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CENTRE FOR INTERNATIONAL SERVICES TO MUSHROOM BIOTECHNOLOGY

MUSHROOM DATABASE PROJECT

PROGRESS REPORT

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UNIDO CONTRACT XP/RAS/94/135

INTRODUCTION

Several general criteria have been adopted in defining the component structure of CISMB Mushroom Database. These are:

1. Target should satisfy UNIDO specifications.

2. CUHK/UNIDO database should have unique features which are relevant to the needs of targeted end-users and should avoid duplication of other systems.

3. Objectives should be realistic, and attainable within the constraints of available manpower and resources.

The information stored in the database falls into three major categories: two of the categories have been selected on the basis of material most often requested by potential end-users, and the third in order to fulfill a commitment to address aspects of mushroom biotechnology. The main categories are:

A. CULTIVATION & MANAGEMENT TECHNIQUES

Sub-categories:

a. identification of strains used for spawn production
b. mushroom growth in relation to specified physical parameters: e.g. cardinal temperatures, pH values
c. fruiting prerequisites
d. recorded substrate formulations and composting treatments
e. special bed management requirements: e.g. watering
f. recorded pest problems
g. special features

B. PRODUCTION LEVELS AND MARKETING PATTERNS

Sub-categories:

a. national and regional production figures
b. production costs
c. production yields
d. product quality
e. consumption categories: e.g. domestic vs export, fresh vs processed
f. data related to mushroom imports

C. MUSHROOM PRODUCTS

Sub-categories:

a. types of mushroom products: (i) already marketed, (ii) experimental
b. sources

c. applications
d. country-based production levels
e. market value of individual products

The information currently being inserted into the database applies in the main only to mushrooms which are grown commercially although other mushroom species will be added at a later date.The mushroom species are:

1. Edible

Lentinus
Agaricus
Volvariella
Pleurotus
Auricularia
Flammulina
Tricholoma

2. Non-edible

Ganoderma
Coriolus

In order to broaden the CISMB's source base, we have also built up a catalogue of individuals and institutions worldwide who are engaged in mushroom-related activities. Included on the list are research scientists working in universities, research institutions (academic, governmental, private), or for commercial companies, growers and spawn producers.The list has been compiled using various sources at our disposal including lists of participants to international conferences, membership of the WSMBMP, personal communications, and authorship of research and other publications related to mushrooms. In addition to serving as future sources of information for the database, the list will allow for identification of (a) consultants able to resolve problems addressed to the Centre and which fall outside the scope of expertise available there, and (b) candidates able to serve as regional nodes for MushNET.

The database also includes a section covering mushroom-related publications available in the scientific literature. Material is stored under the main category of individual mushroom species with sub-categories of major area of interest, journal, author, year, and country. Numerous publications relating to *Volvariella volvacea* are included in the attached representative items extracted from the database.

The Database Facility currently employs a full-time assistant (working under the overall supervision of the Centre's Director and Deputy Director) who is responsible for processing data as they become available, and for installing data into, and disseminating the information stored in, the database.

References for *Volvariella volvacea*

No.	Index	Author	Journal	Year	Country	Title
1	Cultivation	Addae, K.	J. of the Southern African Society for Horticultural Sciences	1993	Sourth-Africa	Cultivation of the straw mushroom (*Volvariella volvacea)* in south Africa: the posibillities
2	Physiolgy	Albert, O.A. etc	Material u. Organismen	1984	Ghana	Growth studies with isolates of *Volvariella volvacea* for cultivation on wood wastes
3	Nutrition	Angle, R.Y. & D.V. Tamhane	Indian Food Packer,	1974	Matunga	Mushrooms: an exotic source of nutritious and palatable food
4	Cultivation	Antonio, J. P. S. & C. Fordyce	Hort. Science	1972		Cultivation of paddy straw mushroom,*Volvariella volvacea*
5	Genetics	Au, C.M & S.T.Chang	Thesis of CUHK	1979	Hong Kong	Studies of morphogenesis of *Volvariella volvacea*
6	Genetics	Barroso, G., T.T.Mai & J.Labarire	Mushroom J. for the Tropics	1988		Effects of UV irradiation on germination and on chloramphenicol and tetracyaline resistance of *Volvariella volvacea* basidiospores
7	Cultivation	Bisht, N.S. & N.S. K. Harsh	Mushroom J.	1984		Utilization of waste tea-leaves- Preparation of spawn of *Agaricus bisporus* and *Volvariella volvacea*
8	Cultivation	C.K.Yau & S.T. Chang	Chin. Hort.	1970	Hong Kong	Cultivation of straw mushroom in growth chamber
9	Biochemistry	Cai, Y.J., S.T. Chang & J.A.Buswell	Thesis of CUHK	1993	Hong Kong	Comparison of Lignocellulose-degrading enzymes in *Lentodes, P. sajor-caju* and *Volvariella volvacea*
10	Biochemistry	Cai, Y.J., J.A. Buswell & S.T. Chang	World J. of Microbiology and Biotechnology	1993	Hong Kong	Effect of lignin-derived phenolic monomers on the groVolwth of the edible mushroom *Lentinus edodes, Pleurotus sajor-caju* and *variella volvacea*
11	Biochemistry	Cai, Y.J., J.A. Buswell & S.T. Chang	Mycol. Res.	1994	Hong Kong	Production of cellulase and hemicellulases by the straw mushroom, *Volvariella volvacea*

No.	Index	Author	Journal	Year	Country	Title
12	Genetics	Chang, S.T., S.X. Li & M.J.Maher	Mushroom Sci XIII Part I	1991	Hong Kong	Genetical studies on the sexuality pattern of *Volvariella volvacea*
13	Genetics	Challen, M. P., T.J. Elliot	Cultivation Mushroom Research-CMR Newsletter	1994	U.K.	Evaluation of the 5-fluoroindole resistance marker for mushroom transformation
14	Biology	Chandra, K. L.	Mushroom Research	1992	India	Mushroom research and development in India
15	Cultivation	Chang, S.T.	Mushroom Sci. Part II	1979	Hong Kong	Cultivation of *Volvariella volvacea* from cotton waste composts
16	Genetics	Chang, S.T.	Nature	1966	Hong Kong	Spore of *Volvariella volvacea*
17	Biochemistry	Chang, S.T. & K.Y.Chan	Mycologia	1973	Hong Kong	Quantitive and qualitive changes in protein during morphogenesis of the basiocarp of *Volvariella volvacea*
18	Biochemistry	Chang, S.T. & S.L.Ling Wong	J. of the Chinese University of Hong Kong	1974	Hong Kong	Ulstructure of mycelium and gill of *Volvariella volvacea*
19	Biochemistry	Chang, S.T. & K.Tanaka	Cytologia	1971	Hong Kong	An electron microscope study of complex membranous structure in basidiomycete, *Volvariella volvacea*
20	Cultivation	Chang, S.T.	Mushroom J. For the Tropics	1987	Hong Kong	World production of cultivated edible mushroom in 1986
21	Biochemistry	Chang, S.T. & H.S.Kwan	Mushroom Sci. 11 Part II	1981	Hong Kong	Biochemical studies of cotton waste compost during the cultivation of *Volvariella volvacea*
22	Genetics	Chang, S.T.	Bot. Mag.	1969	Hong Kong	A cytological study of spore germination of *Volvariella volvacea*
23	Cultivation	Chang, S.T.	New Horizon	1978	Hong Kong	Cultivation of straw mushroom in school laboratories
24	Culture	Chang, S.T. & S.F.Li	Advances in Agricultural Microbiology	1982	Hong Kong	Mushroom Culture
25	Cultivation	Chang, S.T. & C.K.Yau	Chung Chi Journal	1972	Hong Kong	A decade's research on *Volvariella volvacea* at Chung Chi
26	Genetics	Chang, S.T.	Sci. Agriculture.	1969	Hong Kong	A study of basidium spore of *Volvariella volvacea*

No.	Index	Author	Journal	Year	Country	Title
27	Cultivation	Chang, S.T.	J. of the Hort. Society of China	1972	Hong Kong	Retrospect and prospect of Chinese mushroom(*Volvariella volvacea*)
28	Genetics	Chang, & S.S.Chu	Physiology Plantarum	1969	Hong Kong	Factors affecting spore germination of *Volvariella volvacea*
29	Culture	Chang, S.T.	Chung Chi Bulletin	1964	Hong Kong	Pure-culture spawn for *Volvariella volvacea*
30	Genetics	Chang, S.T. & C.K.Yau	Amer. J. Bot.	1971	Hong Kong	*Volvariella volvacea* and its life history
31	Biochemistry	Chang, S.T. & K.Tanaka	Microscopie Electronique	1970	Hong Kong	The ultrastructure of complex membranes in the germinating spore of *Volvariella volvacea*
32	Culture	Chang, S. T.	Chung Chi J.	1964	Hong Kong	The influence of culture method on the production and nutritive content of *Volvariella volvacea*
33	Cultivation	Chang, S.T.	Mushroom News Letter for the Tropics	1983	Hong Kong	Prospects of *Volvariella volvacea* cultivation
34	Biology	Chang, S.T.	The Biology and Cultivation of Edible Mushroom	1978	Hong Kong	*Volvariella volvacea*
35	Biochemistry	Chang, S.T. .& S.L.Ling Wong	Electron Microscopy	1974	Hong Kong	Ulstructural features of basidial ontogeny in *Volvariella volvacea*
36	Cultivation	Chang, S.T.	Mushroom Newsletter for the Tropic	1980	Hong Kong	Cultivation of Volvariella mushroom in Southeast Asia
37	Genetics	Chang, S.T. & K.Y. Ling	Amer. J. Bot.	1970	Hong Kong	Nuclear behaviour in the basidiomycete, *Volvariella volvacea*
38	Cultivation	Chang, S.T.	The Mushroom J.	1974	Hong Kong	Production of the straw mushroom (*Volvariella volvacea*) from cotton wastes
39	Biology	Chang, S.T.	Mushroom Sci. Part II	1974	Hong Kong	Biological and commercial aspects of straw mushroom (*Volvariella volvacea*) cultivation
40	Biology	Chang, S.T.	ASAIHL Lecture	1979	Hong Kong	The production of straw mushroom on industrial and agricultural waste as a method of food proteins recovery in Southeast Asia

No.	Index	Author	Journal	Year	Country	Title
41	Cultivation	Chang, S.T.	Biological Nature and Cultivation Method	1982	Hong Kong	Cultivation of *Volvariella volvacea* in Southeast Asia
42	Physiology	Chang, S.T. & S.L.L Wong	Mushroom Sci. Part I	1974	Hong Kong	A study of basidial ontogeny in *Volvariella volvacea* utilizing light and electron microscopy
43	Cultivation	Chang, S.T.	World Crops	1965	Hong Kong	Cultivation of straw mushroom in southeast China
44	Genetics	Chang, S.T. & S.S.Chu	Cytologia	1969	Hong Kong	Nuclear behaviour in the basidium of *Volvariella volvacea*
45	Cultivation	Chang, S.T. & C.K.Yau	Mushroom News	1970	Hong Kong	A simple technique for indoor cultivation of the straw mushroom
46	Cultivation	Chang S. T.	Quart. J. Taiwan Museum	1965	Hong Kong	How to cultivating *Volvariella volvacea*
47	Genetics	Chang, S.T. & C.K.Yau	Chinese Horticulture	1972	Hong Kong	Chinese mushroom (*Volvariella volvacea*) and its life history
48	Biology	Chang, S.T.	Mushroom Biology and Mushroom Products	1993	Hong Kong	Fungal-and substrate-associated factors affecting the growth of individual mushroom species on different lignocellulosic substrate
49	Cultivation	Chang, S.T.	Econ. Bot.	1977	Hong Kong	The origin and early development of straw mushroom cultivation
50	Genetics	Chang, S.T., P.G.Miles & C.C.Wai	Mushroom Sci.11 Part II	1981	Hong Kong	A study of monosporous isolates of *Volvariella volvacea*
51	Cultivation	Chang, S.T.	Mushroom Newsletter for the Tropic	1980	Hong Kong	Mushroom production in Southeast Asia
52	Physiology	Chang, S.T. & C.K.Yau	J. Horticulture. Soc. China	1970	Hong Kong	The effect of light intensity on fructification of padi straw mushroom
53	Genetics	Chang,S.T. & C.K.Yau &M.O.Lin	J. of the Hort. Society of China	1970	Hong Kong	Cytology of monospore hyphae of Volvariella volvacea

No.	Index	Author	Journal	Year	Country	Title
54	Biochemistry	Chapman, S.J. & S.T. Chang	Thesis of CUHK	1994	Hong Kong	The uptake of Zinc by selected musjhroom fungi
55	Disease	Chen K.,P.Liang, M. Yu & S.T. Chang	Mycologia	1988	Hong Kong	A new double-stranded RNA virus from *Volvariella volvacea*
56	Genetics	Chen, M.J. & S.T. Chang	Thesis of CUHK	1994	Hong Kong	Molecular studies on the Chinese straw mushroom, *Volvariella volvacea*
57	Genetics	Chen, M.J., S.W.Chiu & S.T. Chang	Acta Edulis Fungi	1994	China	Construction of a genomic library for *Volvariella volvacea*
58	Genetics	Chen, M.J., S.W.Chiu & S.T. Chang	Acta Edulis Fungi	1995	China	Electrophoretic of *Volvariella volvacea*
59	Nutrition	Cheng, S.C.	Thesis of CUHK	1979	Hong Kong	Study on the nutritive value of the straw mushroom,
60	Nutrition	Cheng, S.C. & S.T. Chang	Thesis of CUHK	1979	Hong Kong	Studies on the nutritive value ofthe straw mushroom, *Volvariella volvacea*
61	Physiology	Cheng. S. & C.P. Chiang	Taiwan Horticulture	1976	Taiwan	A study on the components evolution of culturial substance during the cultivation period of straw mushroom (*Volvariella volvacea)*
62	Disease	Chen,K., P.Liang, S.T. Chang & M.Yu	Acta Microbiological Sinica	1988	Hong Kong	*Volvariella volvacea* virus-A new fungal dsRNA virus from mushroom
63	Nutrition	Chiu, K.W. & A.H.W. Lam etc.	Phototherapy Research	1995	Hong Kong	Cardiovascular active substances from the straw mushroom *Volvariella volvacea,*
64	Genetics	Chiu, S.W.,M.G. Chen & S.T. Chang	Mycological Research	1995	Hong Kong	Differentiating homothallic *Volvariella* mushroom by RFLPs and AP-PCR

No.	Index	Author	Journal	Year	Country	Title
65	Genetics	Chiu, S.W.	Mycological Research	1993	Hong Kong	Evidence for a haploid life-cycle in Volvariella volvacea from microspectrophotometric measurement and observations of nuclear behavior
66	Cultivation	Chua, S.E. & S.Y. Ho	World Crops	1973		Cultivation of straw mushroom on paddi-sreaw, banana leaves and sawdust
67	Cultivation	Chua, S.E.	Mushroom Sci IX	1976		Cultivation of straw mushroom (*Volvariella volvacea)* using diferent substrates in multitiered racks
68	Physiology	Chua, S.E. & S.Y.Ho	World Crops	1973	Philippine	Fruiting on sterile agar and cultivation of straw mushroom on padi straw, banana leaves and sawdust
69	Cultivation	Chua, S.E.	Mushroom Sci IX Part I	1974	Singapore	Cultivation of straw mushroom substrates in multi-tiered racks
70	Culture	Claro, M. S. Jr.	Philipp. J. Biol.	1983	Philippine	Basidiocap production in *Volvariella volvacea* in laboratory cultures
71	Biology	Devi, S.B., M.C.Nair &	Mushroom Sci. XII Part II	1989	India	Observation on the biology and cultivation of *Volvariella volvacea* (Bull:Fr.) Sing.Var heimi Sing.
72	Nutrition	Devi, P.S. & G. Sarojini	The Ind., J. Nutr. Dietel.	1983		Effect of maturity and heat treatment on the nutritional quality of paddy straw mushroom *Volvariella volvacea*
73	Culture	Diwakar, D.	India Phytopathology	1989	India	Cultural trails on *Volvariella volvacea*
74	Biology	Don Reynolds	Philippine Agriculturist	1966	Philippine	Taxonomic consideration of a mushroom under cultivation in the U.P.C.A., Philippines
75	Disease	Eicker, A., J.T.Peng etc.	Mushroom Sci XIII Part I	1991	Taiwan	A survey of pathogenic fungi and weed moulds of cultivated mushroom in Taiwan
76	Nutrition	Eisenhut, R. & D. Fritz	Gartenbauwissenschaft	1991	Germany	Medicinally useful effects and composition of edible fungi
77	Cultivation	Garcha, H.S. & S.T. Chang etc.	Mushroom J. for the Tropics	1989	Hong Kong	Studies on substrate manipulation for growing *Volvariella* in India
78	Cultivation	Garcha, H.S. & L.K.Kallra	Mushroom Science X Part II	1978	India	Paddy straw mushroom in North India

No.	Index	Author	Journal	Year	Country	Title
79	Nutrition	Gerpacio, A.L. And T.H. Quimio etc.	Philippine Agriculturist	1990	Philippine	The protein of rice straw-based composts from mushroom production as livestock/poultry feed
80	Biology	Ghosh, A. K. & S. Sengupta	J. of Food Science and Technology	1977		Studies on biochemistry of higher fungi. I. Submerged growth of *Volvariella volvacea* in synthetic medium
81	Nutrition	Ghosh A.K.	Phytochemistry	1993	India	Protein carboxyl methylation in the mushroom *Volvariella volvacea*
82	Cultivation	Go, L.K.	Phil. Agric.	1959	Philippine	Experimental cultivation of *Volvariella volvacea*
83	Cultivation	Go, L.K.	Quel. Phil. Agr.	1959		Experimental cultivation of *Volvariella volvacea*
84	Cultivation	Go, L.K.	Phil. Agr.	1959	Philippine	Culture of the padi straw mushroom (*Volvariella volvacea*) on oil palm pericarp wastes
85	Culture	Goh, S.C. & S.T.Chang	Thesis of CUHK	1977	Hong Kong	Culture of the padi straw mushroom (*Volvariella volvacea*) on oil palm pericarp wastes
86	Culture	Goh, S.C. & S.T. Chang	Thesis of CUHK	1977	Hong Kong	Studies on the padi straw mushroom. (*Volvariella volvacea*)
87	Cultivation	Goh, S.C.	Mal. Agric res.	1975		
88	Genetics	Graham, K.M.	Mal. Agric. Res.	1974	Malaysia	Studies on the padi straw mushroom (*Volvariella volvacea*) /I. Effect of bed depth on yield on oil palm pericarp waste
89	Cultivation	Graham, K.M.	Mal. Agric. Res.	1974	Malaysia	Studies on the padi straw mushroom (*Volvariella volvacea*) II. Effect of bed depth on yield on oil palm pericarp waste
90	Nutrition	Gray, W. D.	Chemical Rubber Co.	1970	U.S.A.	The use of fungi as food and in food processing
91	Culture	Hashioka, Y.	Tottori Mycol. Inst.	1962	Thailand	Culture of *Volvariella*-mushroom in Thailand
92	Culture	Hashioka, Y.	Reports Tottori Mycol. Inst.	1962	Thailand	Culture of *Volvariella volvacea* mushroom in Thailand
93	Nutrition	Ho, T.M.	Mushroom Sci. X	1979		Effect of nitrogen amendment on the growyh of *Volvariella volvacea*
94	Cultivation	Ho, M. S.	Mushroom Sci. VIII	1971		Straw mushroom cultivation in plastic house

No.	Index	Author	Journal	Year	Country	Title
95	Cultivation	Hu, K.J., S.F. Song & P. Liu	Mushroom Sci IX Part I	1974	Taiwan	Studies on sugarcane rubbish for Chinese mushroom culture and its growth factor
96	Cultivation	Hu, K.H., S.F.SONG & P. Liu	J. Taiwan Agric. Res.	1973	Taiwan	Experiments on Chinese mushroom cultivation I. The comparison of Cultivating materials. II. Investigation on sugar cane rubbish for Chinese mushroom cultivation and its growth factors
97	Cultivation	Hu, K.J., S.F. Song & P. Liu	Mushroom Sci. IX Part I	1974	Taiwan	The comparason of composts made of different raw materials for *Volvariella volvacea*
98	Cultivation	Hu, K.J., S.F. Song & P. Liu	J. of Taiwan Agricultural Research	1973	Taiwan	Experiements on Chinese mushrom cultivation
99	Nutrition	Huang.B.H.,K.H. Yung & S.T. Chang	Mushroom Sci. XII Part II	1989	Hong Kong	Fatty acid composition of *Volvariella volvacea* and other edible mushroom
100	Nutrition	Huang,B.H.,K.H. Yung & S.T.Chang	Mycologia	1985	Hong Kong	The sterol composition of *Volvariella volvacea* and other edible mushrooms
101	Cultivation	Iqbal, S.M. & B. Muhammad	Pakistan J. of Scientific and industrial Research	1993	Pakistan	Performance of exotic and local strains of Chinese mushroom *Volvariella volvacea* on different substrates
102	Biochemistry	J.A. Buswell & S.T. Chang	Biotechnology Letters	1994	Hong Kong	Biomass and extracellular hydrolytic enzyme production by six mushroom species grow on soybean waste
103	Genetics	Juliano, J.P. & S.T. Chang	Thesis of CUHK	1968	Hong Kong	Thesis of CUHKThe cytology of the padi straw mushroom, *Volvariella volvacea*
104	Genetics	Kawagishi, H.	Nippon Nogeikagaku Kaishi	1994	Japan	Cell-fusion regulating substance from mushroom
105	Cultivation	Khan, S.M., R. Haq & M.A. Dogar etc.	Mushroom Sci. XIII Part II	1991	French	Some studies on the cultivation of Chinese mushroom on sugarcane industrial by-products

No.	Index	Author	Journal	Year	Country	Title
106	Disease	Khan,S.M., Khattoon A.etc.	Mushroom Sci. XII Part II	1989	Pakistan	Chemical control of green mould Aspergills funmigatus on beds of Chinese mushroom at Faisalabad, Pakistan
107	Biochemistry	Khowala, S. & S. Sengupta	Can. J. Microbio.	1984	India	The production of extracellular endo-@-mannanase by the mushroom *Volvariella volvacea*
108	Biochemistry	Khowala, S.& S.Sengupta	Canadian J. of Microbiology	1984		The production of extracellular endo-alfa-mannase by the mushroom *Volvariella volvacea*
109	Biochemistry	Kishida, E., Y.Sone & A. Misaki	Carbohydrate Research	1989		Purification of an antitumoractive, branched (1 fwdarw 3)-beta-D-glucana from Volvariella volvacea, and elucidation of its fine structure
110	Biochemistry	Kishida, E. & C. Kinoshita etc.	Biochemistry	1992	Japan	Structures and antitumor activities of polysaccharides isolated from mycelium of Volvariella volvacea
111	Cultivation	Ku, H.C., L.W. Leung & S.T. Chang	Proceedings of Symposium on Microbial and Engineering Technology in Wastes Treatment	1991	Hong Kong	Waste utilization of coffee spent grounds:cultivation of edible mushroom
112	Nutrition	Kundu, R.B., S. Mitra & B. Nandi	J. of Mycopathological Reasearch	1990	India	Mycelial protein production from agroindustrial wastes
113	Nutrition	Kundu, R.B.	J. of Mycopathological Research	1994	India	Nutrition value in respect of sugar, starch and ascorbic acid content of two mushroom mycelia grown on agroindustrial wastes
114	Physiology	Kurtzman, Jr.R.H. & Y.H.Chang	Tropical Mushroom: Biological Nature and Cultivation Method	1982	Hong Kong	Physiological consideration for cultivation of *Volvariella volvacea*
115	Biochemistry	Kwan, H.S. & S.T. Chang	Thesis of CUHK	1978	Hong Kong	Chemical and microbiological studies of cotton waste compost for cultivation of the straw mushroom *Volvariella volvacea*
116	Nutrition	Lee, T. F. & S.T. Chang	J. of the Chinese Society for Horticultural Science	1975	Taiwan	Nutrition analysis of *Volvariella volvacea*

No.	Index	Author	Journal	Year	Country	Title
117	Nutrition	Lee T.F. & Chang, S.T.	Horticulture. Sci.	1975	Hong Kong	Nutrition analysis of *Volvariella volvacea*
118	Genetics	Li, Shuxian & S.T. Chang	Sci. and Cultivation of Edible Fungi	1991	Hong Kong	Study on the spore pattern in basidium of *Volvariella volvacea*
119	Biochemistry	Li, J.S., J. Zhu & S.Z.Quo	J. of Fujian Agricultural College	1990	China	The superoxide dismutase of the mycelia of straw mushroom, *Volvariella volvacea*
120	Biochemistry	Li, Y., K.Y.Cho & Y.Z. Wu etc.	World J. of Microbiology and Biotechnology	1992		The effect of lipids and temperature on the physiology and growth of *Volvariella volvacea*
121	Genetics	Li, S.F. & S.T. Chang	Thesis of CUHK	1977	Hong Kong	Cytological and genetical analysis on the life cycle of *Volvariella volvacea*
122	Genetics	Li, S.X., cd & M.J.Maher	Mushroom Sci XIII Part I	1991	Hong Kong	Study on the spore pattern in basidium of *Volvariella volvacea*
123	Genetics	Li, Shuxiang & S.T. Chang	World J. of Microbiology and Biotechnology	1991	Hong Kong	Selection and Characterization of crystal-violet-and malachite-green-resistant mutant in *Volvariella volvacea*
124	Cultivation	Li, Y.Y. & L. Wang etc	J. of the Hebei Academy of Sciences	1986	China	Studies on yhe cultivation of *Volvariella volvacea* using wheatstraw
125	Physiology	Li, G.S.F.	Mushroom Newsletter for the Tropics	1981	Hong Kong	Simple techniques for fruiting of the straw mushroom *Volvariella volvacea* in laboratory
126	Biochemistry	Li, J. & Z. Zhu etc.	J. of Fujia Agricultural College	1986	China	A study on four pattern of isoenzymes developed in different stages of the fruitbody of straw mushroom, *Volvariella volvacea*
127	Genetics	Li, S.F. & hang, S.T.	Mushroom Sci. Part I	1979	Hong Kong	Variation in the homothallic Basidiomycete, *Volvariella volvacea*
128	Genetics	Li, S X. & S.T.Chang	Thesis of CUHK	1991	Hong Kong	Genetical and cytological studies on variation of *Volvariella volvacea*
129	Genetics	Li, X.Y.,Y.Z. Yang & R.D. Sen	Acta Mycologica Sinica	1991	China	Meiosis and behaviour of nuclei during basidiospore formation in *Volvariella volvacea*

No.	Index	Author	Journal	Year	Country	Title
130	Disease	Liang, P.Y. & K.Y. Chen	Chinese J. of Virology	1990	China	Homolgy between Gaeumannomyces graminis virus and other mycoviruses by dot blot hybridization
131	Nutrition	Li,G.S.F. & S.T. Chang	Biological Nature and Cultivation Method	1982	Hong Kong	Nutritive value of *Volvariella volvacea*
132	Cultivation	Lim, W.C.	Symposium on Soil Microbiology and Plant Nutrition	1976	Malaysia	An improved method of cultivation of *Volvariella volvacea* using pasi straw
133	Cultivation	Lim, G., L.L. Tee & P.N. Avadhani	Phil. Agr.	1982	Singapore	Cultivating padi-straw mushrooms on industrial wastes
134	Cultivation	Lim, W.C.	Mushroom Sci. XI Part II	1981	Malaysia	The microbiology of paddy straw compost for the cultivation of *Volvariella volvacea*
135	Biochemistry	Lin, J.Y. & T.W.Teng etc.	Nature	1973	130	Disease
136	Biochemistry	Lin, J.Y. & T.B. Chou	J. Biochem	1984		Isolation and characterization of lectin from edible mushroom, *Volvariella volvacea*
137	Biology	Liu, B.	Shansi Normal College	1958	China	The primary investigation on study and utilization of the fungi by ancient Chines
138	Genetics	Li,X.Y.,Y.Z.Yan g & R.D.Sen	Acta Mycologica Sinica	1991	China	Meiosis and behaviour of nuclei during basidiospore formation in *Volvariella volvacea*
139	Disease	Lok, C.L. and F. y. Tam etc	New Asia College Academic Annual	1975	Hong Kong	Comparative study on the chemical control for disease of cultuvated straw mushrooms
140	Culture	Madane, N.P., B.B. More & P.L.Patil	Res. J. Mahamatma Phule Agric Univ.	1974		Spawn production in paddy straw mushroom
141	Culture	Madane, N.P., & B.B. More	Res. J. mahamatma Phule Agr. Univ.	1974		Spawn production in paddy straw mushroom
142	Cultivation	Madane, C.	Res. J. Mahamatma Phule Agr. Univ.	1974		Spawn production in paddy straw mushroom

No.	Index	Author	Journal	Year	Country	Title
143	Cultivation	Mani, M.T. & T. marimuthu	Mushroom Research	1992	India	Utilization of *Pleurotus sp.* for decomposing coconut coirpith
144	Cultivation	Martine-Arrrera, D., S.T. Chang & S.N.Mok	Mex. Mik	1985	Hong Kong	Cultivation of edible mushroom *Volvariella volvacea* on three different composts in Hong Kong
145	Biochemistry	Mascarenhas, M	Mushroom Research	1994	India	Structure-activity characterization, a quick method to screen mushroom for the presence of antitumour glucans
146	Cultivation	Matiru, V.N. & T.H. Quimio	Mushroom Research	1992	Philippine	Enhancement of growth of *Volvariella volvacea* on sawdust
147	Culture	Milagros, A.R. etc.	Philipp. J. Sci.	1967	Philippine	A study on submerged culture production of banana mushroom as a source of protein, B-vitamin and food flavour
148	Nutrition	Misaki, A. & M. Nasu etc.	Agricultural and Biological Chemistry	1986		Comparison of structure and antitumour activity of polysaccharides isolated from Fukurotake, the fruiting body of *Volvariella volvacea*
149	Genetics	Mukherjee, M., and S. Sengupta	Applied and Environmental Microbiology	1986		Mutagenesis of protoplasts and regeneration of mycelium in the mushroom, *Volvariella volvacea*
150	Cultivation	Naidu, N.R.	The Planter	1971		Cultivation of padi straw mushroom (*Volvariella volvacea*) using oil palm bunch waste as medium
151	Nutrition	orillo, C.A. & A.R. Carangal	Philippine Agric.	1961	Philippine	Nitrogenous constituents of *Volvariella volvacea*
152	Cultivation	Park, Y.H. & H.G. Chang etc.	Korean J. Mycol	1974	Korea	Some experiments on the cultivation of straw mushroom, *Volvariella volvacea* in Korea
153	Cultivation	Park, Y. H. etc.	Korean J. of Mycology	1974	Korea	Some experiements on the cultivation of straw mushroom, *Volvariella volvacea* in Korea
154	Breeding	Pitakpaivan, P. etc.	Mushroom Sci. XIII Part I	1991	Thailand	Study on species of fungi associated with the cultivation of straw mushroom, *Volvariella volvacea* in Thailand
155	Physiology	Pruthi, J.S. & J.K. Manan etc	Indian Food Packer	1984	India	Improvement in whiteness and extension of shelf life of fresh and processed mushrooms (*Agaricus bisporus & Volvariella volvacea)*

No.	Index	Author	Journal	Year	Country	Title
156	Culture	Purkayactha, R.P., A.K. Das & Biswas	Taiwan Mushrooms	1981	Taiwan	Cultural practices and condition affecting production of paddy straw mushroom
157	Genetics	Quaye, J.	Mushroom J. for Tropics	1987		Evidence for haploidy of basdiospores of *Volvariella volvacea* from gamma radiation studies
158	Cultivation	Quimio T. H.	Mushroom Research	1993	Philippine	Indoor Cultivation of the straw mushroom *Volvariella volvacea*
159	Nutrition	Quimio, T.H.	Mushroom Newsletter for the Tropics	1981		Nutritional studies on *Volvariella volvacea*
160	Nutrition	Quimio, T.H.	Mushroom Newsletter for the Tropics	1981		Nutritional studies on *Volvariella volvacea*
167	Nutrition	Quimio, T.H.	Mushroom Newsletter for the Tropics	1981		Nutritional studies on *Volvariella volvacea*
168	Biology	Renolds, D.	Phil. Agric.	1967	Philippine	Taxonomic consideration II The Philippine *Volvariella volvacea*
169	Genetics	Royse, J.C. & W.E. Hints etc.	Experimental Mycology	1987	U.S.A.	Confirmation of intraspecific crossing and single and joint segregation of biochemical loci of *Volvariella volvacea*
170	Physiology	Samarawira, I.	Economic Botany	1979	Nigeria	A classification of the stages in the growth cycle of the cultivated paddy straw mushroom (*Volvariella volvacea*) and its commercial importance
171	Cultivation	San Antonio, J.P. & C. Fordyce Jr.	Hort. Science	1972		Cultivation of the paddy straw mushroom, *Volvariella volvacea*
172	Cultivation	Sands, W.M.	Malay. Agric. J.	1935	Malay	The padi straw mushroom in Kedah
173	Cultivation	Santiago	Mushroom Newsletter for the Tropics.	1982	Hong Kong	Production of *Volvariella volvacea* protoplasts by use of Trichoderma enzyme
174	Genetics	Santiago, C.M. Jr.	Mushroom Newsletter for the Tropics	1982		Production of *Volvariella volvacea* protoplasts by use of Trichoderma enzyme

No.	Index	Author	Journal	Year	Country	Title
175	Breeding	Santiago, C. M. Jr. etc	Philippine J. of Science	1991	Philippine	Strain improvement of selected species of edible fungi
176	Nutrition	Savita, G., V.P. Kapoor & S. Gupta	Vegetable Sci.	1990	India	Carbohydrate analysis of some edible mushroom
177	Biology	Shaffer, R. L.	Mycologia	1957		*Volvariella* in north America
178	Cultivation	Sharma S.R. & G. Yash etc.	National Bank News Review Bombay	1993	India	Mushroom production in India-a broad prospective
179	Culture	Sieh, C. & C.P. Chiang	Hort. China	1976	Taiwan	A study on the components evolution of cultural substance during the cultivation period of straw mushroom (*Volvariella volvacea*)
180	Nutrition	Somasundaram R. etc	Advances in Applied Microbiology	1992	India	Bioproteintialities of the basidiomacromycetes
181	Nutrition	Sone, Y. & S. Shibata etc.	J. of Nutrition Science and Vitaminology	1994	Japan	Alteration of beta-D-glucan from edible mushroom after injection into mouse peritoneal cavity
182	Cultivation	Su, U.T. & L.N. Seth	India Farming	1940		Cultivation
183	Cultivation	Su, U.T. & L.N. Seth	India Farming	1940	India	Cultivation of the straw mushroom
184	Cultivation	Su, U.T., & L.N. Seth	Indian Farming	1940	India	Cultivation of the straw mushroom
185	Genetics	Tanaka, K. & Chang, S. T.	J. Gen. Appl. Microbiol.	1972	Hong Kong	Cytoplasmic vesicles in the growing hyphae of the basidiomycete, *Volvariella volvacea*
186	Cultivation	Thomas, K.M. etc.	Madras Agric, J.	1943		Paddy straw mushroom
187	Cultivation	Tolentino, P.R.	Mushroom Sci. XI Part II P. 577-584	1981	Philippine	Mushroom culture utilizing tobacco waste

No.	Index	Author	Journal	Year	Country	Title
188	Cultivation	Tontyaporn, S.	Advanced Technology Assessment System	1992	Thailand	Open-field mushroom production in Thailand
189	Physiology	Tu, C.C., Y.H. Cheng & M.F. Hu	Taiwan Agric. Quart	1972	Taiwan	The effect of various types of sisal tow on fructification of straw mushroom
190	Physiology	Tu, C.C., Y.H. Cheng & M.F.Hu	Taiwan Agricultural Quarterly	1972	Taiwan	The effect of various types of sisal tow on fructification of straw mushroom
191	Nutrition	Tzeng, D.S.	Thesis of Chung Hsing, Taichung, Taiwan	1974	Taiwan	Studies on nutritional requirements and improvement techniques in cultivation of straw mushroom, *Volvariella volvace*
192	Nutrition	Ueda, S. & Y. Kuwabara	J. of the Japanese Society for Food Science and Technology	1991	Japan	Antimutagenic capacities of different of vegetable and mushroom
193	Cultivation	Vedder P.J.C. and M.J. Maher	Mushroom Sci. XIII Part II	1991	Indonesia	The biggest mushroom farm in the world
194	Cultivation	Vela, R.M. & C.D. martinez	Mushroom J. for the tropics	1989	Mexico	Cultivation of Volvariella bakeri and *Volvariella volvace* in Mexico
195	Cultivation	Vela, R.M. & C.D. Martinez	Thesis of Dept. Plant Pathology, Natl. Chung Hsing Univ., Taichung, Taiwan	1974	Taiwan	Studies on nutritional requirements and the improvement of techniques in cultivation of straw mushroom *Volvariella volvace*
196	Biochemistry	Wang, N.& S.T. Chang	Thesis of CUHK	1984	Hong Kong	Production of extracellular enzymes by Trichoderma species and their use for protoplast formation in *Volvariella volvacea*
197	Genetics	Wang, F.D. & X.F.Ye	Acta Agriculturae Shanghai	1992	China	Interspecific protoplast fusion of straw mushroom and behaviour of regeneration strain
198	Cultivation	Widiastuti, H. & D.H. Goenadi etc	Indonesian J. of Tropical Agriculture	1992	Indonesia	Utilisation of paper plant waste for straw mushroom (*Volvariella volvacea*) media
199	Cultivation	X. M. Yang	Agriculture Press, Beijing	1988	China	Cultivation method of Chinese mushroom

No.	Index	Author	Journal	Year	Country	Title
200	Cultivation	Yau,C.K. & Chang, S.T.	World Crops	1972	Hong Kong	Cotton waste for indoor cultivation of straw mushroom
201	Biochemistry	Yen, G.C.	J. of the Science of Food and Agriculture	1992	Taiwan	Effects of heat treatment and storage temperature on the biogenic amine contents of straw mushroom (*Volvariella volvacea*)
202	Physiology	Yong, Y.C. & K.M. Graham	Malay. Agric. Res.	1974		Studies on the padi mushroom (*Volvariella volvacea*)
203	Nutrition	Zakia, B., K.S. Srinivasan & N.S. Singh	J. food Sci. Technol.	1971		Essential amino acid composition of the proteins of a mushroom
204	Biochemistry	Zalhary, J.W. etc.	Food Chemistry	1984	Egypt	Cultivation and chemicl composition of the paddy-straw mushroom
205	Genetics	Zhang, Z.G., D.P.Li & F. Fang	Acta Scientiarum Naturalium Universitatis Normalis Hunanensis	1994	China	Studies on protoplasts technology of filamentous fungi.(V) Morphological observation of protoplasts fusion
206	Genetics	Zhao, J. & S.T. Chang	Thesis of CUHK	1994	Hong Kong	Isolation, identification and application of protoplast fusion products in edible mushroom

Cultivated Mushroom Species

Species	First Record Cultivated (ETS)	Country	Source
Agaricus blazei			Huang
Agaricus silvicola			Chang & Miles(1989)
Agaricus compestris			Chang & Mao(1995)
Agaricus bitorquis	1961		Singer(1961)
Agaricus bisporus	1600	France	Atkins(1979)
Agaricus arvensis			Chang & Miles(1989)
Agaricus perpurascens	1981		Brian, C. etc.(1981)
Agrocybe praecox			Chang & Miles (1989)
Agrocybe cylindracea	1950		Huang (1984)
Amanita ceasarea	1984	China	Zhu & Xie (1984)
Armillariella mellea	1983	China	Zhang & Lu (1983)
Auricullaria polytricha	1975		
Auricullaria auricula	600	China	So (659)
Auricullaria fuscossuccinea	1978	China	Lou, L.H. (1981)
Calocybe indica	1974		Purkayastha & Chandra
Collybia radicata	1983	China	Ji, D.G. et al. (1983)
Coprinus atramentarius	1979		
Coprinus comatus	1984		Wang & Kang (1984)
Coprinus micaceus	1979		
Coprinus fimetarius			Chang & Hays (1978)
Cordyceps militaris	1988	China	Yuan (1988)
Cordyceps sinensis	1990	China	
Coriolus versicolor		China	Chang & Mao (1995)
Corticium sulphureum	1987	China	
Dictyophora indusiata	1982	China	Lin et al (1982)
Dictyophore duplicata	1982	China	Lin et al (1982)

Species	First Record Cultivated (ETS)	Country	Source
Flammulina velutipes	800	China	Han (1590)
Ganoderma lucidum	1921	China	Wang (1621)
Ganoderma applanatum	1621	China	Wang (1621)
Ganoderma sinensis	1621	China	Wang (1621)
Ganoderma tenus	1621	China	Wang (1621)
Gloeostereum incarnatum	1989	China	Zhang et al.(1989)
Grifola umbellata		China	
Grifola frondosus	1983	China	Zhao & Yang (1983)
Hericium erinaceus	1960	China	Chen (1988)
Hericium coralloides	1984	China	Xu & Li (1984)
Hohenbuehelia serotina	1982	China	Liu & Guo (1982)
Hypholoma capnoides			Chang & Miles (1989)
Hypsizigus marmoreus	1973		Zhang & Wang (1992)
Kuehneromyces mutabilis			Chang & Hays (1989)
Lentinus javanicus	1985		
Lentinus edodes	1000	China	Wang (1313)
Lentinus lepideus	1986		
Lentinus tigrinus	1988	China	Wu & Wei (1988)
Lepiota rhacodes			Chang & Miles (1989)
Lepiota naucina	1981		Brian et al. (1981)
Lepista nuda	1981		Vaandrager, M. et al. (1981)
Lepista sordida			Chang & Mao (1995)
Lyophyllum ulmarium	1987	China	Wang & Zhang (1987)
Lyophyllum fumosum			Chang & Mao (1995)
Lyophyllum decastes	1979	Japan	Hashioka, Y. et al. (1979)
Macrolepiota procera	1981		Jandaik, C.L. (1981)
Macrolepiota zeyheri	1989		Eicker, J.C. et al (1989)

Species	First Record Cultivated (ETS)	Country	Source
Marasmius oreades			Chang & Miles (1989)
Morchella esculenta	1986		Ower et al. (1986)
Oudemansiella radicata	1982	China	Ji, D.J.et al. (1982)
Oudemansiella canarii	1979	Japan	Hashioka, Y. et al. (1979)
Panellus serotinus	1979		Hashioka, Y. et al. (1979)
Panus rudis			Chang & Mao (1995)
Peziza aurantia			Chang & Miles (1989)
Pholiota adipose	1983	China	
Pholiota nameko	1958		Kaga & Kondo (1958)
Pholiota aurivella	1979		Hashioka, Y. et al. (1979)
Pleurocybella porrigens			Chang & Mao (1995)
Pleurotus pulmonarius			Chang & Mao (1995)
Pleurotus cystidiosus	1969		Miller (1969)
Pleurotus abolonus	1985	China	Guo (1985)
Pleurotus flabellatus	1962		Bano & Srinvatava (1962)
Pleurotus florida	1958		Block et al. (1958)
Pleurotus sapidus	1973	China	
Pleurotus ostreatus	1900	Germany	Falck (1917)
Pleurotus ferulae	1958		Mou & Cao (1986)
Pleurotus corticatus	1985	China	
Pleurotus sajor-caju	1974	India	Jandaik (1974)
Pleurotus samoneostrineus	1992		
Pleurotus citrinopileatus	1981	China	Shen (1981)
Pleurotus cornucopiae	1979	Japan	Hashioka et al. 1979
Pleurotus rhodophyllus			Chang & Miles (1989)
Poria cocos	1232	China	Zhou (1232)
Schizophyllum commune	1960		

Species	First Record Cultivated (ETS)	Country	Source
Sparassis crispa	1985		Sun et al. (1985)
Stropharia cubensis	1989		Thielke, C. (1989)
Stropharia rugosoannulata			Chang & Hays (1978)
Termitomyces sp.	1993	China	
Tremella fuciformis	1800	China	Chen (1983)
Tremella mesenterica	1985	China	Liu (1985)
Tremella aurantia	1986	China	Rong et al. (1986)
Trichoderma gambosum	1991	China	Tian & Yang (1991)
Tricholoma lobayense	1990		Ganeshan (1990)
Tricholoma mongolicum	1991	China	Tian & Yang (1991)
Volvariella bombycina	1984		
Volvariella diplisia	1968		
Volvariella speciosa	1968		
Volvariella volvacea	1700	China	Yuen (1822)

Cultivation Condition and Management of Commercial Important Mushroom Species

Species	Substrate	Temperature range		Production cycle time	Yield	Remarks
		Mycelial growth	Fruiting			
Lentinus edodes	Wood logs, Sawdust, Cotton waste	5-35 (24)	6-25 (15) autumn (10)winter (20)spring	3-6 yr spring/autumn	40	Temperature shock for fruiting
Auricularia auricula	Wood logs, Sawdust, Cotton waste	15-34 (28)	15-28 (22-25)	2-5 yr spring/autumn	2-12	
Auricularia polytricha	Wood logs, Sawdust, Cotton waste	10-36 (20-34)	15-28 (24-27)	1-2 yr spring/autumn	20-40	
Tremella fuciformis	Wood logs, Sawdust, Cotton waste	5-38 (25)	20-28 (20-24)	3-6 yr 7 months/yr	10-30	
Pleurotus sajor-caju	Sawdust, Cotton waste, Rice straw, Corn waste	5-35 (25-27)	10-26 (19-21)	4-10 weeks	80-100	
Pleurotus ostreatus	Sawdust, Cotton waste, Rice straw, Corn waste	5-35 (25)	8-22 (12-20)	4-10 weeks	80-100	
Agaricus bisporus	Composted cereal straw/ animal manure mixtures	3-32 (22-25)	9-22 (15-17)	14-16 weeks	65-80	Long Composting process
Agaricus bitorquis	Composted cereal straw/ animal manure mixtures	3-35 (18-30)	18-25 (22-24)	14-16 weeks	40-65	Long composting process
Volvariella volvacea	Rice straw, Cotton waste	15-45 (32-35)	22-38 (28-32)	4-6 weeks (outdoor) & 2-3 weeks (indoor)	6-10 (outdoor) & 30-45 (indoor)	Some pretreatment for substrate

a: Kg Fresh weight/kg d.m. ; b: Figures within parentheses are optimal values

Production of edible mushroom species under commercial cultivation in some countries (1991, fresh weight, MT)

Country	*Agaricus*	*Lentinus*	*Pleurotus*	*Volvariella*	*Auricularia*	*Flammulina*	Other	Total
Austria	2610	-	-	-	-	-	-	2, 610
Australia	25, 510	10	-	-	-	-	10	25, 530
Belgium	30, 000	-	-	-	-	-	-	30, 000
Bulgaria	4, 000	-	-	-	-	-	-	4, 000
Canada	53, 100	150	-	-	-	-	-	53, 250
China	170, 000	340, 000	800, 000	150, 000	440, 000	80, 000	265, 800	2, 245, 800
Czechoslovakia	2, 500	-	500	-	-	-	-	3, 000
Denmark	8, 000	-	-	-	-	-	-	8, 000
France	231, 000	1, 000	-	-	-	-	-	232, 000
Germany	56, 000	100	-	-	-	-	-	56, 100
Greece	2, 000	-	-	-	-	-	-	2, 000
Holland	165, 000	350	-	-	-	-	-	165, 350
Hungary	18, 000	5	2, 500	-	-	-	-	20, 505
India	6, 000	-	600	400	-	-	-	7, 000
Indonesia	20, 000	-	15, 000	35, 000	10, 000	-	-	80, 000
Ireland	42, 000	-	-	-	-	-	-	42, 000

Continued

Italy	102, 000	-	-	-	-	-	-	102, 000
Japan	2, 700	149, 000	33, 475	-	160	92, 255	58, 840	336, 430
Mexico	10332	-	360	-	-	-	-	10, 692
New Zealand	6, 900	11	-	-	-	-	-	6, 911
Philippines	800	50	500	800	120	-	-	2, 270
Poland	65, 000	-	-	-	-	-	100	65, 100
Spain	62, 500	-	-	-	-	-	5, 000	67, 500
Switzerland	6, 050	50	-	-	-	-	-	6, 100
S. Africa	4, 680	-	-	-	-	-	-	4, 680
S. Korea	8, 990	12, 327	51, 782	-	-	350	1, 349	74, 798
Taiwan	6, 500	21, 000	3, 500	3, 000	2, 000	14, 000	1, 000	51, 000
Thailand	6, 000	150	7, 000	63, 000	4, 000	-	3	80, 153
U.K.	118, 000	-	-	-	-	-	-	118, 000
U.S.S.R.	2, 000	-	-	-	-	-	-	2, 000
U.S.A.	341, 830	1, 841	695	-	-	-	351	344, 717
Yugosolavia	5, 000	-	-	-	-	-	-	5, 000
others	5, 170	50	1, 500	400	50	120	2, 500	9, 790
Total	1, 590, 172	526, 094	917, 412	252, 600	465, 330	186, 725	334, 953	4, 273, 286

The World Production of *Agaricus bisporus* (1994, fresh weight, Tones)

Country	Production
Australia	32. 000
Belgium	30. 000
Canada	54. 000
China	23, 0000
Denmark	7. 500
France	180. 000
Germany	60. 000
Hungary	24. 000
India	21, 000
Ireland	42, 000
Italy	115, 000
Netherlands	210, 000
New Zealand	
Poland	60, 000
South Africa	11000
Spanish	70, 000
U.K.	97, 000
U.S.A.	370. 000

Mushroom Research Institutes

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Mushroom Research Institutes

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