Spawn 3)	Seedling 4	l) Sapling	
488. The temperature required for the development of					
	spawn is				
	1) 23°C	2) 24°C	3) 25°C	4) 26°C	

489. The temperature for spawning is 50				
1) 25+2°C 2) 35+2°C 3)45+2°C 4) 15+2°C				
490. A	fter spawn running, the n	nycelial growth is covered		
by a thin layer of pasteurised soil called 50				
1)) Blanching 2) Casing	3) Cropping 4) Packing		
491. N	lushrooms are produced	l at regular intervals, each		
CI	op is called		503	
1)) Spawn 2) Slice	3) Flush 4) Pack		
492. T	his is a poisonous mushr	coom	50/	
1)) Amanita phalloides	2) Amanita virosa	504	
3) Agaricus bisporous 4) 1 and 2				
493. A	mount of calcium carbor	nate added for grain spawn		
at	fter boiling of grains is		504	
1))2 g/kg	2) 20 g/20kg	000	
3)20 g/kg	4)200g/kg		
494. N	latch the following			
L	ist I	List II		
(Com	non name)	(Scientific name)		
A. Pad	dy straw mushroom	I. Amanita virosa	506	
B. Oys	ster mushroom	II. Agaricus bisporus		
C. Dea	ath cap	III. Volvariella volvaceae		
D. Wh	ite button mushroom	IV. Pleurotus sojar-caju	507	
		V. Amanita phelloides		
1. A-II	II, B-IV, C-II, D-V 2.	A-III, B-I, C-II, D-IV		
3. A-II	II, B-II, C-IV, D-I 4.	A-III, B-IV, C-V, D-II		
495. Arrange the following steps of mushroom 50				
	production in a correct	t sequence		
	I.Spawing	II.Cropping		
	III.Compost preparation	on IV.Casing		
	1)III,I,IV,II	2)III,I,II,IV	509	
	3)I,III,IV,II	4)I,III,II,IV		
496.	Shelf life of mushroon	ns extended to one week		
	by storing at			
	1) 25 ° C 2)16 ° C	3)5 ° C 4)15 ° C		
497.			51(
	Luminescent fungus is		510	
	Luminescent fungus is 1) Agaricus bisporus	2)Pleurotus sojar-caju	51(
	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa	2)Pleurotus sojar-caju 4)Armillaria mellea	51(
498.	Luminescent fungus is 1) Agaricus bisporus 3) Amanita virosa Root rot of apple is ca	2)Pleurotus sojar-caju 4)Armillaria mellea used by	51(
498.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa	510	
498.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides	510	
498. LEVE	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides	510	
498. LEVE 499.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise	 2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean 	510	
498. LEVE 499.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise mycelia	 2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean known as 	510	
498. LEVE 499.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise mycelia 1)Rhizoids	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean known as 2) Stolon	510	
498. LEVE 499.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise mycelia 1) Rhizoids 3) Rhizomorphs	 2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean known as 2) Stolon 4) Sporangiophores 	510	
498. LEVE 499. 500.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise mycelia 1) Rhizoids 3) Rhizomorphs The fruiting bodies of r	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean known as 2) Stolon 4) Sporangiophores nushrooms are known as	510 511 512	
498.LEVE499.500.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise mycelia 1)Rhizoids 3) Rhizomorphs The fruiting bodies of r 1) Basidiocarps	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean known as 2) Stolon 4) Sporangiophores nushrooms are known as 2) Pileus	510 511 512	
498. LEVE 499. 500.	Luminescent fungus is 1) Agaricus bisporus 3)Amanita virosa Root rot of apple is ca 1)Armillariella mellea 3)Amanita muscaria L-II The basidiocarps arise mycelia 1) Rhizoids 3) Rhizomorphs The fruiting bodies of r 1) Basidiocarps 3) conidia	2)Pleurotus sojar-caju 4)Armillaria mellea used by 2)Amanita virosa 4)Amanita phalloides from a subterranean known as 2) Stolon 4) Sporangiophores nushrooms are known as 2) Pileus 4) Sporangia	510	

501.	Basidia are borne on				
	1) subhymenium	2) Gills			
	3) Hymenium	4) Pileus			
502.	Mushrooms belong to one of the order of fungi				
	1) Mucroales	2)Agaricales			
	3) Filicales	4) Mucarels			
503.	Toad stool are also commonly called				
	1) Edible mushroom 2) Poisonous mushrooms				
	3) Fungus 4) c	commercial mushrooms			
504.	The protein content in mushrooms is much higher				
	than				
	1) Rice	2) Wheat			
	3) Vegetables	4) All the above			
505.	Mushroom is an ideal food for those who suffer				
	from hypertension and hyperacidity is due to				
	1) High potassium sodium ratio				
	2) High potassium copper ratio				
	3) High potassium iron ratio				
	4) High potassium phosphorus ratio				
506.	The protein content in n	nushrooms is			
	1) 19 – 30%	2) $19 - 35\%$			
507	3) 19 – 31 %	4) 19 – 36 %			
507.	Mushroom dry protein obtained per unit area is				
	higher than	0) F ' 1			
	I) cattle	2) Fish			
	3)Beef	4) All the above			
508.	Good yield in mushrooms per 100 kg of com				
	post is about				
	1) 2 - 5 kg	2) 10 - 15 kg			
	3) 17 - 20 kg	4) 20 - 25 kg			
509.	By storing mushrooms at 5°C their shelf life can				
	be extended by about				
	1) One week	2) Two weeks			
	3) Three weeks	4) Four weeks			
510.	The incubation period a	and temperature in spawn			
	production				
	1) 2 weeks and 35° C	2) 2 weeks and 25°C			
	3) 3 weeks and 25° C	4) 1 week and 10°C			
511	Mushroom which emit	slight in the dark is			
511.	1) Shiitalaa waxahaa am	s light in the tark is			
	1) Shillake mushroom				
	2) De date strange 1				
	3) Paddy straw mushroom				
510	4) White button mushroom				
512.	A good compost should not have this character				
	2) Lack of grassinges				
	2) Lack 01 greasifiess 3) Relative humidity 65, 70% and nitrogen con				
	tent around 2.2%				
	ω_{111} around $2.2/0$				

4) pH between 7 and 7.5

513. Unture about nutritional value of mushrooms is	522. The seeding material (spawn) of mushroom fungi is	
1) low carbohydrate and fat content	1) Spore 2) Fruiting body	
2) more protein content than in vegetables	3) Dormant mycelium	
3) excellent source of vitamins like Vit B_{12}	4) Actively growing vegetative mycelium	
4) Poor mineral composition like K, P and Cu	523 The chemical used in the production of amin	
514. Good yield of mushrooms on good compost is	525. The chemical used in the production of grain	
obtained for the period of	spawn is	
1) 10-12 weeks 2) 8-9 weeks	1) Calcium Carbonate 2) Sodium Carbonate	
5)/-10 days 4) 3 weeks	3) Lime water 4) Sodium Chloride	
1) Composting 2) Mushroom produce	524. Incubation period for spawn production is	
tion 3) Spawn production 4) Casing	1) $3 - 4$ weeks 2) $4 - 5$ weeks	
516 Study the following table regarding mushroom	3) 2 – weeks 4) 10 – 12 weeks	
production	525.Good compost of mushroom cultivation after	
Moisture content Temperature	incubation before spawning contains	
I) Composting 65 - 70%65°C	1) No ammonia smell 2) P^{H} of $7 - 7.5$	
II) Spawn running 70 and 80%25 \pm 2°C	3) 2.2% Nitrogen content 4) All the above	
III) Casing $95\%16 \pm 2^{\circ}C$	526. Inoculation of spawn on to the pasteurized com-	
IV) Cropping 100%20°C	nost is called	
The correct combination is	1) Snowning 2) Snown running	
1) I & II 2) I & III 3) I & III 4) II & III	2) second string (1) Spawin running	
	3) composing 4) Casing	
517. Agaricus mushrooms are harvested at	52 /. In the process of mushroom production, lowest	
1) Spawn stage 2) Button stage 3) Spawn running stage 4) Sporulation stage	temperature is maintained during	
518 Pick out the correct statement	1) Spawning2) Spawn running	
1) Mushrooms are all edible and uniform in colour	3) Casing 4) Cropping	
2) All mushrooms belong to the same taxonomical	528. The shelf life of mushrooms can be extended by	
group among fungi	one week with	
3) Mushrooms produce uniformly same type of	1) Chemical treatment 2) Cold treatment	
fruiting body.	3) Heat treatment 4) Light treatment	
4) Mushrooms sometimes grow as symbionts.	529. Which of the following statements is correct with	
519. Untrue about the nutritional value of mushrooms is	respect to A garicus hisporus ? (2004)	
1) Low carbonydrate and fat content.	1) It contains toxins hence not suitable for consump-	
2) More protein content than in vegetables 3) Excellent source of vitaming like Vit B	for	
4) Poor mineral composition like potassium		
phosphorus and copper	2) It does not contain essential amino acids	
520.Mushrooms can best be used as	3) It is a good source of B-vitamin	
1) Diet for diabetics	4) Its cultivation on agro wastes is impossible	
2)Substitutive protein supplement to animal proteins	530. The fruiting body formed from a filamentous	
3)Medicine to prevent heart problems and Cancer	heteroutrophic organism which is known for it nutri-	
4) All the above	tive value for the humanity : (2005)	
name for	1) Cremocarp 2) Acervulus	
1) White button mushroom 2) Oyster mushroom	3) Basidiocarp 4) Akinite	
3) Paddy straw mushroom 4) Fly Agaric		