EFFECT OF SIX PLANT EXTRACTS ON THE GROWTH OF OYSTER MUSHROOM (*PLEUROTUS OSTREATUS*) AND SOME ASSOCIATED COMMON WEED MOULDS

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ABSTRACT

One of the constraints in mushroom production is the contamination of spawn media and mushroom beds by competitive weed moulds with resulting yield losses. The effect of addition of crude extracts of several wild plants was evaluated on the growth of *Pleurotus ostreatus* (oyster mushroom) and the moulds *Aspergillus* sp. and *penicillium* sp. on potato dextrose agar medium. Mycelial growth of oyster mushroom was enhanced by the extracts of *Cassia occidentalis*, *Lantana camara* and *Tithonia diversifolia*. *L. camara* significantly suppressed the growth of *Aspergillus* sp. and *Penicillium* sp, Substantial yield increase of oyster mushroom on paper beds was obtained by the addition of *L. camara* extract, even exceeding the yield obtained after steam sterilization of paper beds.

KEY WORDS : *Aspergillus* sp., *Lantana camara*, Oyster mushroom, *Penicillium* sp., *Pleurotus ostreatus*, Weed moulds

INTRODUCTION

Pleurotus ostreatus (Oyster mushroom) is widely cultivated in Sri Lanka at present. One of the main problems faced by the mushroom growers is the contamination of spawn media and mushroom beds by competitive moulds. The contamination by weed moulds leads to incomplete colonization of the growth medium by mushroom mycelium resulting in heavy yield losses. Fungi that frequently contaminate the mushroom beds include *Penicillium*, *Aspergillus*, *Rhizopus* and *Trichoderma* species. The problem of weed moulds becomes more acute when mushroom

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is raised on paper substrate than on straw or sawdust medium. Although steam sterilization of the substrate is often used to reduce contamination, the process is expensive and cumbersome. It is therefore, desirable to find an alternate and cheaper method to control weed moulds in mushroom cultivation.

A study carried out with some wild plant species used in indigenous medicine as antiseptics by Sivakadadcham and Dodanwela (1987) revealed that their extracts exert selective suppressive or stimulatory effects on growth and development of different fungi on agar media. This paper presents the results of a study on the effect of crude extracts of selected wild plants on growth and development of oyster mushroom and some common weed moulds.

MATERIALS AND METHODS

Effect of different plant extracts on growth of mushroom mycelium and weed moulds on potato dextrose agar

Effect of crude plant extracts of *Lantana camara* var *aculeata* (L.) Motdenke. (Family-Verbenaceae), *Cassia occidentalis* (L.) (Family-Leguminosae), *Eupatorium ayapana* vent. (Family-compositae), *Adhatoda vasica* nees. (Family-Acanthaceae), *Tithonia diversifolia* L. (Family-Compositae), and *Ocimum sanctum* L. (Family-Labiatae) on the growth of *Pleurotus ostreatus*, *Penicillium* sp. and *Aspergillus* sp. were tested *in vitro* with five replicates. The plant extracts were obtained by macerating 100g fresh leaves and young stems in 100 ml distilled water in an electric blender at a speed of 21,000 rpm for two minutes. The filtered extracts were added to an equal volume of double strength of potato dextrose agar (PDA). The amended medium was autoclaved at 121°C and 1.09 kg/cm^2 pressure for 15 minutes. Agar pieces from *Pleurotus*, *Penicillum* and *Aspergillus* cultures (2mm square) grown on PDA were transferred to the leaf extract medium in petri-dishes and incubated at 25°C. The test fungi were also on PDA under similar conditions. Colony diameter was measured at 24, 48 and 72 hours after inoculation.

Effect of *L. camara* and *T. diversifolia* plant extracts on growth of oyster mushroom on paper medium

Three concentrations of crude plant extracts of *L. camara* and *T. diversifolia* were obtained by macerating 90, 180 and 270g of young leaves and stems in distilled water using a wooden mortar and pestle.

The extract was made up to one litre with distilled water. One litre of each preparation was added separately to 1 kg of unsteamed paper cuttings in aluminium trays ($38 \times 28 \times 7$ cm^3). In the control treatment the paper cuttings were wetted with water instead of the plant extract.

Each paper bed was inoculated with 20g of spawn from 18 day old wheat grain culture of *P. ostreatus*. During the 21 days of inoculation period the inoculated paper beds were covered with transparent polyethylene sheets. After this period the polyethylene sheets were removed and the beds sprinkled with water twice daily. Three picks of mushroom were taken at 10 to 14 day intervals, the first pick commencing on the 26th day after spawning. Records were kept on the number and fresh weight of mushroom harvested from each bed during each pick.

Nutrient analysis of *L. camara* and *T. diversifolia* leaf extracts was carried out using Kjeldahl method (N), flame photometry (K), spectrophotometry (P) and atomic absorption spectrophotomery (Ca and Mg).

Effect of different concentrations of *L. camara* plant extract on growth of oyster mushroom on paper medium

The treatment consisted of five concentrations of *L. camara* plant extract obtained by macerating 60, 120, 180, 240 and 300g of fresh young leaves and stems in one litre of distilled water, using a wooden mortar and pestle. The crude plant extract was added to unsteamed paper cuttings (1 kg) in aluminium trays ($38 \times 28 \times 7$ cm^3). Two control treatments consisting of 1 kg each of steamed and unsteamed paper cuttings were included. The steamed paper cuttings were treated in the autoclave at 121° C under a pressure of 1.09 kg/cm^2 for 15 minutes. These two treatments received water only. The oyster mushroom was raised in these beds following the same procedures adopted in the previous experiment.

RESULTS AND DISCUSSION

The results of the first experiment confirm earlier findings (Sivakadadcham and Dodanwela, 1987) that different plant extracts could selectively suppress or enhance mycelial growth of different fungi on agar media. Mycelial growth of oyster mushroom on agar medium

was enhanced by the incorporation of leaf extracts of *C. occidentalis*, *T. diversifolia* as well as *L. camara* but reduced by *A. vasica*, *E. ayapana* and *O. sanctum* (Table 1). Leaf extracts of *C. occidentalis* enhanced the growth of *Penicillium* sp. and *Aspergillus* sp. *T. diversifolia* slightly enhanced the growth of *Penicillium* sp. but did not have any significant effect on the growth of *Aspergillus* sp. *L. camara* significantly suppressed the growth of common competitive weed moulds, *Penicillium* sp. and *Aspergillus* sp. on agar (Tables 2 and 3).

A. vasica, *E. ayapana* and *O. sanctum* were not selected for subsequent studies as these plant species suppressed the growth of oyster mushroom on agar medium. *C. occidentalis* was also omitted as the autoclaved extract of the plant stimulated the growth of weed moulds. *L. camara* and *T. diversifolia* were therefore selected for further tests.

The extracts of *L. camara* and *T. diversifolia* increased the yield of mushroom when incorporated into paper beds. However, the yield of mushroom obtained from paper beds treated with *L. camara* was much higher than with *T. diversifolia* (Table 4). Contamination by weed moulds was evident in beds treated with *T. diversifolia* extract while there was no visible weed mould contamination in beds treated with *L. camara* extract.

Increase in yield obtained by the addition of fresh extracts of *T. diversifolia* and *L. camara* could be attributed to additional nutrients supplied to the mushroom beds. However, this does not explain the higher yields obtained with *L. camara* compared with *T. diversifolia* as the nutrient content (N, P, K, Ca and Mg) of *L. camara* was found to be lower than that of *T. diversifolia* (Table 5).

The yields obtained with incorporation of *L. camara* plant extract to unsteamed paper beds were much higher than those obtained from unamended steamed paper (Table 6). Increasing the concentration of *L. camara* extract from 60 to 180 g/l resulted in an increased yield of mushroom. Any further increase in concentration of the extract however, failed to produce any beneficial effect on the yield. It was also observed during this experiment that there was a suppression of weed moulds in *L. camara* treated beds while steaming failed to prevent contamination by weed moulds.

The ability of *L. camara* to suppress weed moulds while stimulating the growth of oyster mycelium was clearly demonstrated in agar culture studies. *L. camara* was the only plant among those tested which had the ability to suppress weed moulds while enhancing the growth of mushroom mycelium (Fig. 1). The substantial increase in mushroom yields with *L. camara* could therefore be attributed to this selective action.

L. camara (Family-Verbenaceae) is a native of West Indies and introduced to Sri Lanka in about 1826 as an ornamental plant. It has become one of the most widespread weeds in this country. It is most commonly found in the semi-dry districts to altitude up to 1500 m (Dassanayaka and Fosberg, 1983). *L. camara* Var. *aculeata*, the plant used in our experiment can be distinguished from other common species by the presence of stout and curved prickles (Plate 1).

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Table 1. Effect of crude plant extracts on the growth of *P. ostreatus* (oyster mushroom) on agar medium

Plant extract	*Colony diameter (cm)*		
	24 h	*48 h*	*72 h*
Potato dextrose agar	1.15	1.39	2.01
Adhatoda vasica	1.13	1.33	1.53
Eupatorium ayapana	1.26	1.53	1.63
Ocimum sanctum	0.90	0.82	0.92
Cassia occidentalis	1.33	1.76	3.10
Tithonia diversifolia	1.58	2.16	3.30
Lantana camara	1.84	2.30	3.19
LSD (P=0.01)	0.18	0.31	0.31
CV (%)	7.7	10.3	6.9

Table 2. Effect of crude plant extracts on growth of *Penicillium* sp. on agar medium

Plant extract	*Colony diameter (cm)*		
	24 h	*48 h*	*72 h*
Potato dextrose agar	0.76	1.48	1.65
Ocimum sanctum	0.97	2.24	2.46
Cassia occidentalis	0.86	1.97	2.20
Tithonia diversifolia	0.74	1.41	1.81
Lantana camara	0.20	0.83	1.17
LSD (P=0.01)	0.13	0.22	0.15
CV (%)	11.0	7.7	4.5

Table 3. Effect of crude plant extracts on the growth of *Aspergillus* sp. on agar medium

Plant extract	*Colony diameter (cm)*		
	24 h	*48 h*	*72 h*
Potato dextrose agar	0.95	1.43	1.80
Ocimum sanctum	0.55	0.81	1.84
Cassia occidentalis	1.41	2.12	2.80
Tithonia diversifolia	0.87	1.57	1.88
Lantana camara	0.40	0.73	1.40
LSD (P=0.01)	0.50	0.22	0.19
CV (%)	13.3	9.2	5.5

Table 4. Effect of different concentrations of *L. camara* and *T. diversifolia* plant extracts on the yield of oyster mushroom

Concentration (g / l)	*L. camara*		*T. diversifolia*	
	Number of fruit bodies (No./kg paper)	*Fresh wt. of mushroom (g/kg paper)*	*Number of fruit bodies (No./kg paper)*	*Fresh wt. of mushroom (g/kg paper)*
0 (water)	48	135.2	48	135.2
90	68	637.6	45	458.4
180	92	946.8	46	248.0
270	147	653.2	53	281.2
LSD (P=.001)	11	96.1	11	96.1
CV (%)	23.8	19.9	23.8	19.9

Table 5. Chemical analysis of *L. camara* and *T. diversifalia* plant extract

Nutrient	*T. diversifolia* (*mg / l*)	*L. camara* (*mg / l*)
N	3100	1840
P	150	50
K	7000	6500
Ca	230	180
Mg	1050	760

Tadle 6. Effect of different concentrations of *L. camara* plant on the yield of oyster mushroom

Treatment	*Number of fruit bodies* (*No./kg paper*)	*Mushroom fresh wt.* (*g/kg paper*)
Control I (unsteamed paper)	25	47
Control II (steamed paper)	40	167
L. camara, 60g / l	44	410
L. camara, 120g / l	54	442
L. camara, 180g / l	103	873
L. camara, 240g / l	104	889
L. camara, 300g / l	124	827
LSD (P = 0.01)	45	278
CV (%)	34.0	28.1

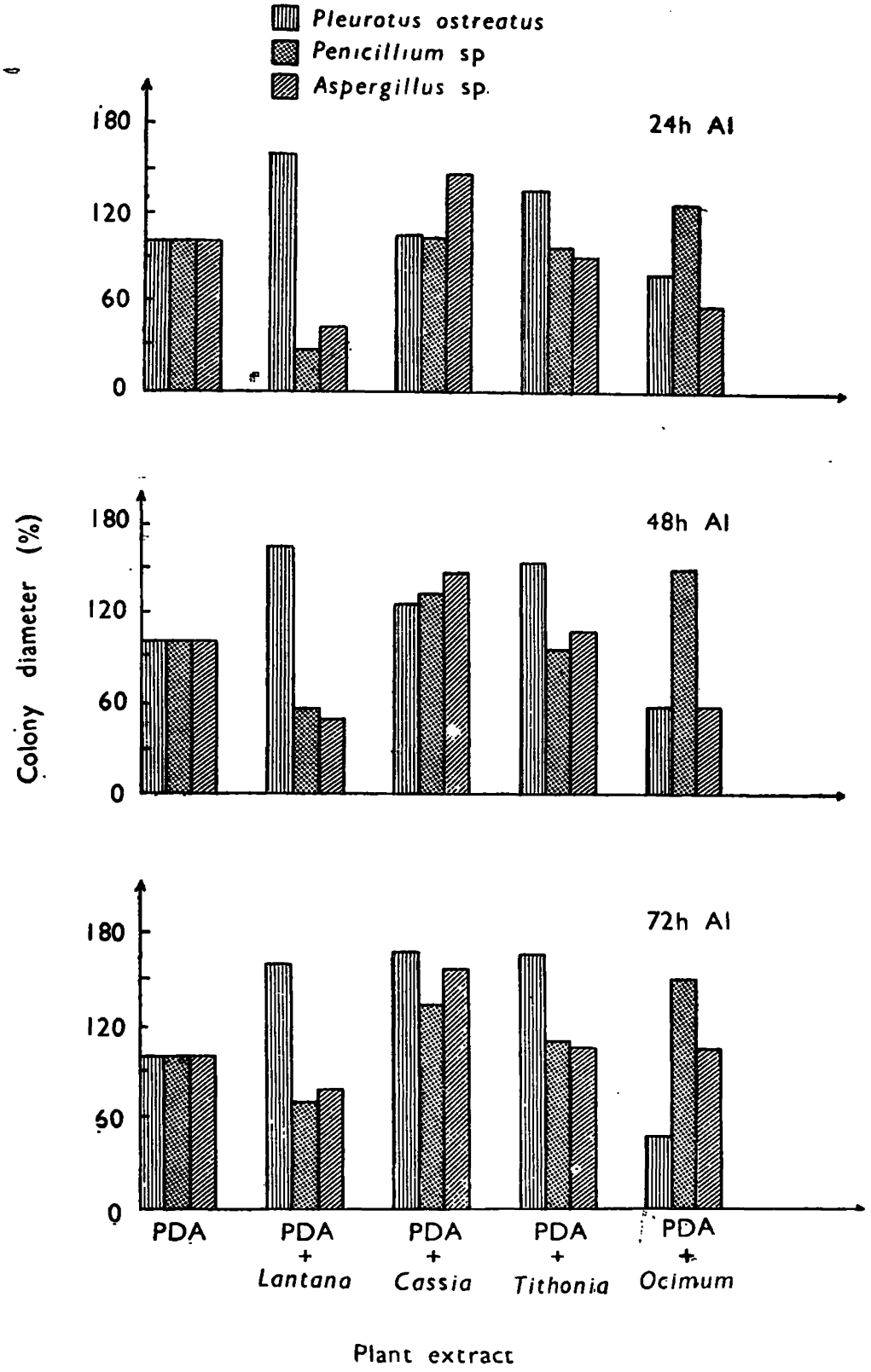

Fig. 1. Growth of *Pleurotus ostreatus*, *Penicillum* sp. and *Aspergillus* sp. on potato dextrose agar (PDA) amended with plant extracts in comparison with that on unamended PDA. AI=after inoculation.

Plate 1. *Lantana Camara* **var.** *aculeata*