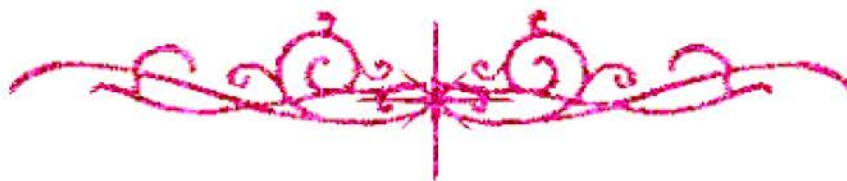


# بسم الله الرحمن الرحيم





# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم





# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

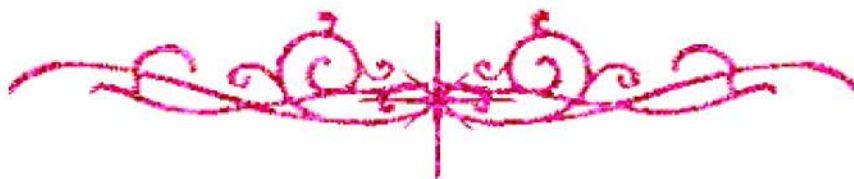
## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



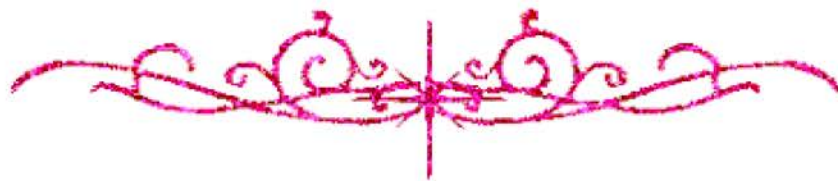
## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار





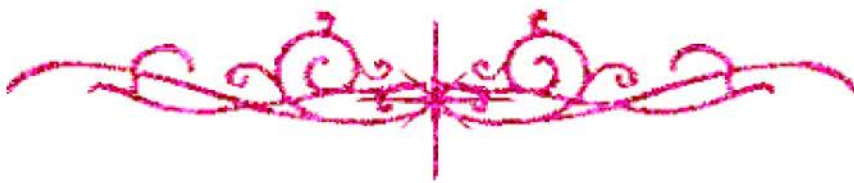
بالرسالة صفحات  
لم ترد بالأصل







# بعض الوثائق الأصلية تالفة



B11E0V

*Biochemical and Ecological  
Studies On Production Of Some Chinese  
Mushroom Species to be used as special diets.*

By

*Nesreen Mohamed El – Said Ali*

B.Sc. (Agric : Biochem.) 1986

M.Sc. (Agric : Biochem.) 1994

Fac. Of Agric. Cairo Univ.

Thesis

*Submitted in partial fulfillment  
Of the requirement for the degree of  
Philosophy Doctor*

(Agric. Biochem.)  
Biochemistry Department  
Faculty of Agriculture  
Cairo University  
Giza , A.R.E.

2001

## Approval Sheet

**Title :** Biochemical and Ecological studies on production of some Chinese Mushroom species to be used as special diets.

**Name :** Nesreen Mohamed El – Said Ali.

**Degree :** Thesis submitted for the Ph. D. Degree.

Approved by : M. A. Osman

O. Shaba

N. A. Elshahy

[Signature]

(Committee In Charge)

**Date :** / 2 / 5 / 2001.

Name of Candidate: Nesreen Mohamed El-Said Ali

degree: Ph.D

Title of Thesis: Biochemical and Ecological studies on production of some Chinese Mushroom species to be used as special diets.

Supervision: Prof. Dr. M.A. Osman, Prof. Dr. O.A.A. Shaban and Prof. Dr. A.M. Khorshid

Department: Biochemistry

Branch: Biochemistry

approval: 12/5/2001

#### Summary

The commercial cultivation of edible mushrooms has spread in many countries throughout the world. Since cultivated mushrooms can be grown on agricultural and industrial wastes, they provide a solution to many problems of global importance including protein shortages, resource recovery, recycling and environmental management. Many edible mushrooms are receiving additional recognition for their medicinal and qualities.

For this reason trials to introduce new strains of Chinese mushroom which could be of nutritional and medicinal value were carried out in this study. Twelve mushroom culture strains obtained from China were tried to be cultivated under Egyptian conditions. The successfully grown mushroom strains in Egypt were chemically analyzed for their chemical composition and evaluated for some medicinal properties.

Results could be summarized in the following: The propagation resulted in the success of four Chinese strains i.e., Auricularia polytricha, Flammulina velutipes, Ganoderma lucidum, and Lentinus edodes using PDYA medium in bottles. After propagation and spawn production were carried out using four different master grain media i.e., sorghum, decorticated wheat, whole wheat, and supplemented sorghum, where sorghum and decorticated wheat were the best. Cultivation of spawn on three different agrowastes media i.e., 100% wheat straw (W); 80% wheat straw +20% sawdust (WS); 60% wheat straw + (W); 20% sawdust +20% sugar-cane bagasse. (WSB).

A. polytricha reached successfully, fruiting stage in summer and gave two flushes, with total yield of (99.3g/4 bags) and E. velutipes reached successfully, fruiting stage in winter and gave only one flush with total yield of (118g/4 bags).

Samples from the obtained fruit bodies of the two successfully grown Chinese strains A. polytricha and E. velutipes under Egyptian conditions were analyzed for dry matter, protein, fat, carbohydrates, fiber, and ash. Differences in chemical composition due to the growing media were observed. Differences in chemical composition due to the geographical zone of cultivation were also reported. Minerals content of ash was determined in both cultispecies and results as following; ash content is not related to minerals content. Differences in minerals content due to growing media were noticed as well as between cultispecies and between that grown in Egypt and China. The highest relative percentage fatty acid in A. polytricha and E. velutipes was C<sub>18:2</sub> which reached (44.43%) and (38.55%) of total fatty acids respectively followed by C<sub>18:1</sub> in A. polytricha (24.67%) while in E. velutipes it was C<sub>16:1</sub> (23.41%).

The major amino acids in both A. polytricha and E. velutipes were tyrosine (12.8%, 13.8%), aspartic acid (9.0%, 8.9%) and glutamic acid (8.8%, 8.9%) respectively. Electrophoresis pattern of soluble protein reveal on the presence of 5 bands with M.W (64, 56, 33, 22 and 17 kd) in those grown in Egypt compared with only three bands for that grown in China. The band of M.W 17 and / or 22 kd could be a glycoprotein (lectin) which needs further studies for its chemicals and biological properties. The hot water extracted and purification of polysaccharides sediment were studied and results could be summarized in the following. Soluble polysaccharides content in both A. polytricha (5.02%) and E. velutipes (6.80%). HPLC indicated the presence of glucose as major component (A. polytricha; 99.4% and E. velutipes; 98.5%), which may recommended a  $\beta$ -glucans. Low molecular weight compounds extracted by dialysis from Auricularia mushroom grown in Egypt reached to 2.15% on dry weight basis were tested for its effect as anticoagulant. The minimum inhibitory platelet aggregation could be in the range of 35-36  $\mu$ g/ml of dialysate.

M.A. Osman

O.A.A. Shaban



## Acknowledgements

The author would like to acknowledge the continuing supervision throughout the course of this study , guidance and encouragement of **Dr. M.A. Osman** , Professor of Biochemistry , Faculty of Agriculture , Cairo University.

Many thanks are also due to **Dr. O.A.A. Shaban** , Professor of Biochemistry of the same department for his close supervision , advices and valuable cooperation throughout the course of this work.

Many thanks are also due to **Dr. A.M. Khorshid** , Professor of Food Science and Technology , Food. Tech. Res. Inst., Agric. Res. Center, Giza , for his help and advices during this work. Many thanks are also due to Prof. **Dr. Lin Yuexin** director of Bio. Eng. College , Fujian Teachers. Univ. Fuzhou , Fujian , P.R. China , for his help and advices during this work and encouragement. I also greetfully acknowledge the help given by **Dr. Saeb Abd El – Monem Hufez** Professor of Special Food and Nutrition , Food , Tech. Res. Inst. , Agric. Res. Center.

The author expresses many thanks to all the members of the Biochemistry Department in the same Faculty , and Food. Tech. Res. Inst., Agric. Res. Center , for the helps and all the facilities offered .

## Contents

	Page
<b>Introduction.....</b>	<b>1</b>
<b>1. Review of Literature .....</b>	<b>3</b>
<b>1.1. Some agricultural features of mushroom .....</b>	<b>3</b>
1.1.1. World production and consumption .....	3
1.1.2. Climatic conditions for growing Chinese mushroom...	5
1.1.3. Cultivation and production of Chinese mushroom.....	9
1.1.4. Morphological characters.....	12
1.1.4.1. <u>Auricularia polytricha</u> (wood ear mushroom) .....	12
1.1.4.2. <u>Flammulina velutipes</u> (Enokitake mushroom).....	13
<b>1.2. Chemical composition and Nutritive value .....</b>	<b>15</b>
1.2.1. General chemical composition.....	15
1.2.2. Proteins and amino acids.....	16
1.2.3. Carbohydrates, crude fibres, and polysaccharides.....	23
1.2.4. Ash and minerals .....	26
1.2.5. Lipids and fatty acids .....	30
<b>1.3. Medicinal properties of mushroom .....</b>	<b>32</b>
1.3.1. General nutraceutical properties.....	32
1.3.2. Anti-coagulant agent(s).....	36
1.3.3. Antitumor properties .....	39

<b>2. Materials and Methods.....</b>	<b>42</b>
<b>2.1. Materials.....</b>	<b>42</b>
2.1.1. Experimental organisms and source .....	42
2.1.2. Reactivation media.....	42
2.1.3. Spawn production media.....	43
2.1.4. Cultivation media.....	43
2.1.5. Growing bags system.....	43
2.1.6. Mushroom samples .....	43
<b>2.2. Methods .....</b>	<b>44</b>
2.2.1. Fungal propagation .....	44
2.2.1.1. Preparation of media.....	44
2.2.1.1.1. PDA (direction) media.....	44
2.2.1.1.2. Modified PDYA media.....	44
2.2.1.2. Reactivation.....	45
2.2.2. The preparation of spawn.....	45
2.2.3. Cultivation of mushroom .....	46
2.2.3.1. The mushroom house.....	46
2.2.3.2. Preparation of growing substrate.....	46
2.2.3.3. Inoculation and incubation.....	47
2.2.3.4. Induction of fruit bodies.....	47
2.2.3.5. Harvesting.....	48
2.2.4. General chemical analysis.....	48
2.2.4.1. Determination of moisture content.....	48



2.2.4.2.	Determination of ash.....	48
2.2.4.3.	Determination of crude fiber.....	48
2.2.4.4.	Determination of total lipids.....	49
2.2.4.5.	Determination of crude protein.....	49
2.2.4.6.	Total carbohydrate .....	49
2.2.5.	Mushroom protein fraction .....	49
2.2.5.1.	Extraction .....	49
2.2.5.2.	Determination of total protein by Biuret method .....	50
2.2.5.3.	Determination of amino acids.....	50
2.2.5.4.	SDS gel electrophoresis of protein fraction.....	50
2.2.6.	Lipids fraction .....	50
2.2.7.	Carbohydrates.....	50
2.2.7.1.	Extraction of biological active polysaccharides.....	50
2.2.7.2.	HPLC components of isolated polysaccharides .....	51
2.2.8.	Minerals.....	51
2.2.9.	Anti-coagulant agent(s).....	51
2.2.9.1.	Extraction and recovery .....	51
2.2.9.2.	Preparation of tested dialysates solutions .....	52
2.2.9.3.	Preparation of plasma.....	52
2.2.9.4.	Procedure for coagulant time.....	52

<b>3. Results and Discussion .....</b>	<b>53</b>
<b>3.1. Trial and growing Chinese mushroom in Egypt.....</b>	<b>53</b>
3.1.1. Fungal propagation.....	53
3.1.2. Spawn production.....	55
3.1.3. Cultivation of Chinese mushroom .....	57
3.1.3.1. Mycelial growth stage.....	57
3.1.3.2. Buttoning stage .....	59
3.1.3.3. -Fruiting and cropping stage .....	59
<b>3.2. General chemical analysis .....</b>	<b>61</b>
3.2.1. Effect of species and media on chemical composition.....	61
3.2.2. Effect of ecological conditions .....	64
<b>3.3. Mineral content .....</b>	<b>66</b>
3.3.1. Effect of species and media.....	66
3.3.2. Ecological effect.....	69
<b>3.4. Lipid fraction .....</b>	<b>71</b>
3.4.1. Fatty acids.....	71
<b>3.5. Mushroom proteins .....</b>	<b>74</b>
3.5.1. Amino acids composition of crude protein.....	74
3.5.2. Soluble protein fraction of Auricularia mushroom.....	77
3.5.2.1. Electrophoresis pattern.....	77
3.5.2.2. Amino acids composition of soluble protein fraction ..	78

<b>3.6. The soluble polysaccharides.....</b>	<b>82</b>
3.6.1. Extraction and recovery .....	82
3.6.2. Components of soluble polysaccharides.....	83
<b>3.7. Anticoagulant agent(s).....</b>	<b>85</b>
3.7.1. Extraction and recovery .....	85
3.7.2. Anticoagulant activity dialysate.....	85
<b>Summary and Conclusion.....</b>	<b>90</b>
<b>References.....</b>	<b>96</b>

**Arabic summary.**



# INTRODUCTION