

## Growth Performance of Different Wild Edible Oyster Isolates on Wheat Straw

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### ABSTRACT

Various strains of *Pleurotus* spp. were collected from Sahyadri and Satpuda valleys of Maharashtra state which included Pune, Ahmednagar and Nashik districts. Twenty six samples were collected from different habitat like tree trunk, leaf litter, humus, compost and wooden stumps.

**Key words** Growth Performance of Different Wild Edible Oyster Isolates on Wheat Straw

Selected wild oyster mushrooms were isolated and their growth performance on Potato Dextrose Agar (PDA) media was studied. Isolate Pune *Pleurotus*-4 (PNP-4) showed significantly maximum growth than remaining isolates and control *P. sajor-caju*. The spawn of selected isolates was prepared on wheat grains and the time required for spawn production varied from 14 to 19.75 days. The strain PNP-10 required minimum time for spawn production (14 days).

The mushroom beds were filled with wheat straw as substrate. The time required for spawn run varied from 15.75 to 22 days. The time needed for pinhead formation after spawn run varied from 3.25 to 6.25 days. The strain PNP-4 was early to complete spawn run as well as pinhead formation. The time for the harvesting from the date of spawning was recorded as for first harvest (23.5 to 35.75 days), second harvest (31.75 to 50 days) and third harvest (43.75 to 66.25 days). The strain PNP-4 was found early than the recommended variety *P. sajor-caju* of oyster mushroom.

### MATERIAL AND METHODS

#### Isolation by tissue culture method

Fully matured fresh fruiting bodies were collected during survey and brought to laboratory for tissue culture. The adhered dust particles were removed with the help of cotton swab. The fruiting body was held with the sterilized forcep and dipped in 70 per cent ethanol for 30 sec. to eliminate the microbes present on bit surface. The fruiting body was cut longitudinally with a sterilized scalpel and tissue bits of approximately 3 to 5 mm were separated from the pileus-stipe junction (i.e. collar region). The bits were aseptically transferred on to pre-sterilized Petri plates containing Potato Dextrose Agar culture media with the help of sterilized forcep. Petri plates were wrapped with parafilm and incubated in BOD incubator at 30 to 32°C for 6 to 7 days and observations regarding growth performance and colony diameter were recorded. The actively growing mycelium from edges along with culture medium of about 5mm size was transferred in slants and incubated at 30 to 32°C for a week. This pure culture was used as inoculum for spawn preparation.

### Maintenance of cultures

The pure cultures of fungus were maintained on Potato Dextrose Agar medium. Sub-culturing of the fungus were done at an interval of 8 days & stored under controlled conditions at  $28 \pm 1^\circ\text{C}$ . Seven days old pure mycelial cultures of the test fungi were used in various studies.

The cultures derived from wild edible oyster mushroom were coded as isolate numbers as below and used for further study.

Sr. No.	Sample No.	Isolate No.
1	PN-14-25	PNP-1
2	PN-14-38	PNP-2
3	PN-14-40	PNP-3
4	PN-14-41	PNP-4
5	PN-14-42	PNP-5
6	PN-14-47	PNP-6
7	PN-14-48	PNP-7
8	PN-14-49	PNP-8
9	PN-14-50	PNP-9
10	<i>P. sajor-caju</i> (Control)	PNP-10

### Spawn Preparation

#### Preparation of commercial spawn

Mushroom spawn has been defined as the vegetative mycelium from a selected mushroom grown on a convenient medium. The spawn comprises mycelium of the mushroom and a supporting medium, which provides nutrition to the fungus during its growth.

Wheat grains were used as the base material for multiplying the mycelium in the spawn bottles and polypropylene bags. The bold, healthy and pesticide free grains were chosen for substrate purpose.

Steps followed in preparation of commercial spawn:

- 1) Wheat grains were washed for twice to remove the suspended dust particles or foreign materials.
- 2) Then wheat grains were boiled in the container with water till they soften. Care was taken that the starch should not ooze out of the grains.
- 3) 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.
- 4) Calcium carbonate powder ( $\text{CaCO}_3$ ) @ three per cent of the dry substrate was thoroughly mixed with grains for maintenance of proper pH (6.5 to 7.0) in the spawn substrate.

- 5) The grains were filled up to  $\frac{3}{4}$  <sup>th</sup> in the polypropylene bags of 100 gauge thickness.
- 6) Then polypropylene bags were plugged with non-absorbent cotton and sterilized in autoclave at 20 psi for 2 hrs.
- 7) After sterilization, bags were allow to cool over-night and then transferred to the inoculation chamber.
- 8) The inoculation chamber was sterilized by spraying four per cent formalin solution.
- 9) Sterilized bags were inoculated in an inoculation chamber.
- 10) The inoculating needle and forcep were properly sterilized by flame and transfer of the culture was made close to the flame of spirit lamp.
- 11) Sterilized bags were inoculated with master culture which was 15 days old and were incubated at  $27 \pm 1^\circ\text{C}$  for 15 days.
- 12) The mycelium covered the grains in 15 to 20 days and the spawn was ready for growing mushroom on large scale.

#### **Precautions taken during spawn preparation:**

- 1) The inoculation was done under aseptic condition.
- 2) In case there was fungal or bacterial contamination in the spawn bags, the entire content of the bottles or bags were destroyed.
- 3) 15 to 20 days old spawn was used for bed filling.
- 4) Cultures and spawns were stored at room temperature.

#### **Substrate preparation and sterilization**

Wheat straw was taken as substrate for cultivation of selected isolates. Wheat straw was then filled in gunny bags and soaked in fresh water for 12 hrs. After soaking the excess water was allowed to drain off. The pre-soaked wheat straw was pasteurized by immersing them in hot water at  $80^\circ\text{C}$  for 1 hr. After pasteurization excess of hot water was drained off and the substrate was allowed to cool at room temperature. At this stage, the moisture content of the substrate was around 70 to 75 per cent, and then substrate was taken for bed filling.

#### **Bed filling and spawning**

Spawn prepared on wheat grains was used for spawning @ 2 per cent spawn on wet weight basis of the substrate. Spawning in layers was done in polythene bags of size  $35 \times 55$  cm. The bags were filled with substrate @ 3 kg per bag. After spawning the top of polythene bag was closed with thread and about 25 to 30 holes with sterilized pin were made per polythene bag for proper aeration. The spawned bags were then incubated at room temperature for spawn run and observations regarding spawn run were recorded at regular intervals.

#### **Incubation and spawn run**

After bed filling beds were kept for incubation in incubation room. Sufficient amount of light, proper ventilation, optimum temperature (i.e.  $25$  to  $28^\circ\text{C}$ ) and required humidity (i.e. 70 to 85 %) was maintained during entire cropping period.

Beds took near about 15 to 22 days for complete spawn run and then transferred to growing room having controlled conditions as that of incubation room.

#### **Cropping**

The bags were cut opened when wheat straw was fully covered with whitish mycelium to expose the substratum surface for initiation of pinheads. The beds were then kept on hangers. The environmental conditions *viz.*, temperature in between  $25$  to  $27^\circ\text{C}$ , relative humidity in between 70 to 80 per cent and diffused light during day time were maintained for primordial formation and fruit body development. Ventilation of 2 to 3 hours per day was given for maintaining  $\text{CO}_2$  level in the growing room and observations regarding days required for pinhead formation were taken at regular intervals. Light mist spray of water was given to beds twice in a day till the end of cropping seasons. Watering was stopped a day before harvesting.

#### **Harvesting**

Fruiting bodies were harvested at full maturity. Mature fruiting bodies were those which started forming spores but the margins of pileus become wavy. The fruiting bodies were harvested when fruit body has curled under edges and well formed gills, because over matured fruit body is fragile and difficult to handle. Harvesting was done by twisting the mushroom fruit body at its base. After first harvest, beds were scrapped slightly to remove dead mycelial growth then second and third flushes were taken. Harvested fruiting bodies were packed into polythene bags and preserved by drying.

### **RESULTS AND DISCUSSION**

#### **Growth performance of different isolates of wild edible oyster mushrooms on wheat straw**

After spawn production, the mushroom beds were filled with wheat straw and the observations *viz.*, days required for spawn run, days required for pinhead formation and days required for first, second and third harvest after pinhead formation were recorded. The results for the same are reflected in Table 1 and Table 2.

#### **Days required for spawn run**

The observation on days required for spawn run was recorded when the mycelial growth had completely covered the mushroom beds. Variation was noticed for the observation on days required for spawn run among the isolates. The spawn run was completed within 15.75 to 22 days from inoculation in all the isolates under study. It was noticed that the isolate PNP-4 was found significantly superior over all other isolates which shows minimum period (15.75 days) to complete spawn run on the wheat straw. It was followed by PNP-10 (16.75 days), PNP- 7 (18.50 days), PNP-2, PNP-3 and PNP-6 (18.75 days), PNP-8 and PNP-9 (19.25 days), PNP-1 (20 days). The isolate PNP-5 required the maximum duration (22 days) to complete spawn run and noticed a slow growing isolate.

#### **Days required for pinhead formation**

This observation was recorded when the mushroom beds were transferred to the growing room and the small

**Table 1. Growth performance of different isolates of wild edible oyster mushrooms on wheat straw.**

Sr. No.	Treatments	Days required for spawn run*	Days required for pinhead formation after spawn run*
	Isolate No.		
1	PNP-1	20.00	4.75
2	PNP-2	18.75	5.25
3	PNP-3	18.75	4.75
4	PNP-4	15.75	3.25
5	PNP-5	22.00	6.25
6	PNP-6	18.75	4.75
7	PNP-7	18.50	4.25
8	PNP-8	19.25	4.75
9	PNP-9	19.25	5.75
10	PNP-10	16.75	3.75
	( <i>P. sajor-caju</i> )		
	Control		
	S.E. $\pm$	0.47	0.31
	C.D. (0.05)	1.36	0.90

\*Mean of four replications

pinheads had started emerging. The isolate PNP-4 was found significantly superior (3.25 days) over all other isolates, followed by PNP-10 (3.75 days), PNP-7 (4.25 days), PNP-1, PNP-3, PNP-6 and PNP-8 (4.75 days), PNP-2 (5.25 days) and PNP-9 (5.75 days). The maximum number of days required for pinhead formation (6.25 days) was recorded for PNP-5.

#### Days required for harvesting after pinhead formation

After pinhead formation, the harvesting was done three times. The number of days required for first, second and third harvests were recorded and results for the same are presented in Table 2.

#### First harvest

The minimum days required for first harvest after pinhead formation were recorded in isolate PNP-4 (3.5 days), followed by PNP-10 (3.75 days), PNP-2 and PNP-3 (4.25 days), PNP-1 (4.75 days), PNP-6 and PNP-7 (5 days), PNP-8 (5.75 days), PNP-9 (6.25 days) where as isolate PNP-5 required maximum number of days (6.75 days) for first harvest after pinhead formation.

#### Second harvest

The minimum days required for second harvest after pinhead formation were recorded in isolate PNP-4 (13 days),

**Table 2. Days required for harvesting after pinhead formation.**

Sr. No.	Treatments	1 <sup>st</sup> harvest*	2 <sup>nd</sup> harvest*	3 <sup>rd</sup> harvest*
	Isolate No.			
1	PNP-1	4.75	16.75	29.75
2	PNP-2	4.25	15.25	28.25
3	PNP-3	4.25	15.25	27.25
4	PNP-4	3.50	13.00	25.00
5	PNP-5	6.75	20.75	36.75
6	PNP-6	5.00	16.75	30.25
7	PNP-7	5.00	18.25	30.25
8	PNP-8	5.75	17.75	29.75
9	PNP-9	6.25	18.25	30.75
10	PNP-10	3.75	13.25	25.25
	( <i>P. sajor-caju</i> )			
	Control			
	S.E. $\pm$	0.32	0.37	0.44
	C.D. (0.05)	0.93	1.09	1.27

\*Mean of four replications

followed by PNP-10 (13.25 days), PNP-2 and PNP-3 (15.25 days), PNP-1 and PNP-6 (16.75 days), PNP-8 (17.75 days), PNP-7 and PNP-9 (18.25 days). The isolate PNP-5 required maximum number of days (20.75 days) for second harvest after pinhead formation.

### Third harvest

The minimum days required for third harvest after pinhead formation were recorded in isolate PNP-4 (25 days), followed by PNP-10 (25.25 days), PNP-3 (27.25 days) PNP-2 (28.25 days), PNP-1 and PNP-8 (29.75 days), PNP-6 and PNP-7 (30.25 days), PNP-9 (30.75 days) where as isolate PNP-5 required maximum number of days (36.75 days) for third harvest after pinhead formation.

### Total days required for first, second and third harvesting after spawning

The observations pertaining to total days required for first, second and third harvesting were recorded from date of spawning (inoculation) to date of first, second and third harvesting respectively. The results are reflected in Table 3.

#### First harvest:

The minimum days required for first harvest after spawning were recorded in isolate PNP-4 (23.5 days), followed by PNP-10 (24.25 days), PNP-2 and PNP-3 (27.75 days), PNP-6 (28.75 days), PNP-7 (29.25 days), PNP-1 (30 days), PNP-9 (31.75 days) where as isolate PNP-5 required maximum number of days (35.75 days) for first harvest after spawning.

#### Second harvest

The minimum days required for second harvest after spawning were recorded in isolate PNP-4 (31.75 days), followed by PNP-10 (32 days), PNP-3 (38.75 days), PNP-2 (39.25 days), PNP-6 (41 days), PNP-7 and PNP-8 (41.50 days),

PNP-1 (41.75 days), PNP-9 (44.25 days), where as isolate PNP-5 required maximum number of days (50 days) for second harvest after spawning.

### Third harvest

The minimum days required for third harvest after spawning were recorded in isolate PNP-4 (43.75 days), followed by PNP-10 (44.25 days), PNP-3 (50.75 days) PNP-2 (52.25 days), PNP-8 (54 days), PNP-6 and PNP-7 (54.50 days), PNP-1 (54.75 days) and PNP-9 (57.25 days). The isolate PNP-5 required maximum number of days (66.25 days) for third harvest after spawning.

### Morphological characters of mushroom fruits from different wild edible oyster isolates

The observations of the fruit bodies *viz.*, pileus diameter, stipe length, stipe size, colour and odour were recorded from different wild edible oyster isolates. The result are presented in Table 4.

#### Pileus diameter

The pileus diameter of fruit bodies were ranged from 4.81 to 6.36 cm in different isolates under study and the maximum pileus diameter was noticed in PNP-10 (6.36 cm), followed by PNP-4 (6.19 cm), PNP-1 (6.13cm), PNP-2 (6.11cm), PNP-6(6.07cm)PNP-5(5.94cm), PNP-7(5.57), PNP-9 (5.53 cm), PNP-3 (5.52 cm), where as minimum diameter (4.81 cm) was noticed in PNP-8.

#### Stipe length

The stipe length of fruit bodies in different isolates of wild mushrooms were ranged from 0.91 to 2.63 cm. However minimum stipe length (0.81 cm) was recorded in PNP-8 followed by PNP-9 (0.87 cm), PNP-2 (0.91 cm), PNP-5 (0.95 cm), PNP-1 (0.96 cm), PNP-4 (0.98 cm), PNP-7 (1.01 cm), PNP-3 (1.03 cm), PNP-6(1.22 cm) and maximum stipe length (2.63cm) was recorded in PNP-10.

**Table 3.** Total days required for first, second and third harvesting after spawning.

Sr. No.	Treatments	1 <sup>st</sup> harvest*	2 <sup>nd</sup> harvest*	3 <sup>rd</sup> harvest*
	Isolate No.			
1	PNP-1	30.00	41.75	54.75
2	PNP-2	27.75	39.25	52.25
3	PNP-3	27.75	38.75	50.75
4	PNP-4	23.50	31.75	43.75
5	PNP-5	35.75	50.00	66.25
6	PNP-6	28.75	41.00	54.50
7	PNP-7	29.25	41.50	54.50
8	PNP-8	29.50	41.50	54.00
9	PNP-9	31.75	44.25	57.25
	PNP-10			
10	( <i>P. sajor-caju</i> )	24.25	32.00	44.25
	Control			
	S.E. ±	0.40	0.46	0.63
	C.D. (0.05)	1.16	1.34	1.82

\*Mean of four replications

**Table 4. Morphological characters of mushroom fruits from different wild edible oyster isolates.**

Sr. No.	Treatments	Pileus diameter (cm)*	Stipe length (cm)*	Stipe size (circumference) (cm)*	Colour	Odour
	Isolate No.					
1	PNP-1	6.13	0.96	1.31	White	Farinaceous
2	PNP-2	6.11	0.91	2.04	Creamy white	Fishy
3	PNP-3	5.52	1.03	1.42	Pinkish	Pleasant
4	PNP-4	6.19	0.98	1.19	Pink	Mild anise
5	PNP-5	5.94	0.95	1.84	White	Mild fishy
6	PNP-6	6.07	1.22	1.88	Creamy white	Farinaceous
7	PNP-7	5.57	1.01	1.41	Light pink	Pleasant
8	PNP-8	4.21	0.81	2.03	Light pink	Farinaceous
9	PNP-9	5.53	0.87	2.01	Dark pink	Mild anise
10	PNP-10 ( <i>P. sajor-caju</i> ) Control	6.36	2.63	2.92	Grey	Mild fishy
	S.E. ±	0.21	0.07	0.04		
	C.D. (0.05)	0.57	0.21	0.13		

\*Mean of four replications

#### Stipe size

The stipe size (circumference) of fruit bodies in different isolates of wild mushrooms were ranged from 1.19 to 2.92 cm. However minimum stipe size (1.19 cm) was recorded in PNP-4 followed by PNP-1 (1.31 cm), PNP-7 (1.41 cm), PNP-3 (1.43 cm), PNP-5 (1.84 cm), PNP-6 (1.88), PNP-9 (2.01 cm), PNP-8 (2.03 cm), PNP-2 (2.04 cm) and maximum stipe size (2.92 cm) was recorded in PNP-10.

#### Colour

There was variation observed in the colour of fruit bodies of the collected wild edible oyster isolates (Table:8). Different isolates possessed different colours viz. isolates PNP-1, and PNP-5 were white, PNP-2 and PNP-6 were creamy white, PNP-3 was pinkish, PNP-4 was pink, PNP-7 and PNP-8 was light pink, PNP-9 was dark pink and PNP-10 was grey in colour.

#### Odour

There was variation noticed in the odour of fruit bodies of the collected wild edible oyster isolates (Table:8). The isolates PNP-1, PNP-6 and PNP-8 possessed farinaceous type of odour, PNP-2 had fishy odour, PNP-3 and PNP-7 had pleasant odour, PNP-4 and PNP-9 had mild anise odour and PNP-5 and PNP-10 had mild fishy type of odour.

#### Yield parameters of different isolates from wild edible oyster mushrooms on wheat straw

The yield parameters include the observations viz., average fruit body weight, total number of fruits per kg dry substrate, fresh yield of different isolates, dry weight of different isolates and total dry weight with per cent of fresh weight.

#### Average mature fruit body weight

The observations for average fruit body weight were

recorded by random selection of ten mature fruit bodies from all the isolates and the results are shown in the Table 5. The average fruit body weight in all the isolates under study was ranged from 3.28 to 6.42g per fruit. The isolate PNP-10 had significantly highest average fruit body weight (6.42g), followed by PNP-2 (6.14g), PNP-6 (5.85g) PNP-4 (5.58g), PNP-5 (5.14g), PNP-3 (5.09g), PNP-9 (4.62g), PNP-8 (4.58g), PNP-7 (4.04g), where as lowest average fruit body weight was observed for PNP-1 (3.28g) per fruit body.

#### Number of fruits per kg dry substrate

The observations for number of fruits per kg dry substrate were recorded for all the isolates and the results are presented in Table:9. The number of fruits per kg dry substrate in all the isolates under study were ranged from 153 to 235. The maximum number of fruits were observed for PNP-4 (235), followed by PNP-6 (216), PNP-10 (214), PNP-1 (205.50), PNP-7 (203.25), PNP-8 (197.25), PNP-3 (195.50), PNP-2 (182), PNP-5 (175) and minimum number of fruits were observed for PNP-9 (153) per kg dry substrate.

#### Fresh yield from different isolates of wild edible oyster mushrooms on wheat substrate:

Fresh yield performance of different isolates at first, second and third harvest was recorded separately and reflected in Table:10.

#### First harvest:

The results of first harvest (Table:10) revealed that the isolate PNP-4 had recorded maximum fresh yield (567.25g), followed by PNP-10 (547.5g), PNP-6 (534.75g), PNP-8 (514g), PNP-9 (506.25g), PNP-2 (420.25g), PNP-7 (400.25g), PNP-3 (398.25g), PNP-1 (380.25g) and isolate PNP-5 had recorded the minimum fresh yield (336.25g) per kg dry substrate.

At the first harvest, the yield of isolate PNP-1 was 66.54 per cent of the total yield, followed by PNP-7 (66.26%),

**Table 5. Yield parameters of different isolates of wild edible oyster mushrooms on wheat straw substrate.**

Sr. No.	Treatments		Average fruit body weight (g)*	No. of fruits/ kg dry substrate*
	Isolate No.			
1	PNP-1		3.28	205.50
2	PNP-2		6.14	182.00
3	PNP-3		5.09	195.50
4	PNP-4		5.58	235.00
5	PNP-5		5.14	175.00
6	PNP-6		5.85	216.25
7	PNP-7		4.04	203.25
8	PNP-8		4.58	197.25
9	PNP-9		4.62	153.00
10	PNP-10		6.42	214.00
	<i>(P. sajor-caju)</i>			
	Control			
	S.E. $\pm$			
	C.D. (0.05)		0.16	3.06
			0.45	8.90

\*Mean of four replications

PNP-9 (60.62%) and PNP-3 (60.61%), where as yield of isolate PNP-4 was 59.33 per cent of the total yield.

#### Second harvest:

The results of second harvest (Table:10) revealed that the isolate PNP-4 had maximum fresh yield (262.5g), followed by PNP-10 (223.75g), PNP-8 (222.75g), PNP-6 (220.75g), PNP-9 (210.75g), PNP-2 (168.75g), PNP-3 (164g), PNP-7 (127g) and PNP-1 (112.75g) while the isolate PNP-5 had the minimum fresh yield (112 g) per kg dry substrate.

At the second harvest, the yield of isolate PNP-4 was 27.45per cent of the total yield, followed by PNP-8 (25.87%), PNP-9 (25.23%) and PNP-3 (60.61%), while the yield of isolate PNP-6 was 24.97 per cent of the total yield.

#### Third harvest:

The results of third harvest (Table:10) revealed that the isolate PNP-6 had recorded maximum fresh yield (128.5 g), followed by PNP-10 (127.75 g), PNP-4 (126.75 g), PNP-8 (125 g), PNP-9 (118 g), PNP-2 (115 g), PNP-5 (107 g), PNP-3

**Table 10. Fresh yield performance of isolates from wild edible oyster mushroom on wheat substrate. (g/kg dry substrate)**

Sr. No.	Treatments		Yield of 1 <sup>st</sup> harvest*		Yield of 2 <sup>nd</sup> harvest*		Yield of 3 <sup>rd</sup> harvest*		Total Yield (g)*
	Isolate No.	Weight (g)	Total yield (%)	Weight (g)	Total yield (%)	Weight (g)	Total yield (%)		
1	PNP-1	380.25	66.54	112.75	19.74	78.25	13.70	571.25	
2	PNP-2	420.25	59.56	168.75	23.97	115.00	16.33	704.00	
3	PNP-3	398.25	60.61	164.00	24.96	95.50	14.53	657.75	
4	PNP-4	567.25	59.33	262.50	27.45	126.75	13.25	956.50	
5	PNP-5	336.25	60.58	112.00	20.18	107.00	19.27	555.25	
6	PNP-6	534.75	60.49	220.75	24.97	128.50	14.53	884.00	
7	PNP-7	400.25	66.26	127.00	21.02	77.25	12.78	604.50	
8	PNP-8	514.00	59.69	222.75	25.87	125.00	14.51	861.75	
9	PNP-9	506.25	60.62	210.75	25.23	118.00	14.13	835.00	
10	PNP-10	547.50	60.90	223.75	24.88	127.75	14.21	899.00	
	<i>(P. sajor-caju)</i>								
	Control								
	S.E. $\pm$								
	C.D. (0.05)	17.94		32.10		21.21		35.18	

\*Mean of four replications

(95.50g) and PNP-1 (78.25 g) where as isolate PNP-7 had recorded the minimum fresh yield (77.25 g) per kg dry substrate.

At the third harvest, the yield of isolate PNP-5 was 19.27 per cent of the total yield, followed by PNP-2 (16.33%), PNP-3 (14.53%) and PNP-6 (14.53%), while the yield of isolate PNP-7 was 12.78 per cent of the total yield. The results in respect of fresh mushroom yield revealed that about 2/3<sup>rd</sup> of total yield was obtained at first harvest and decreases thereafter up to 1/3<sup>rd</sup> at third harvest in all isolates under study.

#### Total fresh yield of different isolates from wild edible oyster mushrooms on wheat substrate:

After third harvest, total fresh yield per kg dry substrate from different isolates were recorded and reflected in Table:10. The total fresh yield from all isolates were ranged from 555.25 to 956.50g per kg dry wheat straw substrate. However the fresh yield recorded by isolate PNP-4 (956.5g) was found significantly superior, followed by PNP-10 (899g), PNP-6 (884g), PNP-8 (861.75g), PNP-9 (835g), PNP-2 (704g), PNP-3 (657.75g), PNP-7 (604.50g), PNP-1 (571.25g) where as minimum yield was recorded for PNP-5 (555.25g) per kg dry substrate as compared to other isolates.

#### Dry weight of different isolates from wild edible oyster mushrooms:

After each harvesting, the mushrooms were dried in mushroom dryer and observations regarding dry weight at first, second and third harvests were recorded and are presented in Table:11.

#### First harvest:

The results of first harvest (Table:12) revealed that

the isolate PNP-4 had recorded maximum dry yield (72.75g), followed by PNP-10 (67.5g), PNP-6 (63g), PNP-8 (62.25g), PNP-9 (59.25g), PNP-2 (47g), PNP-3 (43.75g), PNP-7 (42.50g), PNP-1 (39.75g) and the isolate PNP-5 had the minimum dry yield (34 g) per kg dry substrate.

At first harvest, the yield of isolate PNP-7 was 67.46 per cent of the total yield, followed by PNP-1 (66.25%), PNP-8 (61.63%) and PNP-10 (61.36%), where as yield of isolate PNP-2 was 59.49 per cent of the total yield.

#### Second harvest

The results of second harvest revealed that the isolate PNP-4 had maximum fresh yield (34g), followed by PNP-10 (26.75g), PNP-6 (26.25g), PNP-9 (24.25g), PNP-8 (23.50g), PNP-2 (18.50g), PNP-3 (17.75g), PNP-7 (12.75g), PNP-1 (11.75g) where as isolate PNP-5 had the minimum fresh yield (11.25 g) per kg dry wheat straw.

At second harvest, the yield of isolate PNP-4 was 28.33 per cent of the total yield, followed by PNP-6 (25.24%), PNP-9 (25%) and PNP-3 (24.65%), while the yield of isolate PNP-1 was 19.58 per cent of the total yield.

#### Third harvest:

The results of third harvest revealed that the isolate PNP-10 had maximum fresh yield (15.75g), followed by PNP-8 (15.5g), PNP-6 (15g), PNP-2 (14.25g), PNP-4 (14g), PNP-9 (13.50g), PNP-5 (11.75g), PNP-3 (10.50g), PNP-1 (8.50g) where as isolate PNP-7 had the minimum fresh yield (8.25g) per kg dry wheat straw.

Further the results indicate that isolate PNP-5 was 20.61 per cent of the total yield, followed by PNP-2 (18.04%), PNP-8 (15.35%) and PNP-3 (14.58%) and yield of isolate PNP-4 was 11.67 per cent of the total yield.

**Table 11. Dry weight of different isolates from wild edible oyster mushroom on wheat substrate.(g/kg dry substrate)**

Sr. No.	Treatments Isolate No.	Yield of 1 <sup>st</sup> harvest*		Yield of 2 <sup>nd</sup> harvest*		Yield of 3 <sup>rd</sup> harvest*	
		Weight (g)	Total yield (%)	Weight (g)	Total yield (%)	Weight (g)	Total yield (%)
1	PNP-1	39.75	66.25	11.75	19.58	8.50	14.17
2	PNP-2	47.00	59.49	18.50	23.41	14.25	18.04
3	PNP-3	43.75	60.76	17.75	24.65	10.50	14.58
4	PNP-4	72.75	60.62	34.00	28.33	14.00	11.67
5	PNP-5	34.00	59.64	11.25	19.74	11.75	20.61
6	PNP-6	63.00	60.57	26.25	25.24	15.00	14.42
7	PNP-7	42.50	67.46	12.75	20.24	8.25	13.10
8	PNP-8	62.25	61.63	23.50	23.27	15.50	15.35
9	PNP-9	59.25	61.08	24.25	25.00	13.50	13.92
10	PNP-10 ( <i>P. sajor-caju</i> )	67.50	61.36	26.75	24.32	15.75	14.32
	Control						
	S.E. ±	1.06		1.41		0.91	
	C.D. (0.05)	3.09		4.08		2.63	

\*Mean of four replications

**Table 12. Total dry weight of different isolates from wild edible oyster mushroom on wheat substrate.**

Sr. No.	Treatments Isolate No.	Total yield (g)*	Per cent of fresh weight	Moisture Content (%)
1	PNP-1	60.00	10.51	89.49
2	PNP-2	79.75	11.32	88.68
3	PNP-3	72.00	10.95	89.05
4	PNP-4	120.75	12.63	87.38
5	PNP-5	57.00	10.20	89.80
6	PNP-6	104.25	11.79	88.21
7	PNP-7	63.50	10.51	89.49
8	PNP-8	101.25	11.75	88.25
9	PNP-9	97.00	11.61	88.39
10	PNP-10 ( <i>P. sajor-caju</i> )	110.00	12.23	87.77
	Control			
	S.E. $\pm$	1.33		
	C.D. (0.05)	3.87		

\*Mean of four replications

#### Total dry weight of different isolates from wild edible oyster mushrooms on wheat substrate:

Under this title, two observations were recorded *viz.*, total dry weight and total dry weight to the per cent of fresh weight. The results are shown in Table:12.

#### Total dry weight

After drying of the third harvest fruit bodies, total dry weight per kg dry substrate from different isolates were recorded. The dry yield of isolate PNP-4 (120.75g) was found significantly superior, followed by PNP-10 (110g), PNP-6 (104.25g), PNP-8 (101.25g), PNP-9 (97g), PNP-2 (79.75g), PNP-3 (72g), PNP-7 (63.50g), PNP-1 (60g), where as the minimum yield was recorded in PNP-5 (57g) as compared to other isolates.

#### Total dry weight to the total fresh weight :

After recording the total fresh yield and dry weight of all the ten isolates, total dry weight to the per cent of fresh weight was calculated. It was found maximum in the isolate PNP-4 (12.63%), followed by PNP-10 (12.63%), PNP-6 (11.79%), PNP-8 (11.75%), PNP-9 (11.61%), PNP-2 (11.32%), PNP-3 (10.95%), PNP-1 and PNP-7 (10.51%) where as it was minimum (10.20%) in the isolate PNP-5.

#### Moisture content

The moisture content in all wild edible oyster mushrooms was found negatively corelated with dry matter content in mushroom i.e. the dry matter increases with decrease in moisture content in mushroom.

#### Growth performance of different isolates from wild edible oyster mushrooms on wheat straw

Growth performance on wheat straw includes the observations *viz.*, days required for spawn run, days

required for pinhead formation and days required for first, second and third harvest after pinhead formation. The variation was observed for all the observations.

The results on spawn run clearly showed that the time taken for spawn run of the different isolates varies from 15 to 22 days depending upon the isolate. The isolate PNP-4 was found significantly superior, followed by PNP-10, PNP-7, PNP-2, PNP-3, PNP-6, PNP-8, PNP-9 and PNP-1. The isolate PNP-5 required more days for spawn run. The findings of Shah *et al.* (2004) and Hassan Sher *et al.* (2010) showed that 2 to 3 weeks are required for completion of spawn run which supports present study.

After the spawn run, days required for pinhead formation was recorded. It varied between 3.25 to 6.25 days. The performance of isolate PNP-4 was superior which showed early pinhead formation after spawn run, followed by PNP-10, PNP-7, PNP-1, PNP-3, PNP-6, PNP-8, PNP-2 and PNP-9, where as maximum number of days were required by PNP-5 for pinhead formation. Gaikwad (2004) reported that the time duration required for pinhead formation varies between 17 to 23 days after spawning in *Pleurotus sajor-caju*. Sivaprakasam and Ramraj (1991) have reported, 25-27 days for appearance of pinhead, in case of *Pleurotus sajor-caju* grown on wheat straw. Sharma and Jandaik (1983) and Zadrazil and Kurtzman (1982) also reported similar results. They reported 3 to 7 days required for pinhead formation after removal of polypropylene bags.

After pinhead formation the observations for days required for first, second and third harvesting were recorded. Days required for first harvest after pinhead formation were minimum and significantly superior for PNP-4, followed by PNP-10, PNP-2, PNP-3, PNP-1, PNP-6, PNP-7, PNP-8 and PNP-9. The maximum number of days for first harvest after pinhead formation was recorded in PNP-5. In second

harvesting minimum days were required by PNP-4, followed by PNP-10, PNP-2, PNP-3, PNP-1, PNP-6, PNP-8, PNP-7 and PNP-9, where as maximum days were required by PNP-5. For third harvest minimum days were required by PNP-4, followed by PNP-10, PNP-3, PNP-2, PNP-1, PNP-8, PNP-6, PNP-7, and PNP-9, where as maximum number of days were required by PNP-5. Similar results were reported by Mshandete and Kivaisi (2013), Hassan Sher *et al.* (2010), Muhammad Iqbal *et al.* (2005) and Shah *et al.* (2004). They noted 4 to 10 days were required for first, 15 to 28 days for second and 32 to 52 days for third harvesting after pinhead formation.

#### **Total days required for first, second and third harvest after spawning**

The observation on total days required for harvesting after spawning was recorded. Among the ten isolates under study, isolate PNP-4 was found significantly superior for days required for first, second and third harvest from the date of spawning, followed by PNP-10 and the maximum number of days for first, second and third harvest were recorded for PNP-5. The findings of Mshandete and Kivaisi (2013), Hassan Sher *et al.* (2010), Muhammad Iqbal *et al.* (2005) and Shah *et al.* (2004) noted the similar duration for *Pleurotus* spp. They reported 25 to 35 days required for first, 40 to 50 days for second and 55 to 70 for third harvest after inoculation, which shows close proximity with our results.

#### **Morphological characters of mushroom fruits from different wild edible oyster isolates**

The various morphological characters *viz.*, pileus diameter, stipe length, stipe size, colour, and odour were recorded.

The pileus diameter of the isolates varied from 4.81 to 6.36 cm. Pileus diameter in PNP-10 was significantly superior, followed by PNP-4, PNP-1, PNP-2, PNP-5, PNP-7, PNP-9, PNP-3, PNP-8 while it was minimum for PNP-6 isolate.

The stipe length of the isolates varied from 0.81 to 2.63 cm. The minimum length was noticed in PNP-8, followed by PNP-9, PNP-2, PNP-5, PNP-1, PNP-4, PNP-7, PNP-3, PNP-6 and maximum stipe length was noticed in PNP-10.

The stipe size of the isolates varied from 1.31 to 2.92 cm. PNP-4 recorded minimum size, followed by PNP-1, PNP-7, PNP-3, PNP-5, PNP-6, PNP-9, PNP-8, PNP-2 and it was recorded maximum in PNP-10.

Pruthvi *et al.* (1984) studied the mushrooms comprise a large heterogeneous group which differs greatly in their shape, size, colour, appearance and edibility. Hassan Sher *et al.* (2010) observed the same results for *Pleurotus ostreatus* and Mshandete and Kivaisi (2013) for *Pleurotus* HK-37.

#### **Yield parameters of different isolates from wild edible oyster mushroom on wheat straw**

##### **Average mature fruit body weight:**

The harvested matured mushroom fruit bodies were collected and the average fruit body weight (g) was recorded. It varied between 3.28 to 6.42g. The average fruit body weight was high for PNP-10 followed by PNP-2, PNP-

6, PNP-4, PNP-5, PNP-3, PNP-9 and PNP-7 while it was minimum in PNP-1 per fruit body. Sharma and Jandaik (1991) in their studies with *Pleurotus* spp. recorded fruit body weight of 5.0 to 5.8 g. Hassan Sher *et al.* (2010) also noted 2.3 to 9.7 g average fruit body weight in Peshavar.

##### **Number of fruits per kg dry substrate:**

The total number of fruit bodies harvested from the mushroom beds were recorded. The number of fruits per kg dry substrate varied from 153 to 235. The isolate PNP-4 had maximum number of fruit bodies, followed by PNP-6, PNP-10, PNP-1, PNP-7, PNP-8, PNP-3, PNP-2 and PNP-5, while number of fruit bodies were minimum in PNP-9 per kg dry substrate. Gaikwad (2004) noted that the total number of fruits formed in *Pleurotus sajor-caju* ranged between 125 - 200.

##### **Fresh yield of different isolates from wild edible oyster mushrooms on wheat substrate:**

The fresh yield of different isolates from wild oyster mushroom was recorded. The fresh yield varied from 555.25 to 956.50g per kg dry substrate. The isolate with maximum dry weight was PNP-4, followed by PNP-10, PNP-6, PNP-8, PNP-9, PNP-2, PNP-7, PNP-3 and PNP-1 where as it was minimum in PNP-5 per kg dry substrate.

Sharma (1992) studied 14 different *Pleurotus* spp. and concluded that *P. sajor-caju* was high yielding. Pani and Das (1999) recorded the yield of *Pleurotus sajor-caju* and was 914g per kg dry substrate. Similarly Sangitrao and Griensven (2000) recorded highest yield (1060.67 g/kg dry wheat straw) for *Pleurotus sajor-caju*, Patil *et al.* (2010) studied the yield performance of *Pleurotus* spp. on wheat straw and recorded mushroom yield i.e. 720.66g per kg substrate. Further Bilal Sofi *et al.* (2014) reported average yield, varied between 630-780 g per kg dry substrate.

##### **Dry weight of different isolates from wild edible oyster mushroom:**

The dry weight of different isolates from wild oyster mushroom was recorded. The dry weight varied from 57 to 120.75g per kg dry substrate. The isolate with maximum dry weight was PNP-4, followed by PNP-10, PNP-6, PNP-8, PNP-9, PNP-2, PNP-3, PNP-7 and PNP-1, while it was minimum in PNP-5 per kg dry substrate. Kumari and Achal (2008) and Quimio (1978) reported that the wheat straw was most suitable substrate for growing mushroom which gives maximum yield of oyster on wheat straw. Singh *et al.* (1995) reported that the yield of *Pleurotus* spp. ranged between 473 to 700 g per kg dry substrate with biological efficiency of 47.30% to 87.50%. Savalgi and Savalgi (1994), Sangwan and Saini (1994), Kadlag *et al.* (1998), Dubey (1999) and Mathew *et al.* (1996) also reported more or less similar results in respect of mushroom yield on substrate.

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