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Research Article

Qualitative Losses in Nutritional Contents of *Pleurotus sajor-caju* (Oyster mushroom) in both Compost and Fruiting Body by *Tyrophagus putrescentiae* (Acari: Acaridae) at different Infestation Levels

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Abstract

In the present study, the total sugar content was 0.710 mg/g compost in control which significantly decreased to 0.615, 0.432 and 0.340 mg/g compost at 10, 20 and 30 *T. putrescentiae* pairs release. The reducing sugar content was 0.159 mg/g compost in control which significantly decreased 0.116 mg/g compost at 30 *T. putrescentiae* pairs release. The starch content was 0.028 mg/g compost in control which changes 0.018 mg/g compost at 30 *T. putrescentiae* pairs release. The crude protein content of compost was 0.760 mg/g compost in control which significantly decreased to 0.418, 0.360 and 0.220 mg/g compost at 10, 20 and 30 *T. putrescentiae* pairs release. Significant reduction in total sugar, reducing sugar, non reducing sugar, starch, protein content of fruiting bodies was recorded. It was 0.134, 0.055, 0.070, 0.010, 0.279 mg/10g fruiting body at 30 mite pairs as compared to 0.162, 0.075, 0.099, 0.029, 0.741mg/10g fruiting body in control.

Keywords: Compost, Fruiting body, *Pleurotus sajor-caju, Tyrophagus putrescentiae*

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Introduction

Oyster mushrooms are a diverse group of saprotrophic fungi belonging to the genus *Pleurotus.*China, which occupies a leading position in mushroom production and consumption uses many species as medicinal mushrooms [1]. In India, it is the third largest commercially important mushroom species and its seasonal production is 15-20,000 tonnes/annum [2]. Haryana is the leading state in seasonal mushroom production contributing approximately 4000 tonnes per year [3]. Despite their nutritional and medicinal values, these are attacked by number of diseases, pests, microbial infections and viruses that might infest the fungal substrate, the mycelium and the fruiting bodies growing on the substrate. Mushroom farms are generally infested by sciarid (*Lycoriella mali*), phorid (*Megaselia halterata*) and cecid (*Mycophila speyeri*, *Heteropeza pygmaea*) flies. The larvae of sciarid flies attack compost, spawn, mycelium, and pinhead formation. Three mycophagous nematode species, namely *Aphelenchoides composticola*, *Aphelenchus avenae* and *Ditylenchus myceliophagus* along with some saprophagous (*Rhabditis* sp.) and predatory (*Seinura* sp.) nematodes were found in compost samples of white button mushroom (*Agaricus* spp.) and oyster mushroom (*Pleurotus* spp.). The saprophagous nematodes (*Rhabditis* sp.) were recorded as the predominant species with 100 percent frequency of occurrence in oyster mushroom [4]. Several types of mite species had been found associated with mushrooms, out of which *Histiogaster* sp., *Histiostoma* sp., *Tarsonemus myceliophagus Tyrophagus lantneri*, *Uroobovella* sp., *Tarsonemus dimidatus, Tarsonemus dimidatus* and *Caloglyphus mycophagus* are of frequent occurrence [5].

Material and Methods

Stock culture of *T. putrescentiae* was maintained in laboratory at 27±1^{0}C and 80-85 percent relative humidity in Department of Zoology, CCS Haryana Agricultural University, Hisar. Oyster mushroom (*Pleurotus sajor caju*) was cultivated on wheat straw in the Department of Plant Pathology, CCS Haryana Agricultural University, Hisar, India. The fruit bodies of *Pleurotus sajor caju* were harvested in the month of November, 2016.

Experimental Set up

Compost was divided into three treatments (10, 20 and 30 *T. putrescentiae* pairs/10g compost) with three sets of different durations viz. 10, 20 and 30 days. Estimation of biochemical parameter from 0 pair (uninfested compost/fruiting body) acted as corresponding control in different sets. At each duration, one set was taken and mites were separated from the compost for estimation of biochemical parameters *viz*., protein, total soluble sugars, reducing sugars, non reducing sugars and starch were carried out following standard procedures. Similar experiment was counducted for fruiting bodies of *Pluerotus sajor caju.*

Chemical Analysis

Quantitative determination of total soluble sugars was carried out according to a colorimetric method [6]. Reducing sugars were estimated by Somogyi's modified method [7]. Non-reducing sugars were determined by calculating the difference between total soluble sugars and reducing sugars samples were drawn from replicates to estimate the protein content by Microkjeldahl method [8]. Starch was estimated by the method of Clegg [9].

Percent losses in compost/fruiting body were calculated with the help of following formulae:

$$\text{Percent loss in protein/ carbohydrate content} = \frac{\text{P/ C in Control - P/ C in treatment}}{\text{Protein/ Carbohydrate in Control}} \times 100$$

P = Protein; C = Carbohydrate

Statistical Analysis

The reported data are the mean of triplicates and was subjected to ANOVA to analyze the significant differences using software 'OPSTAT', developed at the Computer Center, College of Basic Sciences and Humanities, CCS Haryana Agricultural University, Hisar.

Results and Discussion

The total sugar exhibited a significant marked decrease when subjected to different *T. putrescentiae* infestation levels on compost (CD = 0.001; p = 0.05) (**Table 1**). It was 0.710 mg/g compost in control which significantly decreased to 0.615, 0.432 and 0.340 mg/g compost at 10, 20 and 30 *T. putrescentiae* pairs release. The trend similar as witnessed with total sugar was observed with reducing sugar.

Table1 Effect of *Tyrophagus putrescentiae* infestation on nutritional composition of *Pleurotus sajor caju* compost

Treatments	Total Sugar (mg/ 10g)	Reducing Sugar (mg/ 10g)	Non-Reducing Sugar (mg/ 10g)	Starch (mg/ 10g)	Protein (mg/ 10g)
Control/10g compost	0.710	0.159	0.082[a]	0.028	0.760
10Pairs/10g compost	0.615	0.141	0.081[a]	0.024	0.418
20Pairs/10g compost	0.432	0.124	0.081[a]	0.021	0.360
30Pairs/10g compost	0.340	0.116	0.078	0.018	0.220
SE(m)	0.001	0.001	0.001	0.001	0.000
CD(p=0.005)	0.002	0.004	0.003	0.003	0.001

Values with the same superscript do not differ significantly

The protein exhibited a significant marked decrease when subjected to different *T. putrescentiae* infestation levels on compost (CD = 0.001; p = 0.05) (Table 1). It was 0.760 mg/g compost in control which significantly decreased to 0.418, 0.360 and 0.220 mg/g compost at 10, 20 and 30 *T. putrescentiae* pairs release.

Table 2 Relative percent losses in biochemical composition of *Pleurotus sajor caju* compost

Treatments	**Percent loss in Biochemical composition of compost**				
	Total sugar	**Reducing sugar**	**Non Reducing sugar**	**Protein**	**Starch**
10Pairs/10gcompost	13.3 %	11.3 %	1.21%	45.0 %	14.2 %
20Pairs/10gcompost	39.1 %	22.0 %	2.00 %	52.7 %	25.0 %
30Pairs/10gcompost	52.1 %	27.0 %	4.07 %	71.0 %	35.7 %

Graphical representation of biochemical parameters of compost as influenced by various levels of *T. putrescentiae* infestation revealed that with increase in infestation level from 10 pairs to 20 and 30 pairs, corresponding decrease in total sugar (13.3 to 52.1%), reducing sugar (11.3 to 27%) and protein (45 to 71%) was observed.

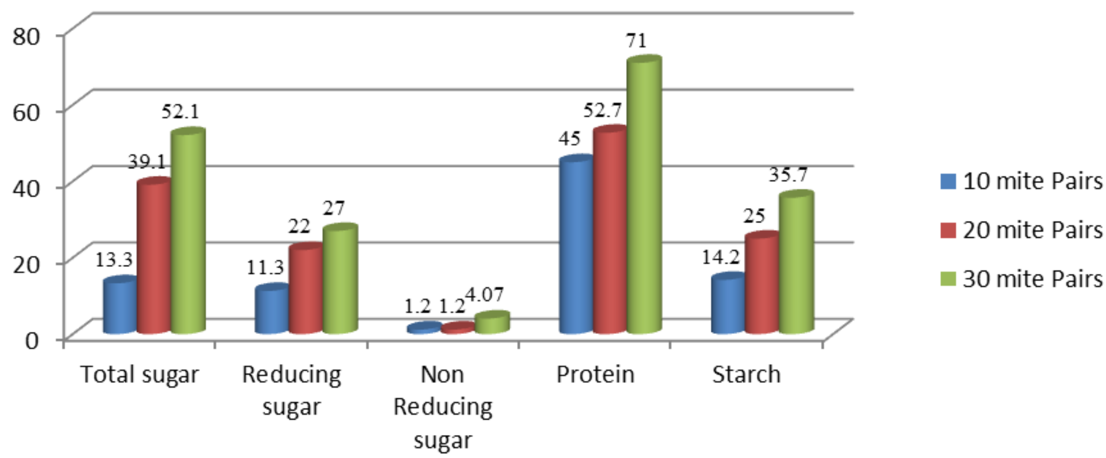

Figure 1 Biochemical parameters of compost as influenced by *T. putrescentiae* infestation

Table 3 Effect of *Tyrophagus putrescentiae* infestation on different biochemical parameters of *Pluerotus sajor-caju* fruiting body

Treatments	**Protein (mg/ 10g)**	**Total Sugar (mg/ 10g)**	**Reducing Sugar (mg/ 10g)**	**Non-Reducing Sugar (mg/ 10g)**	**Starch (mg/ 10g)**
Control/10gFruiting body	0.741±0.00	0.162±0.00	0.078±0.00	0.099±0.00	0.029±0.00
10Pairs/10gFruiting body	0.415±0.00	0.149±0.00	0.063±0.00	0.086±0.00	0.020[a]±0.00
20Pairs/10gFruiting body	0.333±0.00	0.140±0.00	0.054[a] ±0.00	0.078±0.00	0.018[a] ±0.00
30Pairs/10g Fruiting body	0.279±0.00	0.134±0.00	0.055[a] ±0.00	0.070±0.00	0.010±0.00
SE(m)	0.003	0.001	0.001	0.001	0.001
CD(p=0.005)	0.001	0.002	0.002	0.003	0.002

Values with the same superscript do not differ significantly

The comparison of total soluble sugars at different initial inoculums revealed a significant decrease at each level (CD= 0.002; p= 0.05). It was 0.149, 0.140 and 0.134 mites as compared to 0.162 mites in control. Reducing sugars also exhibited a significant decreased. The latter two infestation levels (20, 30 mite pairs) was statistically at par with each other. The non reducing sugar content was significantly higher (0.099 mg/10g fruiting body) in uninfested fruiting body of *Pluerotus sajor caju* as compard to 0.086 and 0.078 mg/10g fruiting body Similarly, starch content at 10 and 20 mite pairs as initial inoculums do not differed significantly with each other. On dry weight basis, mushrooms normally contain 19 to 35% proteins where as fat content is very low as compared to carbohydrates and proteins [10]. It has been earlier reported that *T. putrescentiae* prefers commodities with high-fat and protein contents [11]. The ability of a high protein, high fat combination to boost the reproduction of *T. putrescentiae* was shown by the increased growth of the nutritionally adapted populations of *T. putrescentiae*. Sarwar *et al.* (2010) mentioned that the assessment of macronutrients in soybean, maize, and wheat flours showed that wheat had more carbohydrate and ash but reduced protein and fat contents and merits as leading compound in supporting higher *T. putrescentiae* populations [12] Wahid reported higher percentage of non-reducing sugars in *Pleurotus sajor caju* and *Agaricus* *bisporus*. Variations in sugars content of mushroom might be due to variation in substrate and agroclimatic conditions [13]. Maximum amount of Zn was found (0.017g/100g) in all three mushroom species; *P. sajor-caju*, *P. ostreatus* (white strain) and *P. ostreatus* (grey strain) mushroom cultivated on wheat straw [14].

Conclusion

The present research evaluates the percent loss in total sugar, reducing sugar, non reducing sugar, starch, protein content of compost was in the range of 13.3 to 52.1%, 11.3 to 27%, 1.2 to 4.07%, 14.2 to 35.7%, 45 to 71%, respectively. Significant reduction in total sugar, reducing sugar, non reducing sugar, starch, protein content of fruiting bodies was recorded. It was 0.134, 0.055, 0.070, 0.010, 0.279 mg/10g fruiting body at 30 mite pairs as compared to 0.162, 0.075, 0.099, 0.029, 0.741mg/10g fruiting body in control.

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