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IMPACT OF UV RADIATION SENSITIVITY ON DERMATOPHYTES (*Microsporum boullardii*)

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An experiment has been conducted to measure the impact of UV radiation sensitivity on dermatophytes *(Microsporum boullardii)* by different UV radiation exposure time interval (1 min, 2 min 5 min, 10 min and 20 min) in degradation of keratin (Feather) in growth promoting substances of protein, cysteine, cystine and methionine from 7 to 28 days of incubation period. Mutant strain caused maximum weight loss with 1 minutes of UV radiation exposure at 21 day and mutant strain became immune in sensitivity at 14 days for decomposition of feathers . Maximum protein caused at 21st days with 20 minutes U.V radiation exposure and immune sensitivity had deducted with other UV radiation exposure time. On 28 days, mutant strains became immune with all exposure times, Whereas maximum methionine caused at 21st days with 20 minutes UV radiation exposure. Maximum cysteine caused at 14th day with 5 minutes UV radiation exposure and mutant strain showed immune response at all time periods. Cystine production was also followed by cysteine at 21 day and also showed complete immune response with 1 and 2 minutes UV radiation exposure at 7 and 14 days. Thus mutant strain of *Microsporum boullardii* can be used as a biotechnological tool for production of growth promoting substances.

Key Words: Sensitivity, UV radiation and *Microsporum boullardii*

INTRODUCTION

Waste material Keratin is undegradable and is attacked by a specific group of Bacteria (Nocardia, Streptomyces and Actinomycetes) and fungi (*Chrysosporium, Trichophyton and Microsporum* etc.) and utilize as a source of nutrition as Scleroprotein, Keratin is characterized by high sulphur containing amino acids mainly Cystine and Cysteine etc.(Shrivastava et al 1996) These microbes are able to decompose Keratinous substances and are digested by keratinolytic system which includes active alkalization of substances extracellular. Sulphitolysis of disulphide bonds and proteolysis. In biodegradation of keratin (feather) have studied by various workers (Ghawana 1997; Kunert, 1992; 1995; Kushwaha and Agrawal 1981; Malviya et al 1992; Govil et al 2001; Nigam and Kushwaha 1993; Rajak et al 1991; Ziegler and Bohme 1963) without exposure of ultraviolet radiation. Unfortunately degradation of keratin into amino acid cysteine, Cystine, Methionine was slow growing process with moderate spore formation and therefore these are nonsignificant for commercial utilization of immune strain, further immune nature of *Microsporum boullardii* was attempted by physical mutagenesis. The result in a Mutant strain *Microsporum boullardii* having significant production of growth promoting substances. No report is available regarding the sensitivity of UV radiation on Keratinophyles except Actinomycetes for the production of Antibiotics (Galentenko and Terkhova, 1990) and Gluconic acids. Production by mutant strain of Aspergillus niger (Singh et al 2001). Therefore present study has been undertaken to know the impact of UV radiation sensitivity on dermatophyte (*Microsporum boullardii*).

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MATERIALS AND METHODS

Microorganism *Microsporum boullardii* DEI S 4 mutant derived from wild type strains *Microsporum boullardii* DEI S 3 after exposing at different time periods of UV irradiation was used in present study. The strain was maintained on Sabouraud's dextrose agar (SDA) slant by periodical transfer in separate condition. Culture condition and fermentation medium *Microsporum boullardii* DEI S 2 grown in petriplate containing SDA medium for 7days spores were aseptically harvested with 100 ml of sterile distilled water spore concentration in suspension was determined by dilution plating fermentation was carried out by dilution plating. Fermentation was carried out by inoculating 2.0 ml of well dispersed spore suspension containing 2x1 spores in 50ml of fermentation medium containing salt solution (g/l).K_2HPO_4 – 1.5g, $MgSO_4.7H_2O$ – 0.025g ,$CaCl_2$ – 0.025g, $FeSO_4$ – 0.015g,
$ZnSO_4$ – 0.005g. Fermentation was carried out in batches in an incubators at 28°C for weekly interval for 28days.

ANALYTICAL METHODS

Aliquots were removed from all the flash on 7 day interval at 28 days of incubation. Mycelium and substrate removed through preweighed Whatman's filter paper no 42. The culture filterate was centrifuged at 3000 rpm for 5min and supernatant was tested to following biochemical test.

A- Determination of weight loss : Dry mass of culture was determined by drying the mycelia at 90°C till the constant weight was observed.

B- Determination of Extracellular Protein: Protein was estimated according to the method of Lowery et al (1951).

C- Estimation of Methionine: The estimation of Methionine was done by Mc Carthy Sullivan's method Singh (1994).

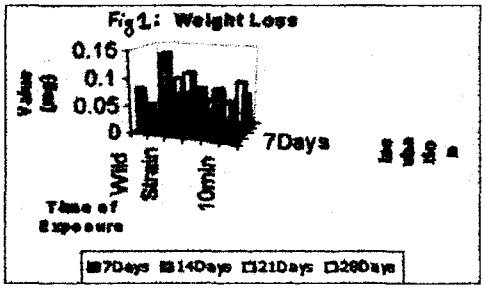
D- Estimation of Cystine and Cysteine: Determination of soluble Sulphohydryl compounds as cysteine (- SH) and disulphide as cystine was done by Ram krishna et al (1979) and Singh (1994) method.

RESULTS AND DISCUSSION

Impact of different time periods of UV radiation were tested on *M.boulluardii* as immune and non immune behaviour for production of proteine , weight loss , Methionine, Cysteine and Cystine.

Weight loss

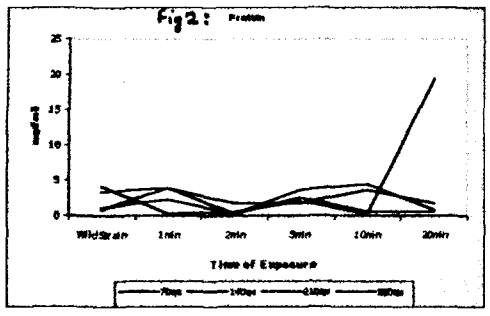
Maximum weight loss (0.08gm) was observed at the 7th day of incubation by wild strain. After radiation mutant strain may or may not be immune for degradation of the feather. The mutant strain showed maximum weight loss (0.14M/at 14 day) with 1 min exposure, it was followed by (0.08gm)at 28th day of some exposure , the weight loss (0.09gm) was observed at 21st of incubation period with 20 minutes.(Fig. 1) Exposure 1gm of dry mycelium



of fungus utilize about 3-4 gm substrate reported by Ziegler and Bohme (1963) and Kunert (1984). The radiation effect the growth of mycelium and extracellular enzyme i.e. RNA and DNA cause the change pH pattern of weight loss by mutant strain for the production of Protein.

Protein

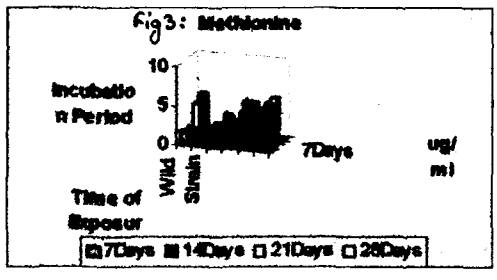
The wild strain caused maximum protein at the 21st day of incubation period after UV radiation with 20 minutes exposure maximum protein caused at same incubation period and immune sensitivity detected with other UV radiation exposure time on the other incubation periods the boosted amount of protein (19.35ug/ml) was observed with 20 minutes of exposure. (Fig. 2) This observation was very significant in protein concentration with mutant strains as compared with wild strains.



Methionine

The concentration of was maximum (5ug/ml) at 28th day in wild strain. The mutant strain showed maximum methionine (6.2ug/ml) at 7 day with 10 minutes exposure and 5.4 ug/ml. At 14th day of incubation period with same exposure. The significant results were observed with 10-20 minute exposure time (Fig 3). The 20-minute exposure of UV radiation showed the sigmoid curve or fermentation of feather substrate by mutant strains as compared with other exposure

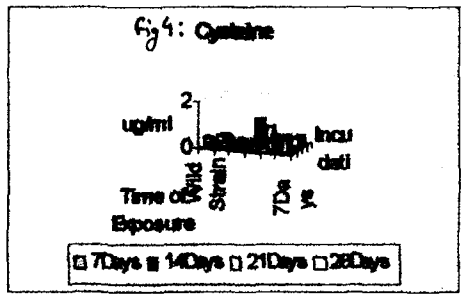
level period.

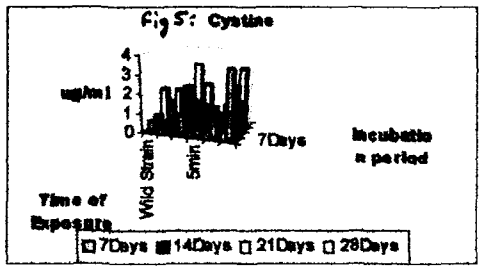


Cysteine and Cysteine

The wild strain caused maximum cysteine (0.44ug/ml) at the 7th day of incubation period. No concentration of cysteine was observed with one or two minute UV radiation which proved immune behavior at all incubation periods. The maximum concentrations of cystine was seen (1.25 ug/ml) at 14th day with 5minutes of UV radiation at 21st day(Fig. 5). Maximum concentration of cystine was observed by wild strain there was no effect with 1 minute UV radiation at 7th and 14th day.Mutant strain caused maximum cystine (3.05ug/ml) with 2 minutes exposure at the end of incubation period. The present observation have a correlation between the observation of protein and amino acid. They shows a sigmoidal curve with 20 minute of UV radiation for degradation of proteins into amino acid.

No report is available regarding the sensitivity of UV radiation on dermatophytes (*Microsporum*) for the production of growth promoting amino acid Cysteine, Cystine etc by mutant strains, However Singh et al (2001) as reported the optimization of fermentation condition for gluconic acid production by UV radiated mutant strain of Aspergillus niger. It was concluded in present study , the mutant strain can be used as biotechnological tool for wild strain management and production of growth promoting substances in microbial biotechnology.





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REFERENCES

Galantenko, O.A and Terkhova, L.P (1990). Isolation of antibiotic producing Actinomycetes from soil sample exposed to UV light. *Antibiot – Khimiter*. 35 (11). 6-8.

Ghawana, V.K. (1997). Studies on decomposition of wool using keratin
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decomposition fungi and its possible role in soil fertility Ph.D thesis *DEI, Dayalbagh*, Agra.

Kunert, J (1992). Effect of reducing agent on Proteolytic and Keratinolytic activity of enzyme on *M. gypseum. Mycosis* 35: 343 – 348.

Kunert J.(1995). Biochemical mechanism of keratin degradation by keratinophilic fungi. *J. Indian. Bot. Soc.* Vol. 74A : 89-90.

Kushwaha, R.K.S and Agarwal, S.C. (1981) Microbial degradation of keratin. *Proceeding Nat. Acad. Sci. India* 51(B) 11 : 181- 183.

Lowery, O.H.; Rosenbrough, N. J ; Larr, A.L; Randall, R.J. (1951). Protein measurements with Folin phenol reagents. *J. Biol. Chem.* 193: 265.

Malviya, H.K; Hasija, S.K. and Rajak, R.C (1992). Keratin degradation by *Scopulariopsis brevicaulis*. *J. Ind. Bot. Soc.* 70 : 213 – 216.

Nagvi, N; Shrivastava, J.N.; Bhatnagar A.K and Mathur, M (2001). Perforation behavior of keratinophyles isolated from Shimla and Agra . *J .of Ind. Soc. of Mycol. and Plant Pathol.* (In Press).

Nigam, N and Kushwaha, R.K.S (1992). Biodegradation of wool by *Chrysosporium keratinophilum* acting singly or in combination with other fungi. *Trans. Mycol. Soc.* Japan 33 : 481 – 486.

Rajak, R.C; Parweker, S; Malviya, H. and Hasija, S.K (1991). Keratin degradation by fungi isolation from the growth of a gelatin factory in Jabalpur, India. *Mycopathologia* 114: 83 – 87.

Ramakrishna Rao. Siraj. R and Prakashshastri, C.S (1979). Spectrophotometric method of direct determination of cysteine in the presence of other naturally occuring amino acid. *Curr. Sci.* 48: 815-821.

Shrivastava, J.N.; Ghawana, V.K. and Kumar, A. (1996). Biodegradation of wool by *Trichophyton simii* and *Aspergillus niger* Interaction and comparison. *Mycoses* vol. 39 : 483 – 487.

Singh, O.V; Sharma, Amit and Singh R.P. (2001). Optimization of fermentation conditions for gluconic acid production by a mutants of *Aspergillus niger. Ind.J. of Exp. Biol.* 1136 – 1143.

Singh, S.P. (1994) Practical manual of Biochemistry 3rd ed. *CBS Publication & distributors.* New Delhi. Pp 291.

Ziegler, H and Bohme, H (1963). Untersuchungenuber den phosphats of fwechsel der Dermatomyzeten. *Mycopathol. Appl.* 29: 219- 319.