

Antifungal activities of phyto extracts against major pathogens infecting oyster mushroom [*Pleurotus ostreatus* (Jacq.) P. Kumm]

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Oyster mushroom (*Pleurotus ostreatus*) is fleshy, edible fungi and is highly susceptible to attacked by various diseases. Among the fungal agents *Trichoderma* sp. and *Aspergillus niger* are major infecting pathogen. A total of eight phyto-extracts viz., neem, turmeric, tulsi, onion, garlic, ginger, spear mint and *Calotropis* were evaluated at 5 and 10 per cent concentration against *Trichoderma* sp. and *Aspergillus niger* under *in vitro* conditions by poison food technique following the procedure given by Ansari (1995) with a slight modification.

Trichoderma sp. and *Aspergillus niger* were isolated from contaminated spawn bags. For making plant extracts, fresh leaves, rhizomes or cloves of respective plants i.e. neem (leaves), turmeric (rhizome), tulsi (leaves), onion (bulb), garlic (cloves), ginger (rhizome), spear mint (leaves) and *Calotropis* (leaves) were first washed with tap water and then with sterile distilled water. Each sample was then homogenized in sterilized distilled water at the rate of 1 g/ml of tissues (1:1 W/V) with a pestle and mortar and filtered through fine muslin cloth. The filtrate was centrifuged at 5000 rpm for 20 minutes and the supernatant was filtered with sterilized sintered funnel (pore size 1-2 microns), which formed the standard plant extract solution (100%).

The extracts were individually incorporated into PDA medium at 5 and 10 per cent concentration in

250 ml conical flasks separately and sterilized at 1.2 kg/cm² for 15 minutes. These were poured in 90 mm sterilized Petri dishes keeping three replications for each concentration of extract. PDA without extracts was maintained as control. All the Petri dishes were inoculated with one week old four mm mycelial disc of the pathogen and incubated at 28 ± 2°C. Seven days after inoculation, the radial growth of mycelium was recorded.

The per cent growth inhibition of the fungus in each treatment was calculated by using following formulae (Vincent, 1947).

$$PGI = \frac{C - T}{C} \times 100$$

Where,

PGI = Per cent growth inhibition index

C = Area of test fungus in control (mm)

T = Area of test fungus in respective treatment (mm)

In case of *Trichoderma* sp the highest per cent inhibition was observed in 10% Turmeric (42.26 %) followed by 10% concentration of Garlic (30.58%). Ten per cent concentrations of all the phyto-extracts gave significantly more inhibition as compared to 5% concentration (Table 1). There were significant differences in different extracts at both concentration levels. Toxicity index was found highest in turmeric (73.43) and lowest in *Calotropis* (44.67) based on maximum toxicity index of 200.00.

ANTIFUNGAL ACTIVITIES OF PHYTO EXTRACTS AGAINST MAJOR PATHOGENS INFECTING OYSTER MUSHROOM

Table 1. Growth inhibition of *Trichoderma* sp. at different concentrations of phyto-extracts after seven days of incubation at 28 ± 2° C

Sr. No.	Phyto-extract (plant parts used)	Per cent inhibition*		Mean	Toxicity Index [#]
		5**	10**		
1	Neem (leaves)	21.42 (13.34)	26.18 (19.46)	23.80 (16.40)	47.60
2	Turmeric (rhizome)	32.88 (29.47)	40.55 (42.26)	36.71 (35.87)	73.43
3	Tulsi (leaves)	26.97 (20.57)	28.14 (22.24)	27.56 (21.40)	55.11
4	Onion (bulb)	19.47 (11.11)	31.82 (27.80)	25.65 (19.45)	51.29
5	Garlic (cloves)	28.14 (22.24)	33.57 (30.58)	30.86 (26.41)	67.71
6	Ginger (rhizome)	21.88 (13.89)	26.97 (20.57)	24.43 (17.23)	48.85
7	Spear mint (leaves)	28.90 (23.35)	30.38 (25.57)	29.64 (24.46)	59.28
8	Calotropis (leaves)	21.89 (13.90)	22.78 (15.00)	22.34 (14.45)	44.67
Mean	25.19 18.48)	30.07 (25.43)	-	-	
		Between phyto extracts	Within phyto extracts (Conc.)	Phyto extracts xConcentration	
	S.Em.+	0.26	0.13	0.36	
	CD at 5 %	0.74	0.37	1.04	
	CV %	2.27			

* Mean of three replications; ** Concentrations (%); # Maximum toxicity index = 200.00; Data are arcsine transformed; values in parentheses are retransformed value.

Table-2. Growth inhibition of *Aspergillus niger* at different concentrations of phyto extracts after seven days of incubation at 28 ± 2° C

Sr. No.	Phyto-extract(plant parts used)	Per cent inhibition*		Mean	Toxicity Index [#]
		5**	10**		
1	Neem (leaves)	36.95 (36.14)	54.76 (66.71)	45.86 (51.42)	91.71
2	Turmeric (rhizome)	40.22 (41.70)	45.02 (50.04)	42.62 (45.87)	85.24
3	Tulsi (leaves)	36.95 (36.14)	41.83 (44.48)	39.39 (40.31)	78.78
4	Onion (bulb)	33.23 (30.03)	41.83 (44.48)	37.53 (37.25)	75.06
5	Garlic (cloves)	33.57 (30.58)	47.57 (54.49)	40.57 (42.53)	81.14
6	Ginger (rhizome)	50.47 (59.49)	59.30 (73.94)	54.89 (66.71)	109.77
7	Spear mint (leaves)	31.10 (26.69)	34.26 (31.69)	32.68 (29.19)	65.36
8	Calotropis (leaves)	32.53 (28.91)	60.77 (76.16)	46.65 (52.54)	93.30
	Mean	36.88 (36.21)	48.17 (55.24)	-	-
		Between phyto extracts	Within phyto extracts (Conc.)	Phyto extracts xConcentration	
	S.Em.+	0.19	0.10	0.27	
	CD at 5 %	0.56	0.28	0.79	
	CV %	1.11			

* Mean of three replications; ** Concentrations (%); # Maximum toxicity index = 200.00; Data are arcsine transformed; values in parentheses are retransformed value.

Similar result was obtained by Narzari *et al.* (2007) who reported complete inhibition of *T. harzianum* by 0.4 per cent consumable and non-consumable garlic extract. While, 0.2 per cent extract of consumable and non-consumable garlic inhibited the green mould by 42.2 and 12.2 per cent, respectively over control. Shah *et al.* (2011) also reported that *Azadirachta indica*, *Allium sativum*, *Juglans regia* were effective in controlling *Trichoderma harzianum* infection on Oyster mushroom under *in vitro* condition.

In the case of *Aspergillus niger*, the highest per cent inhibition was observed in 10% *Calotropis* (76.16%) followed by 10% Ginger (73.94%) (Table 2). There were significant differences in different extracts at both concentration levels. Toxicity index was highest in ginger (109.77) and lowest in spear mint (65.36) based on maximum toxicity index of 200.00. Therefore, it can be concluded that all the botanicals more or less suppressed the growth of *Aspergillus niger*. Similar results were obtained by Biswas *et al.* (2018) who revealed that the best botanical that inhibited *Aspergillus* was ginger (*Zingiber officinale*).

Among the different concentrations tested, significantly highest per cent inhibition was recorded at 10 per cent concentrations of the botanicals. Eventually, it can be concluded that phyto extracts inhibit the growth and sporulation of pathogen.

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