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Efficacy of botanicals on the infection of *Cladobotryum dendroides* in Oyster mushroom (*Pleurotus florida*)

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Abstract
Mushrooms are known for several nutritional and medicinal benefits and are cultivated worldwide. Several fungal contaminants of mushrooms have been serving as the major restraining factor in the growing mushroom industry for a long time. Fungal contaminants like Trichoderma spp., Mycogone spp., Lecanicillium spp., Cladobotryum spp., Coprinus spp., Sependonium spp., Sclerotium rolfsii, and *Cephalothorax roseum* among many, are found to infect mushroom crops at different stages from spawn run period to maturation of fruiting bodies. These contaminants may reduce yield and/or degrade the quality of fruiting bodies of the mushroom causing economic losses. The aim of the present experiment was to check the efficacy of various botanicals against *Cladobotryum dendroides*. *Pleurotus species* commonly known as oyster mushroom or Dhingri mushroom is one of the most important mushrooms cultivated in India. Five botanicals namely Neem Kernel extract. ginger rhizome extract, garlic extract, tulsi leaf extract and Ecaulyptus leaf extract were screened against *Cladobotryum dendroides*. Antifungal efficiency was examined by Poison food method. The percent inhibition produced by Botanicals Ginger was highly effective against *Cladobotryum dendroides* reduced the radial growth of *Cladobotryum dendroides* by (43.32%) followed by Eucalyptus leaves Extract (47.77%), Neem leaves Extract (47.93%), Tulsi Extract (51.43%) and Garlic (52.68%) against *Cladobotryum dendroides*. All Botanicals were most effective than control.

Keywords: Botanicals, *Cladobotryum dendroides*, mushroom, *Pleurotus florida*

Introduction
Among the mushrooms *Pleurotus species* commonly known as oyster mushroom or Dhingri mushroom is extensively cultivated throughout the world and contributed more than 24.1% of total world production (1500 tonnes in 2022, due to low domestic demand) mushroom. Pleurotus can be easily cultivated in simple method on number of base material which do not need composting. The mushroom (*Pleurotus florida*) is an edible Basidiomycetes having excellent flavour, taste and nutritional value. This mushroom has the highest protein content and has many other constituents such as Vitamin B1 and Vitamin B7 and low calorie levels. In addition, they are reported to be low in fat (2 to 3% by dry weight), a good source of essential amino acids and contain 5 to 9% fiber (Yang *et al*. 2001) [9]. The culture of Oyster mushroom is becoming popular throughout the world because of its abilities to utilize a large variety of agricultural waste products and transform the ligno-cellulosic biomass into food of high quality, flavour and nutritive value. *Pleurotus* species have extensive enzynie systems capable of utilizing complex organic compounds that occur as agricultural wastes and industrial by-products (Baysal *et al*. 2003) [2]. *Pleurotus spp*. are having antiviral. anti-inflammatory, anticancer and immune modulation activities.

Pleurotus species are the most popular mushroom growing in India. In India, Jammu and Kashmir State, Uttar Pradesh, Himanchal Pradesh, Punjab comprises area of diverse climatic zones. Unfortunately this mushroom is subject to many vagaries of nature *viz*., pests and diseases that adversely affect its production and productivity. Among the various fungi and competitors of *Pleurotus spp*. green moulds are reported to be devastating disease in the crop production of this mushroom. The pathogen inhibits the growth of mushrooms and in severe outbreaks, the fruiting bodies are not produced from contaminated beds.

Fungal species played part in the initial mesophilic phase of the substrate preparation process, but they disappeared after pasteurization in tunnels at constant elevated temperatures. Changes in the micro biota showed a marked bacterial community succession during substrate preparation investigated by 16S ribosomal deoxyribonucleic acid-based terminal restriction fragment length polymorphism (T-RFLP) (Vajna *et al.*, 2010) [5].

Ying-ming Liao (1993) [10] reported that the effect of medium pH values on the mycelial growth of shiitak and contamination also reported result indicated that species of *Penicillium*, *Nurospora* and *Aspergillus* were most frequently isolated fungi from sawdust. Four fungal species namely *Aspergillus fumigatus, Chetonium Thermophile, Mucar pasillus* and *trichoderma harziamum* isolated and identified from straw and oyster compost substrate collected from research station development board from Ratmalana, Sri Lanka. The applications of vegetable materials by soil drench to the casing layer had a stimulatory effect on mushroom yields. Yield increased with all vegetable treatments over the water-treated control. With the exception of O. natrix and O. onites extracts, significant productivity increases (7.7 to 21.9%) compared to the control were observed as a result of plant extract applications. The results suggest that plant materials may play an important role on the yield and productivity of A. bisporus, and may also be used in organic mushroom cultivation.

Materials and Methods

The *in vitro* experiment was carried out at Shivalik Agriculture Research Farm, Department of agriculture, SIPS, Dehradun UK. *In vitro* evaluation: *Pleurotus florida* substrate poly bags were taken, during the period September to November 2021-22. In the laboratory, pieces of mycelium taken from *Cladobotryum dendroides* affected areas of infected wheat straw were placed on Potato dextrose Agar (PDA) using a sterilized inoculating needle. The samples from infected bottles were obtained by dilution and. plating of sampled material on PDA. The plates were incubated at room temperature (24 °C+2) until fungal growth was visible. The botanicals were mixed in PDA flask through Poison food technique @15% concentration. After mixing of botanicals Pathogen (*Cladobotryum dendroides*) and *Pleurotus florida* taken from the margin of 6 days old cultures, were inoculated in the center of PDA petriplates, separately. Each treatment was replicated twice. The petri plates having Pathogen (*Cladobotryum dendroides*) and *Pleurotus florida* separately served as control. The petriplates were subsequently incubated at 24+2 °C, till the complete growth was observed in control plates. Colony diameter of the Alternaria spp. and *Pleurotus florida* in treated plates were recorded at two locations, right angle to each other and the average diameter was calculated. Percent growth inhibition over control was calculated according to the formula:

$$\text{Mycelial inhibition (\%)} = \frac{\text{Radial growth in control-Radial growth in treatment}}{\text{Radial growth in control}} \times 100$$

Results

Data presented in the Table 1 reveals that all botanicals were more or less inhibiting mycelial growth of *Cladobotryum dendroides* causing contamination in Dhingri *Pleurotus florida* mushroom. Ginger was highly effective against *Cladobotryum dendroides* reduced the radial growth of *Cladobotryum dendroides* by (43.32%) followed by Eucalyptus leaves Extract (47.77%), Neem leaves Extract (47.93%), Tulsi Extract (51.43%) and Garlic (52.68%) against *Cladobotryum dendroides* as comparisons control (Table 1). None of the botanicals were able to cause complete inhibition of *Cladobotryum dendroides*).

Table 1: Efficacy of various botanicals on the radial growth of *Cladobotryum dendroides* (*Pleurotus florida*)

S. No.	Treatments	R1	R2	R3	Mean
1	T1 Garlic Extract spray @5%	52.50	53.25	52.30	52.68
2	T2 Ginger Extract spray @5%	44.50	43.45	42.00	43.32
3	T3 Neem leaves Extract spray @5%	48.30	48.50	47.00	47.93
4	T4 Eucalyptus leaves Extract spray @5%	47.00	48.30	48.00	47.77
5	T5 Tulsi Extract spray @5%	51.50	52.50	50.30	51.43
6	Control	61.00	65.50	63.40	63.30
7	CD at 5%	-	-	-	1.975

* Coefficient of Variation = 2.126

Discussion

All botanicals were effective against *Cladobotryum dendroides*. The best botanical showing inhibitory effect on *Cladobotryum dendroides*. were ginger fallowed by Neem and eucalyptus. Fungal species played part in the initial mesophilic phase of the substrate preparation process, but they disappeared after pasteurization in tunnels at constant elevated temperatures. Changes in the microbiota showed a marked bacterial community succession during substrate preparation investigated by 16S ribosomal deoxyribonucleic acid-based terminal restriction fragment length polymorphism (T-RFLP) (Vajna *et al*. 2010) [5]. Ylug-ming liao (1993) [10] reported that the effect of medium pH values on the mycelial growth of shiitak and contamination also reported result indicated that species of *Fenicillium, Nurospora* and *Aspergillus* were most frequently isolated fungi from sawdust Four flingal species namely *Aspergillus fumigatus Chetonium Therinophile, Mucar pusillus* and *Trichoderma harziamum*.

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