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Effect of oil cakes and supplements aqueous extracts on growth of *Pleurotus eous*

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Abstract
A preliminary experiment was carried out to analyse the growth performance of *P.eous* mushroom cultures using different oil cakes and supplements aqueous extracts. Eight cereal/pulse grains viz., Tur, Gram, Wheat, Bajra, Mung, Soybean and Maize and aqueous extracts of eight de-oilcakes (DOC) viz., Cotton seed cake, Neem seed cake, Karanj seed cake, Castor cake, Safflower cake, Groundnut cake and Soybean cake were used. Cotton seed cake aqueous extract was recorded maximum colony diameter of *P. eous* both at 5% and 10% conc. and it was superior over other oil cakes aqueous extract used in this experiment. Soybean flour aqueous extract was recorded maximum colony diameter of *P. eous* both at 5% and 10% conc. and it was superior over other supplements aqueous extract used in this experiment.

Keywords: *Pleurotus eous*, oil cakes, cereal/pulse grains, soybean, cotton seed cake

Introduction
Mushrooms were so far considered as luxury food especially among the rich community because of their unique flavor and excitingly different taste but now they have grown to a common mans food. Mushrooms are traced as special kind of food, since ancient times. The Greeks believed that mushrooms provided strength for warriors in battle and Romans regarded them as “Food of Gods” or “Gods Flesh”, which were served only on festival occasions.

China leads in world mushroom production by cultivating more than 20 different types of mushrooms on commercial scale. USA is the second largest producer of mushrooms sharing 16 per cent of the world production (Prakasam, 2012; Singh *et al*., 2011) [8, 9]. Currently India stands 54 in the world ranking of mushroom producers. India ranks 6th and world market share 4.44 per cent. Mushroom production in India has been estimated at 48000 tonnes per annum.

At present, only three mushrooms *viz*., button mushroom (*Agaricus bisporus*), oyster mushroom (*Pleurotus* spp.) and paddy straw mushroom (*Volvariella* spp.) is being cultivated on commercial and small scale in India. Button mushroom is mainly cultivated in mechanized mushroom farms on commercial scale in States such as Jammu & Kashmir, Himachal Pradesh, Uttaranchal, etc. To date approximately 70 species of oyster mushroom (*Pleurotus* spp.) have been recorded. The oyster mushroom (*Pleurotus* spp.) also called ‘Dhingri or Abalone’ (Chadha and Sharma, 1995) [1]. Oyster mushroom is usually coloured including dark blue, white, cream, brown, or yellow and pink.

Oyster (*Pleurotus* spp.) mushroom is the 2nd largest cultivated mushroom in the world and its annual production is 797,000 tones. India produces only small quantity (25000 tons) of oyster mushroom in the state of Orissa, Karnataka, Maharashtra and Andhra Pradesh etc.

Various *Pleurotus* species have been shown to possess a number of medicinal properties, such as antitumor, immunomodulatory, antigenotoxic, antioxidant, anti-inflammatory, hypocholesterolemic, antihypertensive, antiviral and antimicrobial activity (Gregori *et al*, 2007) [2]. The production of oyster mushroom has been increasing steadily recent past years. with the availability of sub tropical climate in most part of India, widely adoptability, low coat growing technology, high biological efficiency, ability to grow on variety of agro- wastes and easy to adopt cultivation technology, the cultivation of oyster mushroom has been popularized in various state of country.

There are quite suitable for commercial cultivation of various *Pleurotus* species including *P. sajar-caju, P. eous, P. florida, P. flabellatus, P. ostreatus* etc. *Pleurotus eous* produces pinkish coloured fruit bodies either singly or in clusters. The pileus is oyster shaped initially but

becomes deeply lobed and folded at maturity. The stipe is solid, rigid, eccentric and pink in colour. This mushroom grew excellently at 18-24 °C temperature range but can grow up to 28 °C.

Materials and methods

Oil cakes and supplements

For studying cultural characteristics of *P. eous*, aqueous extracts of eight cereal/pulse grains viz., Tur, Gram, Wheat, Bajra, Mung, Soyabean and Maize and aqueous extracts of eight de-oilcakes (DOC) *viz.*, Cotton seed cake, Neem seed cake, Karanj seed cake, Castor cake, Safflowr cake, Ground cake and Soyabean cake were used. These oil cakes and supplements were purchased from local market of Parbhani.

1. *In vitro* evaluation extracts of de-oil-cakes (DOC)

Aqueous extracts of eight oilcakes *viz*., cotton seed cake, neem seed cake, soybean seed cake, castor cake, karanj cake, safflower cake, sunflower cake and groundnut cake were used to study the culture growth of *P. eous.* Oil cakes were ground to coarse powder using mixer cum grinder. The 100 g each oil cake powder was dispensed in 100 ml distilled water and heated to boiling. Cooled at room temperature and filtered through double layered muslim cloth. The extracts were obtained were further filtered through Whatman No.1 filter paper using funnel and volumetric flasks. The final clear extracts obtained from the standard oil cakes extracts of 100 percent concentration, which were evaluated (each @ 5% and 10%) using PDA as a basal medium.

Experimental details

Design:	CRD
Replications:	Three
Treatments:	Eight

Treatments details

T_1: Cotton seed cake	T_2: Castor cake
T_3: Neem seed cake	T_4: Ground nut cake
T_5: Soybean cake	T_6: Karanj cake
T_7: Safflower cake	T_8: Control (untreated)

An appropriate quantity of each oil cake extract (100%) was separately mixed thoroughly with PDA medium in conical flask (250 ml cap.) to obtain desired concentration (5 and 10%) and autoclaved at 15 lbs/cm² pressure for 15 to 20 minutes. Sterilized and cooled PDA amended with oil cakes extract was then poured (15 to 20 ml/plate) into sterile glass petri plates (90 mm dia.) and allowed to solidify at room temperature. Each oil cake extract and its respective concentration were replicated thrice. The plates containing PDA without any extract were maintained as untreated control. Upon solidification of PDA, all the plates were aseptically inoculated by placing in the centre of a 5 mm mycelial disc obtained from a week old culture of *P. eous* grown on agar plate. Plates containing plain PDA and with test fungus served as untreated control. All these plates were then incubate at 20 °C temperature for a week or till the untreated control plates were fully covered with mycelial growth of the test fungus.

Observation on radial mycelia growth/colony diameters of the test fungal were recorded treatment wise as 24 hours intervals and continued till mycelial growth of the test fungus was fully covered in untreated control plates.

2. *In vitro* evaluation of aqueous extracts of cereals/ pulses grains

Eight supplements *viz*., Jowar, Wheat, Maize, Bajra, Tur, Soybean and Gram were evaluated against *P. eous* in plate culture experiments. Grains of the test supplements were ground to coarse powder using mixture cum grinder. The 100 g powdered grains were dispensed in 100 ml distilled water and kept soaking overnight. On the next day the context was filtered through double layered muslin cloth and the extracts obtained will further filtered through Whatman No. I filter paper using funnel and volumetric flasks. The final clear extracts obtained formed the standard supplement extracts of 100 per cent concentration, which were evaluated (each @ 5 % and 10 %) using PDA as basal medium and applying poisoned food technique.

Experimental details

Design:	CRD
Replication:	Three
Treatments:	Eight

Treatment details

T_1: Jowar	T_2: Bajra	T_3: Wheat	T_4: Tur
T_5: Soybean	T_6: Maize	T_7: Gram	T_8: Control (untreated)

An appropriate quantity of each aqueous extracts of cereals/ pulses grains (100%) was separately mixed throughly with PDA medium in conical flasks (250 ml cap.) to obtain desired concentration (5% and 10%) and autoclaved at 15 lbs /cm² pressure for 15 to 20 minutes. Sterilized and cooled PDA amended with aqueous extracts of cereals/ pulses grains was then poured (15 to 20 ml /plate) into sterile glass petriplates (90 mm dia.) and allowed to solidify at room temperature. Each aqueous extracts of cereals/ pulses grains and its respective concentration were replicated thrice. The plates containing PDA without any extract were maintained as untreated control. Upon solidification of PDA, all the plates were aseptically inoculated by placing in the centre of a 5 mm mycelial disc obtained from a week old culture of *P. eous* grown on agar plate. Plates containing plain PDA and with test fungus served as untreated control. All these plates were then incubate at 20 °C temperature for a week or till the untreated control plates were fully covered with mycelial growth of the test fungus.

Observation on radial mycelial growth/colony diameter of the test fungal were recorded treatment wise at 24 hours intervals and continued till mycelial growth of the test fungus was fully covered in untreated control plates. Observations obtained were averaged and the data was analyzed statistically.

Statistical analysis

All the data related to diseases incidence and yield was statistically analyzed. Calculations were made after applying the test of significance of the means (Panse and Sukhatme, 1978).

Result and discussion

1. *In vitro* effect of de-oiled cake extracts

The effect of eight different de-oiled cake extract (@ 5% and 10% conc.) on colony diameter of *P. eous* were studied and the data obtained is presented in table 1 and depicted in PLATE I and Fig 1.

The average colony diameter of *P. eous* on various aqueous extracts of oil cakes in present investigation ranged between

20.66 to 90 mm. The maximum colony diameter (90 mm) was recorded on Potato dextrose agar (control-without any aqueous extract of oil cakes), followed by Cotton cake extract @ 5% (59.66 mm), Castor cake extract @ 5% (55.00mm), Ground nut cake extract @ 5% (52.66 mm) and the minimum colony diameter was recorded on Karanj cake extract @ 10% (20.66 mm) followed by safflower cake extract @ 10% (25.33 mm).

Cotton seed cake extract reported superior over all other oilseed cake aqueous extracts in present investigation. Similar variation in colony diameter has been reported by earlier workers (Naraian *et al*., 2009) [5].

Table 1: Effect of various oil cakes aqueous extracts (each @ 5% and 10 @ conc.) on growth of *P. eous.*

Tr. No.	Treatments	*Average colony Diameter (mm)	
		5% conc.	10% conc.
T_1	Cotton seed cake	59.66	32.33
T_2	Castor cake	55.00	27.00
T_3	Neem seed cake	35.10	33.10
T_4	Groundnut cake	52.66	34.66
T_5	Soybean cake	38.22	35.11
T_6	Karanj cake	43.66	20.66
T_7	Safflower cake	41.50	25.33
T_8	Control (untreated)	90.00	90.00
S.E. ±		1.58	1.66
C.D. 1%		4.76	4.98
C.V.		3.84	3.58

*: Mean of three replication.

Plate I

5% conc. **10% conc**

Effect of various deoiled cakes (DOC) aqueous extract on growth of *P. eous*

T_1: Cotton seed cake
T_2: Castor cake
T_3: Neem seed cake
T_4: Ground nut cake
T_5: Soybean cake
T_6: Karanj cake
T_7: Safflower cake
T_8: Control (untreated)

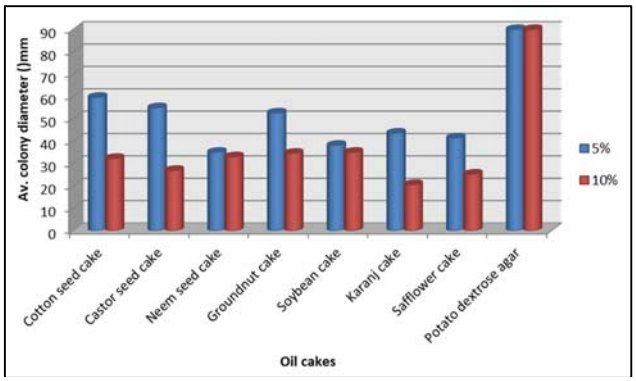

Fig 1: Effect of various de- oiled cakes aqueous extracts on growth of *P. eous*

2. *In vitro* effect of pulses/cereals grains extracts

The effect of eight different aqueous extracts of pulses/cereals grain powdered on colony diameter of *P. eous* were studied and the data obtained is presented in the table 2 and depicted in PLATE II and Fig. 2.

The average colony diameter of *P. eous* in various aqueous extracts of supplements in present investigation ranged between 64.33 to 90 mm. The maximum colony diameter (90 mm) was recorded on Potato dextrose agar (control – without aqueous extract of supplements) and followed by jowar extract @ 10% conc. (87.60 mm), soybean extract @ 10% (87.00 mm) and soybean extract @ 5% conc. (86.33 mm) and minimum colony diameter was recorded on wheat extract @ 5% conc. (64.33 mm) followed by wheat extract @ 10% conc. (68.33 mm) and bajara extract @ 5% conc. (72.10 mm).

Soybean and jowar flour extract reported superior over all other supplements aqueous extract in present investigation. Similar variation in colony diameter of these cultures has been reported by earlier workers (Ibekwe *et al*., 2008 and Neelam *et al*., 2013) [3, 6].

Table 2: Effect of various supplement aqueous extract (each @ 5% and 10 @ conc.) on growth of *P. eous.*

Tr. No.	Treatments	*Avarage colony Diameter (mm)	
		5% conc.	10% conc.
T_1	Jowar	84.60	87.60
T_2	Bajara	72.10	81.33
T_3	Wheat	64.33	68.33
T_4	Tur	80.00	83.33
T_5	Soybean	86.10	87.00
T_6	Maize	75.50	78.50
T_7	Gram	78.22	81.10
T_8	Control (untreated)	90.00	90.00
S.E. ±		1.18	1.25
C.D. 5%		3.55	3.75
C.V.		2.36	2.40

*: Mean of three replication.

Plate II

5% conc. **10% conc.**

Effect of various cereals/pulses grain powder aqueous extract on growth of *P. eous*

T_1: Jowar
T_2: Bajra
T_3: Wheat
T_4: Tur
T_5: Soybean
T_6: Maize
T_7: Gram
T_8: Control (untreated)

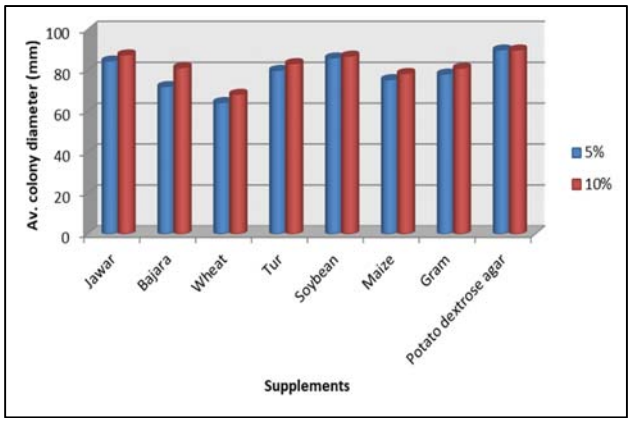

Fig 2: Effect of various pulses/cereals grains aqueous extracts on growth of *P. eous*

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