

Effect of water diluted extract of plants and cakes on weight, whiteness and toughness of harvested button mushroom

S.K. Mishra and R.P. Singh

Department of Plant Pathology, G.B. Pant University of Agriculture and Technology, Pantnagar- 263145 (Uttaranchal) India. E-mail: sarvesh22230@rediffmail.com

Abstract

The effect of water diluted extract of 23 plants and 2 cakes was observed on weight, whiteness and toughness of harvested sporophores of button mushroom at 5 and 25 °C. The weight of harvested sporophores increased by 6.66 % just after washing them with water diluted extract of plants and cakes. At the end of experiment (12th day) the weight declined from 1.87 to 4.38 % among the treatments at 5 °C. However, spoiling of sporophores started from 4th day onwards at 25 °C. The sporophores treated with water-diluted extract of linseed cake retained whiteness to the acceptable extent in comparison to moderate whiteness observed with treatment of KMS and EDTA by 12th day. The water diluted extract of *Aegle marmelos*, *Callistemon lanceolatus*, *Parthenium hysterophorus*, linseed cake, EDTA and KMS performed very good on 5 point hedonic scale to maintain toughness.

Key words: Water diluted extracts, button mushroom, weight, whiteness and toughness

Introduction

Button mushroom is continuously possessing a great importance among the people of Tarai region of Uttaranchal and Uttar Pradesh due to its specific colour, texture, toughness, flavour aroma, nutritional and medicinal values. But the fleshy and succulent nature of mushroom makes it very perishable and limit their scope in marketing and consumption. To improve quality of harvested mushroom, several soaking treatments with reducing agents like oxine (Bartley *et al.*, 1991), sodium sulphite (Guthrie and Beelman, 1989), potassium metabisulphite (Saxena and Rai, 1988), sodium erythorbate and calcium chloride (Rai *et al.*, 2003) have been thoroughly investigated. Some of them are very effective and adopted by small and marginal mushroom growers of North India. However, they are costly and harmful and sometimes degrade nutritive quality of harvested mushroom (Gothandapani *et al.*, 1997). Therefore, to avoid the use of chemicals, water diluted extracts of plants and cakes were tested for their use as washing agents in improving the weight, whiteness and toughness of harvested sporophores.

Materials and Methods

The dry powder of *Achyranthes aspera*, *Aegle marmelos*, *Argemone mexicana*, *Azadirachta indica*, *Callistemon lanceolatus*, *Calotropis gigantea*, *Cannabis sativa*, *Chrysanthemum indica*, *Citrus aurantifolia*, *Cleome viscosa*, *Clerodendrum indicum*, *Dahlia pinnata*, *Datura stramonium*, *Dombeya spectabilis*, *Erigeron canadensis*, *Eucalyptus citriodora*, *Evolvulus alsinoidis*, *Juniperus chinensis*, *Lantana camara*, *Parthenium hysterophorus*, *Pedilanthus tithymaloides*, *Thuja orientalis*, *Tridax procumbens* and cakes of linseed and mustard was prepared using electric grinder. The prepared powder was extracted in sterilized distilled water to obtain water dissolved extracts. The solution of 1:8 w/v was prepared and

kept for 12 hrs. After that it was passed through muslin cloth and then filtered through Whatman No.1 filter paper. The aqueous solution of water dissolved plant and cake extracts of 5 per cent concentration was prepared separately and sporophores of *A. bisporus* (150g) were washed thoroughly using 500 ml of aqueous solution and packed in unperforated polypropylene bags of 200 gauge thickness after drying the surface moisture. Then the bags were kept in refrigerator and room temperature at $5 \pm 1^\circ\text{C}$ and $25 \pm 1^\circ\text{C}$, respectively to find out the effect of aqueous extracts on weight, whiteness and toughness of harvested sporophores using sensory evaluation of 5 point hedonic scale, which is as follows:

Whiteness	Toughness	Point
Excellent	Excellent	5
Very good (Acceptable)	Very good (Acceptable)	4
Moderate	Moderate	3
Poor	Loose	2
Very poor	Very loose	1

Results and discussion

Weight of sporophores: The effect of 23 water diluted plant extracts (WDPEs) and 2 water diluted cake extracts (WDCEs) on weight, whiteness and toughness of sporophores at 5 percent concentration has been presented (Table 1). During the experiment it was observed that weight of sporophores increased by 10 g just after dipping in the solutions of all WDPEs. However, at 25 °C the weight fluctuated from 1-3g in majority of the treatments from 4th day onwards. At the same temperature, maximum 7g weight reduction of the sporophores was recorded with check (water) followed by 4g weight reduction observed with KMS treatment at the end of the experiment. The putrefaction of treated sporophores was noticed in case of 13 treatments on 4th day at 25 °C and remaining 15 on 8th day. In contrast, the treatments kept in

Table 1. Effect of water diluted plant and cake extracts on weight, whiteness and toughness of harvested sporophores of *Agaricus bisporus*

Treatment	Temperature (°C)	Weight (g)				Whiteness				Toughness			
		1#	4	8	12	1	4	8	12	1	4	8	12
<i>Achyranthes aspera</i>	25	160	160	*	*	5	4	*	*	5	3	*	*
	5	160	160	160	160	5	4	1	1	5	4	2	1
<i>Aegle marmelos</i>	25	160	160	*	*	5	4	*	*	5	1	*	*
	5	160	161	160	160	5	4	1	1	5	4	4	4
<i>Argemone mexicana</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	160	160	5	4	4	3	5	4	2	1
<i>Azadirachta indica</i> (leaf)	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	161	*	*	5	4	*	*	5	4	*	*
<i>Callistemon lanceolatus</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	159	159	5	4	4	2	5	4	4	4
<i>Calotropis gigantea</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	158	158	158	5	4	4	2	5	4	4	3
<i>Cannabis sativa</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	159	159	5	4	1	1	5	4	2	2
<i>Chrysanthemum indicum</i>	25	160	160	*	*	5	2	*	*	5	2	*	*
	5	160	160	158	158	5	4	1	1	5	4	2	1
<i>Citrus aurantifolia</i>	25	160	161	*	*	5	2	*	*	5	2	*	*
	5	160	160	159	159	5	4	2	2	5	4	4	3
<i>Cleome viscosa</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	158	157	5	4	2	1	5	4	4	2
<i>Clerodendrum indicum</i>	25	160	160	*	*	5	3	*	*	5	3	*	*
	5	160	159	159	159	5	3	3	2	5	4	4	3
<i>Dahlia pinnata</i>	25	160	160	*	*	5	2	*	*	5	1	*	*
	5	160	160	160	159	5	3	3	2	5	4	4	3
<i>Datura stramonium</i>	25	160	160	*	*	5	3	*	*	5	3	*	*
	5	160	159	160	*	5	4	3	*	5	4	3	*
<i>Dombeya spectabilis</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	160	157	5	4	4	2	5	4	4	3
<i>Erigeron canadensis</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	162	162	160	157	5	3	1	1	5	3	2	1
<i>Eucalyptus citriodora</i>	25	162	162	*	*	5	2	*	*	5	3	*	*
	5	160	160	160	158	5	2	1	1	5	4	4	3
<i>Evolvulus alsinoides</i>	25	160	160	*	*	5	2	*	*	5	3	*	*
	5	160	159	158	157	5	3	1	1	5	4	2	1
<i>Juniperus chinensis</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	158	158	5	3	1	1	5	4	2	1
<i>Lantana camara</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	159	159	159	5	4	3	1	5	4	2	1
<i>Parthenium hysterophorus</i>	25	160	160	*	*	5	3	*	*	5	3	*	*
	5	160	160	159	159	5	4	4	3	5	4	4	4
<i>Pedilanthus tithymaloides</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	159	159	5	4	4	2	5	4	4	3
<i>Thuja orientalis</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	160	159	159	5	3	2	1	5	4	2	1
<i>Tridax procumbens</i>	25	160	*	*	*	5	*	*	*	5	*	*	*
	5	160	159	159	157	5	4	3	2	5	4	4	3
Linseed cake	25	160	161	*	*	5	2	*	*	5	3	*	*
	5	160	161	160	157	5	4	4	4	5	4	4	4
Mustard cake	25	160	160	*	*	5	3	*	*	5	3	*	*
	5	160	163	160	158	5	4	4	3	5	4	4	3
EDTA	25	160	160	*	*	5	2	*	*	5	2	*	*
	5	161	160	159	158	5	4	3	3	5	4	4	4
KMS	25	160	160	*	*	5	2	*	*	5	1	*	*
	5	160	158	158	156	5	4	4	3	5	4	4	4
Water	25	160	159	*	*	5	2	*	*	5	2	*	*
	5	160	160	159	153	5	2	2	1	5	4	3	1
Unwashed sporophores	-	150	-	-	-	5	-	-	-	5	-	-	-

* Indicate discarded putrefied sporophores. # day

refrigerator at 5 °C remain unputrefied upto 12th day except the sporophores treated with WDE of *Azadirachta indica* and *Datura stramonium* which putrefied on 8th day and 12th day, respectively. All putrefied samples were discarded and not considered for further observations.

During present investigation weight of washed sporophores was increased by 6.66 per cent due to quick adsorption process. At higher temperature (25 °C), washed mushroom got spoiled quickly than the mushroom kept at lower temperature (5 °C). Deterioration in quality of mushrooms at higher temperature has been recorded by Popa *et al.* (1999). However, at lower temperature the weight loss of sporophores observed from 1.87- 4.38 % might be due to slow rate of evaporation or metabolic activities (Rai *et al.*, 2003).

Whiteness of sporophores: Sporophores were excellent in terms of whiteness in all the treatments of WDPEs at 1st day (scoring 5 out of 5), which was slightly more than the natural white colour of sporophores. On 4th day at 25°C, WDE of *Achyranthes aspera* and *Aegle marmelos* were superior over other treatments and ascertained the acceptable category of whiteness of sporophores. While, in refrigerator at 5°C on 4th day, the effect of treatments was marked 4 for 20 treatments (*Achyranthes aspera*, *Aegle marmelos*, *Argemone mexicana*, *Azadirachta indica*, *Callistemon lanceolatus*, *Calotropis gigantea*, *Cannabis sativa*, *Chrysanthemum indicum*, *Citrus aurantifolia*, *Cleome viscosa*, *Datura stramonium*, *Dombeya spectabilis*, *Lantana camara*, *Parthenium hysterophorus*, *Pedilanthus tithymaloides*, *Tridax procumbens*, linseed cake, mustard cake, EDTA and KMS) as they resulted very good whiteness of harvested sporophores. These 20 treatments when further evaluated on 8th day, 9 WDE of *Argemone mexicana*, *Callistemon lanceolatus*, *Calotropis gigantea*, *Dombeya spectabilis*, *Parthenium hysterophorus*, *Pedilanthus tithymaloides*, linseed cake, mustard cake and KMS were marked as 4 (acceptable whiteness). Other treatments marked as 3 (6 in numbers), 2 (4 in numbers) and 1 (1 in number) did not show acceptable whiteness of sporophores. Finally, on 12th day at 5°C among 9 selected treatments of 4 score; only linseed cake treated sporophores retained the whiteness to the acceptable extent. It seems that the water diluted extract of linseed cake had antibrowning and antioxidant components, which inhibited the production and activity of tyrosinase enzyme, a major cause of browning in sporophores. The presence of natural antibrowning and antioxidant components in honey (Martyniuk, 1994), plant extracts (Sang *et al.*, 1997), saffron flower (Kubo and Kinst, 1999), garlic (Kubo *et al.*, 2000), onion (Lee and Park, 2001) and spices, turmeric, cumin, black pepper, pipal (Mukherjee *et al.*, 2001) have been widely investigated and stood in the support of present finding.

Toughness of sporophores: The toughness of freshly harvested sporophores before and just after the different treatments of WDPEs scored 5 (excellent). Out of the 15 unputrefied treatments evaluated on 4th day at room temperature (25°C). Eight treatments scored 3 (moderate) and remaining were reduced to score 1 (very loose). All the 28 WDPEs treated sporophores scored 4 (very good) in terms of toughness when kept at 5°C except *Erigeron canadensis* treated sporophores wherein toughness was a little

less and recorded as 3 on 4th day. On 8th day, out of 28 treatments, 16 were very good (scored 4) except *Datura stramonium* and water in which toughness marked a bit lower as 3. The remaining treatments were not found upto the mark in terms of toughness. On 12th day, 6 WDE of *Aegle marmelos*, *Callistemon lanceolatus*, *Parthenium hysterophorus*, linseed cake, EDTA and KMS were found to be very effective in maintaining the toughness to the level of score 4. Probably the lower temperature strengthened the texture and cell wall composition. The toughness increased significantly after treating the harvested sporophores with calcium chloride (Zivanovic and Buesher, 2004).

The results indicate that the water diluted extract of linseed cake had favourable effect on the retention of whiteness to the acceptable extent in comparison with moderate whiteness observed with KMS and EDTA treatment on 12th day. The water diluted extract of *Aegle marmelos*, *Callistemon lanceolatus*, *Parthenium hysterophorus*, linseed cake, EDTA and KMS helps in maintaining toughness of button mushroom.

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