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## Contents

### Articles

- Demographics, Development, and the Environment in Tibetan Areas (8 pages)  
– Kenneth Bauer and Geoff Childs
- Tibetan Fertility Transitions: Comparisons with Europe, China, and India (21 pages)  
– Geoff Childs
- Conflict between Nomadic Herders and Brown Bears in the Byang thang Region of Tibet (42 pages)  
– Dawa Tsering and John D. Farrington
- Subsistence and Rural Livelihood Strategies in Tibet under Rapid Economic and Social Transition (49 pages)  
– Andrew M. Fischer
- Biodiversity Conservation and Pastoralism on the Northwest Tibetan Plateau (Byang thang): Coexistence or Conflict? (21 pages)  
– Joseph L. Fox, Ciren Yangzong, Kelsang Dhondup, Tsechoe Dorji and Camille Richard
- Nomads without Pastures? Globalization, Regionalization, and Livelihood Security of Nomads and Former Nomads in Northern Khams (40 pages)  
– Andreas Gruschke
- Political Space and Socio-Economic Organization in the Lower Spiti Valley (Early Nineteenth to Late Twentieth Century) (34 pages)  
– Christian Jahoda
- South Indian Tibetans: Development Dynamics in the Early Stages of the Tibetan Refugee Settlement Lugs zung bsam grub gling, Bylakuppe (31 pages)  
– Jan Magnusson, Subramanya Nagarajarao and Geoff Childs
- Temporary Migrants in Lha sa in 2005 (42 pages)  
– Ma Rong and Tanzen Lhundup
- Exclusiveness and Openness: A Study of Matrimonial Strategies in the Dga' Idan pho brang Aristocracy (1880-1959) (27 pages)  
– Alice Travers

- The Mushrooming Fungi Market in Tibet Exemplified by *Cordyceps sinensis* and *Tricholoma matsutake* (47 pages)  
– Daniel Winkler
- Interpreting Urbanization in Tibet: Administrative Scales and Discourses of Modernization (44 pages)  
– Emily T. Yeh and Mark Henderson

## **Text Translation, Critical Edition, and Analysis**

- The Sweet Sage and *The Four Yogas*: A Lost Mahāyoga Treatise from Dunhuang (67 pages)  
– Sam van Schaik

## **A Note from the Field**

- Population, Pasture Pressure, and School Education: Case Studies from Nag chu, TAR, PRC (21 pages)  
– Beimatsho

## **Book Reviews**

- Review of *A History of Modern Tibet, Volume 2: The Calm before the Storm, 1951-55*, by Melvyn C. Goldstein (10 pages)  
– Matthew Akester
- Review of *Rulers on the Celestial Plain: Ecclesiastic and Secular Hegemony in Medieval Tibet. A Study of Tshal Gung-thang*, by Per K. Sørensen and Guntram Hazod, with Tsering Gyalbo (7 pages)  
– Bryan J. Cuevas

## **Abstracts**

## **Contributors to this Issue**

# The Mushrooming Fungi Market in Tibet

## Exemplified by *Cordyceps sinensis* and *Tricholoma matsutake*<sup>1</sup>

Daniel Winkler

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**Abstract:** *The collection of wild edible fungi has a long-standing history in Tibet. Today, a wide variety of mushrooms is collected to supplement rural income. Because of the lucrative economic return, rural Tibetans have increased their gathering activities substantially. Matsutake (*Tricholoma matsutake*) is the most important culinary mushroom in Nying khri (Linzhi) and southern Chab mdo (Changdu) Prefectures. This article will present data on matsutake distribution in the Tibet Autonomous Region, production level, and harvest value at the county level as well as typical seasonal activity typified by two collectors. The trade of Dbyar rtswa dgun 'bu (dongchong xiacao), as Tibetans know caterpillar fungus (*Cordyceps sinensis*), has developed into the main source of income in rural Tibet. It accounts for 40 percent of rural cash income and is spurring a globally unique commodification of fungi in the TAR. In late 2007 the value of the best-quality Dbyar rtswa dgun 'bu in Lha sa (Lasa) traded for around CN ¥80,000 (nearly US \$12,000) per pound. The value of the fifty-ton annual harvest of *Cordyceps* surpassed the value of the industry and mining sector in 2004. Most county agencies have established a permit system and require collectors to obtain licenses. The ever-growing economic importance of these fungi raises concerns regarding sustainability of current harvest levels. There are scientific studies regarding matsutake that conclude that when using appropriate harvesting techniques sustainability should be guaranteed. However, the situation regarding *Cordyceps**

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<sup>1</sup> The Beijing-based China's Tibet Research Institute sponsored the fieldwork in the TAR in 2005. This article integrates findings of this collaboration. Special thanks go to *Luorong Zhandui* and *Dawa Ciren*, who enabled research in remote sites in the TAR. Without *Luorong's* support, it would not have been possible to acquire much of the administrative data presented. Jakob Winkler translated the Dbyar rtswa dgun 'bu (*dongchong xiacao*) text by Mnyam nyid rdo rje (1439-75) from Tibetan into English. In addition, I want to acknowledge all the other researchers who shared their knowledge and provided valuable advice as well as my Tibetan counterparts who supported me researching Tibet's wild economically crucial mushrooms. Also, I am grateful to all the collectors and dealers who freely shared their knowledge and data.

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*sinensis* is not clear. Although current harvest figures are at historically unmatched levels, areas in which caterpillar fungus has been collected for centuries still seem to sustain good resources.

## Introduction

In recent years ecosystem-sourced products such as wild medicinal and aromatic plants or plant parts (MAP), edible and medicinal mushrooms, roots and berries, as well as industrial raw materials (fiber from barks, resins and latex), have received increased worldwide attention, including reports focusing on Asia.<sup>2</sup> In industrialized countries the commercial use of ecosystem-sourced products<sup>3</sup> has been well established but it has received little attention from researchers until fairly recently. In developing countries this sector was frequently overlooked due to its informal nature, often being integrated in traditional subsistence production systems or collection aimed at local markets. In addition, much of the collection has been and is still being carried out by poor rural communities, women, and landless people.

Development planners, ecologists, anthropologists, community developers, government agencies, and NGOs have realized the economic and cultural importance of these ecosystem-sourced products to local people who have access to forest ecosystems from the rainforest to the taiga and from tropical savannas to high-alpine grasslands. The development of this sector in order to generate an additional cash income for local communities has raised commercial expectations in many communities.

Dealing with wild economic fungi in Tibet,<sup>4</sup> it becomes apparent that the context in which these products collected from the wild are grouped and dealt with in current research are not well suited. Much of this research is published under the acronyms NWFP and NTFP (non-wood forest products and non-timber forest products, respectively). Both NWFP and NTFP describe forest products other than lumber and also include a wide range of non-fungus resources.<sup>5</sup> Both acronyms

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<sup>2</sup> For example, Paul Vantomme, Annu Markkula, and Robin N. Leslie, eds., *Non-Wood Forest Products in 15 Countries of Tropical Asia: An Overview*, EC-FAO Partnership Programme (Rome: FAO, 2002), 1-188, <http://www.fao.org/docrep/005/ab598e/ab598e00.htm>.

<sup>3</sup> Ecosystem-sourced products in Tibet also include several wildlife-derived products such as musk extracted from musk deer (*Moschus crinitus*/*Moschus sifanicus*, *Moschus berezovskii*) and used as medicine and aroma, antlers from McNeill's deer (*Cervus elaphus macneilli*) and white-lipped deer (*Cervus albostris*) and gall bladders from Tibetan black bear (*Ursus selenarctos tibetanus*) and Asian brown bear (*Ursus arctos*).

<sup>4</sup> "Tibet" describes the Tibetan cultural area, more or less equivalent to the Tibetan Plateau, including Tibetan Autonomous areas in Qinghai, Sichuan, Yunnan, and Gansu Provinces, whereas "TAR" refers to the Tibet Autonomous Region (Chinese: Xizang), which comprises about 40 percent of the Tibetan cultural area.

<sup>5</sup> See, for example N. K. Bhattarai, "Biodiversity – People Interface in Nepal," in *Medicinal Plants for Conservation and Health Care*, Non-Wood Forest Products no. 11 (Rome: FAO, 1995), <http://www.fao.org/docrep/W7261E/W7261e10.HTM>; S. A. He and N. Sheng, "Utilization and Conservation of Medicinal Plants in China," in *Medicinal Plants for Conservation and Health Care*, Non-Wood Forest Products no. 11 (Rome: FAO, 1995), <http://www.fao.org/docrep/W7261E/W7261e13.htm>; Zhang Jinfeng, Wang Wenbing, and Geng Yunfen, "A Case Study on the

exclude wild-crafted products collected from non-forested ecosystems. Wide areas of the Tibetan Plateau are devoid of forests. Alpine grassland ecosystems provide a great variety of wild medicines, aromatics, and foods that are currently much more valuable than forest-derived products. In addition, these grassland-derived fungi and medicinal plants are in cash terms at least as economically important as traditional livestock products (butter, milk, yogurt, meat, wool, and hides), which are the backbone of the traditional rural Tibetan economy. The alpine grasslands provide habitat for Dbyar rtswa dgun 'bu, as Tibetans know caterpillar fungus (*Cordyceps sinensis*), which is by far the most profitable wild-crafted product in Tibet, and other fungi, besides many non-fungus resources such as *Fritillaria* bulbs, *Rhodiola* roots, as well as *Gentiana* and *Saussurea* plants. Winkler suggested the term “non-livestock rangeland products” or NLRP to address the resources in this habitat.<sup>6</sup> Boa, in his global inventory on edible fungus resources,<sup>7</sup> refers to all wild collected mushrooms as WEFs – wild edible fungi, skillfully avoiding a specific reference to the source ecosystem. However, “edible” defines too narrowly the fungus resources in Tibet, which in addition to typical edible fungi like *matsutake* include medicinal fungi like *Cordyceps* and *Ganoderma* (*lingzhi*, a wood conk). Conks are not consumable as food but require grinding or decoction, and *Cordyceps*, though edible, is rather taken as medicine. Thus, in this context the more conclusive acronym WUF, “wild useful fungi,” will be used.

With the advent of a cash economy, the collection and trade of economic fungi and plants has significantly increased and thus has developed into a keystone economy for rural Tibet. It offers access to important cash income which is otherwise very limited for rural households still practicing traditional subsistence herding and farming with low cash return. Whereas the immense central government investments have fuelled a booming new economy in urban Tibet, rural economic development has not kept pace. Also, rural Tibetans face serious challenges to successfully competing with Chinese migrants in many sectors. Much of the central government investment targets development of urban economies and communication infrastructure, such as roads, tunnels, trains, and airports. However, these investments provide very limited tangible benefits for rural households, which have neither the economic resources nor the skills to participate in the urban economy.

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Exploitation and Management of NTFP in Shirong Village of Xiaruo Township in Deqing County,” in *The International Seminar on NTFP, Yunnan* (Yunnan: Yunnan University Press, 2001), [http://www.mekonginfo.org/mrc\\_en/doclib.nsf/0/4DF3BAFD4FB10F4947256B420029A216/\\$FILE/FULLTEXT.html](http://www.mekonginfo.org/mrc_en/doclib.nsf/0/4DF3BAFD4FB10F4947256B420029A216/$FILE/FULLTEXT.html); Paul Vantomme, Annu Markkula, and Robin N. Leslie, eds., *Non-Wood Forest Products*; Eric Boa, *Wild Edible Fungi: A Global Overview of Their Use and Importance*, Non-Wood Forest Products no. 17 (Rome: FAO, 2004), 1-147, <http://www.fao.org/docrep/007/y5489e/y5489e00.htm>; Daniel Winkler, “Forest Use and Implications of the 1998 Logging Ban in the Tibetan Prefectures of Sichuan: Case Study on Forestry, Reforestation and NTFP in Litang County, Ganzi TAP, China,” in *The Ecological Basis and Sustainable Management of Forest Resources*, Informatore Botanico Italiano no. 35, Supplement 1 (Florence: Societa Botanica Italiana, 2003), 116-25.

<sup>6</sup> Daniel Winkler, “Yartsa Gunbu (*Cordyceps sinensis*) and the Fungal Commodification of Tibet’s Rural Economy,” *Economic Botany* 62, no. 3, Special on mushrooms, ed. D. Arora (2008).

<sup>7</sup> Boa, *Wild Edible Fungi*.

However, rural Tibetans have the right skills and knowledge to benefit from the collection of mushrooms and herbs. Their traditional knowledge of the environment and where and when to find these natural resources is crucial in this regard. In addition, their capacity to collect in adverse conditions and, when necessary, to camp in extreme conditions, is an important qualification for success. Furthermore, current policies support the engagement of local Tibetans in this industry.

To date, no research has been published on edible mushroom markets in the Tibet Autonomous Region (TAR) itself, although there are several English-language studies<sup>8</sup> concerning economic mushrooms that focus on or include the Tibetan areas in Yunnan's Bde chen (Diqing) Tibetan Autonomous Prefecture (TAP) and Sichuan's Dkar mdzes (Ganzi) TAP. In addition, the author has published a study on the *Cordyceps sinensis* market in the TAR.<sup>9</sup> The current article will present in detail the two economically dominant WUF in the TAR: Dbyar rtswa dgun 'bu (*Cordyceps sinensis*) and Be shing sha mo (*Tricholoma matsutake*). Furthermore, other WUF of commercial relevance in the TAR will be outlined.

## Methodology

Most data presented in this paper were collected during a June 2005 research project in cooperation with *Luorong Zhandui*, assisted by Dawa Tsering, both from the China Tibetology Research Center in Beijing. Semi-structured interviews were carried out with mushroom collectors and dealers on site and within the TAR prefectures of Nying khri (Linzhi), Chab mdo (Changdu), and Nag chu (Naqu) as well as in TAR offices in Lha sa. In addition, data and information was obtained by interviewing officials from relevant departments (forestry, agriculture and animal husbandry, township enterprise, commerce, poverty alleviation, and so forth) in the above-mentioned administrative units.<sup>10</sup> A total of fifty-five individuals were interviewed in 2005 and another thirty-five in June and July of 2006.

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<sup>8</sup> Lu Rongsen, "Enterprises in Mountain-specific Products in Western Sichuan, China," *MEI Discussion Paper* 98, no. 7 (Kathmandu: ICIMOD, 1998), 51; Yang Zhanchang, ed., *A Guide to Investment in Ganzi TAP* (Kangding: Foreign Investment Bureau of Ganzi Prefectural People's Government, 1999), 32; Emily Yeh, "Forest Claims, Conflicts and Commodification: The Political Ecology of Tibetan Mushroom-harvesting Villages in Yunnan Province, China," *China Quarterly* 161 (2000), 264-78; Winkler, "Forest Use"; Daniel Winkler, "Matsutake Mycelium under Attack in SW China: How the Mushrooming Trade Mines Its Resource and How to Achieve Sustainability" (2004), [http://danielwinkler.com/matsutake\\_conservation\\_in\\_sw\\_china.htm](http://danielwinkler.com/matsutake_conservation_in_sw_china.htm); Daniel Winkler, "Yartsa Gunbu – *Cordyceps sinensis*: Economy, Ecology & Ethno-mycology" (2005), <http://danielwinkler.com/id71.htm>; Yang Xuefei, He Jun, Li Chun, Ma Jianzhong, Yang Yongping, and Xu Jianchu, "Management of Matsutake in NW-Yunnan and Key Issues for Its Sustainable Utilization," in *The Sustainable Harvest of NTFP in China*, ed. E. Kleinn, Yang Yongping, H. Weyerhaeuser, and M. Stark, Proceedings NTFP Sino-German Symposium (Kenya: ICRAF, 2006), 48-58; Wang Lan and Yang Zhuliang, "Wild Edible Fungi of the Hengduan Mountains, SW China," in *The Sustainable Harvest of NTFP in China*, 58-65.

<sup>9</sup> Winkler, "Yartsa Gunbu Fungal Commodification."

<sup>10</sup> I was told by several county officials that most WUF data is collected by rural officials at the township (*shang, xiang*) level and is then passed up to the county level. To verify this statement I asked some collectors if officials register collection quantities. This was confirmed by some interviewees, but others were never asked.

Interviews were carried out in Mandarin and/or Tibetan according to the interviewee's preference. The author was assisted by *Luorong Zhandui* and Dawa Tsering and by trilingual Tibetan interpreters. Dealers and collectors were chosen randomly at collection sites and in mushroom markets. Additional information was collected by the author during eighteen other missions to Tibet since 1997, while carrying out work-related research regarding rural income generation, forestry, non-timber forest products, non-livestock rangeland products (NLRP), and other natural resources. Western, Tibetan, and Chinese sources were also used to integrate research data and draw a more complete picture of the fungus trade of contemporary rural Tibetans. Mushroom species reported were observed in trade and identified by the author and double-checked in regional fungus literature.<sup>11</sup>

## Fungus Resources in Tibet

The collection of medicinal and culinary fungi has a long-standing history in Tibetan culture. Beginning centuries ago, WUF were not only collected for direct consumption or local markets within Tibet but also for export to China. China has historically sourced and is still sourcing from Tibet many of the alpine medicinal plants and fungi used in Traditional Chinese Medicine (TCM) as well as WUF from the TAR and the other Tibetan autonomous areas in Sichuan, Yunnan, Qinghai, and Gansu Provinces.

Table 1 presents the most important WUF classified by economic importance in Tibet. Since *Cordyceps sinensis* alone constitutes over 95 percent of the market by value, it is in its own class. In Lha sa it traded for ¥24,000-¥72,000 (\$3,000-9,000, €2,400-€7,200)<sup>12</sup> per kilogram in 2006. *Cordyceps* is also the most widely distributed economic fungus since it occurs on the vast grasslands and alpine pastures, the most widespread ecosystem on the plateau. Class two are the two other main WUF exported abroad: *matsutake* (*Tricholoma matsutake*), mostly for export to Japan, and several morels,<sup>13</sup> most of which are exported to Europe. Generally speaking, both these WUF fetch in the range of ¥40-120 (\$5-12.5) per kilogram for fresh product. While the price of morels is quite stable, the price of *matsutake* fluctuates more. Exceptional quality (determined first and foremost by an unopened cap still protected by the partial veil, size, and light color) and first

<sup>11</sup> Dai Xiancai et al., *Sichuan Zhen Ganzi Zhou Jun Leizhi* [Mushroom Key of Ganzi Prefecture] (Chengdu: Sichuan Chishu Chubanshe, 1994; Mao Xiaolan, Jiang Changpin, and Otsu Tsewang, *Economic Macrofungi of Tibet* (Beijing: Beijing Science and Technology Publishing House, 2000), 1-652 (in Chinese); Wang X.-H., Liu P. G., and Yu F. Q., *Color Atlas of Wild Commercial Mushrooms in Yunnan* (Kunming: Yunnan Science and Technology Press, 2004); and Yuan M. S. and Sun P. Q., eds., *Sichuan Mushroom* (Chengdu: Sichuan Science and Technology Press, 1995), 1-735 (in Chinese).

<sup>12</sup> ¥10 is valued at roughly €1. Since the conversion into euros is a simple calculation, *yuan* will only be converted into US dollars from here onwards.

<sup>13</sup> Morel taxonomy is in need of revision. Chinese sources (see above) list among others *Morchella esculenta* and *Morchella conical/Morchella elata*. For a description of the trade of *khu khu sha mo* (as Tibetans refer to morels) in Tibetan areas, see Daniel Winkler, "The Return of the Cuckoo or Morels in Tibet," *Mushroom – The Journal of Wild Mushrooming* 25, no. 4 (2007), 5-8. Note that in dialects spoken in Kong po and Khams, the pronunciation of *khu khu sha mo* is closer to "gugu shamo."



fruiting of the season can drive prices to ¥500 per kilogram and higher, whereas an exceptional bumper crop can reduce prices to ¥10 per kilogram.



Photo 1: Tibetan mushroom collector with king bolete (*Boletus edulis*). Cha phreng (Xiangcheng) County, Dkar mdzes TAP, Sichuan Province, July 2007. Photo: Daniel Winkler.

Class three includes the main economic fungi destined for the Chinese market; these are only exported from China on a limited scale. Some of these mushrooms are, in terms of quantity and ubiquitous availability, the most important WUF. Examples are Zang's knight (*Tricholoma zangii*),<sup>14</sup> Hawkwing (*Sarcodon imbricatus*), and Wood ear (*Auricularia auricula*), but since they are mostly consumed within China, their value is much lower. In the case of *Boletus edulis* (see Photo 1), which is one of the most important WUF on the global market, the quality of Chinese boletes currently seems to be regarded as inferior to international standards. Class Three mushrooms usually trade fresh for ¥8-40 (\$1-5). Class Four is comprised by WUF which are not exported from China and

are sometimes only locally traded. An example is *Floccularia luteovirens*,<sup>15</sup> known as Ser sha (*huanghuan jun*), one of Tibet's most famous mushrooms. Class Four mushrooms usually trade for ¥2-8 (\$0.25-1), which is roughly one-tenth of the value of the prime export Class Two WUF. Table 1 also indicates for each WUF the main markets, main use, and typical habitat.

**Table 1: Economically Important Wild Edible Fungi in Tibet**

Scientific Name	English Name <sup>16</sup>	Economic Importance	Market	Main Use	Habitat
<i>Cordyceps sinensis</i>	caterpillar fungus	1	C,T,Ex	M	G

<sup>14</sup> Formerly *Tricholoma quercicola*; see Z. M. Cao, Y. J. Yao, and D. N. Pegler, "Tricholoma zangii, a New Name for *T. quercicola* M. Zang," *Mycotaxon* 85 (2003): 159-64.

<sup>15</sup> Ser sha (*huanghuan jun*), "the golden mushroom," which, according to Zhang Guangya, ed., *Zhongguo Changjian Shiyong Jun Tujian* [Illustration for China Popular Edible Mushroom] (Kunming: Yunnan Science Publishing House, 1999), is *Armillaria luteovirens*. I brought back several specimens for identification by Dr. Tom Volk, but he could only confirm the genus as being part of *Armillaria/Floccularia*. In Europe and North America *Armillaria/Floccularia luteovirens* grows as an ectomycorrhizal species living in symbiosis with trees. In Tibet, it could live root-associated with ubiquitous *Polygonum bistortum* and *Kobresia* sedges, the latter of which dominates alpine grasslands.

<sup>16</sup> Some English names are based on E. M. Holden, "Recommended English Names for Fungi in the UK." Report to the British Mycological Society, English Nature, Plantlife, and Scottish Natural Heritage (2003), [http://www.britmycolsoc.org.uk/files/English\\_Names.pdf](http://www.britmycolsoc.org.uk/files/English_Names.pdf).

<i>Tricholoma matsutake</i>	matsutake	2	Japan,C	C	F
<i>Morchella esculenta</i>	morel	2	EU,C	C (M)	F
<i>Morchella conica/elata</i>	morel	2	EU,C	C (M)	F
<i>Amanita hemibapha</i> <sup>17</sup>	Caesar's mushroom	3	C,T	C	F
<i>Auricularia auricula</i>	wood ear	3	C,T	C	F
<i>Boletus edulis</i> group	king bolete	3	C,T,Ex	C	F
<i>Rozites/Cortinarius emodensis</i>	Tibetan gypsy	3	C,T	C	F
<i>Dictyophora indusiata</i>	basket stinkhorn	3	C,T	C	wF
<i>Ganoderma lucidum</i>	lacquered bracket	3	C,T	M	F
<i>Lentinula edodes</i>	shitake	3	C,T	C,M	F
<i>Sarcodon imbricatus</i>	hawkwing	3	C,T	C	F
<i>Termitomyces striatus</i>	termite mushroom	3	C,T	C	wF
<i>Tricholoma cf saponosum</i>	soap knight	3	C,T	C	F
<i>Tricholoma zangii</i>	Zang's knight	3	C,T	C	F
<i>Agaricus</i> spp.	button mushrooms	4	T	C	F/G
<i>Agaricus campestris</i>	field mushroom	4	T	C	G
<i>Amanita vaginata</i> group	grisettes	4	C,T	C	F
<i>Boletus</i> spp.	boletes	4	C,T	C	F
<i>Cantharellus cibarius</i>	chanterelle	4	C,T	C	F
<i>Cantharellus minor</i>	chanterelle	4	C,T	C	F
<i>Floccularia luteovirens</i>	golden mushroom	4	C,T	C	G
<i>Hericium erinaceous</i>	lion's mane	4	C,T	C	F
<i>Hydnum repandum</i>	hedgehog	4	C,T	C	F
<i>Hygrophorus russula</i>	brittle gill waxcap	4	C,T	C	F
<i>Lactarius</i> spp.	milkcaps	4	C,T	C	F
<i>Leccinum</i> spp.	scaly boletes	4	C,T	C	F
<i>Lycoperdon</i> spp.	puffball	4	T	C,M	G
<i>Paxillus involutus</i>	brown rollrim	4	T	C	F
<i>Ramaria</i> spp.	corals	4	C,T	C	F
<i>Rozites caperata</i>	gypsy	4	C,T	C	F

<sup>17</sup> *Amanita hemibapha* and also *A. hemibapha* var. *ochracea* is an *A. caesarea sensu lato*. There have been a range of names suggested for edible yellowish gilled and orange, red, and brownish capped *Amanitas* in the southeastern Tibetan Plateau region.

<i>Russula</i> spp.	brittlegills	4	C,T	C	F
<i>Suillus</i> spp.	slippery jacks	4	C,T	C	F

## ABBREVIATIONS

**Market:** C = China (other than Tibetan areas), T = Tibet, EU = Europe, Ex = Export including East Asia, North America, and Europe.

**Main Use:** C = culinary, M = medicinal.

**Habitat:** F = forest, wF = only in warm-temperate & subtropical forest, G = grasslands

## Matsutake

In the TAR, nearly all communities with access to sclerophyllous oak forests collect *matsutake* now. They are distributed in valleys in Nying khri and Chab mdo Prefectures of the TAR (see Fig. 1) and the Tibetan Autonomous Prefectures (TAP) of Dkar mdzes and Rnga ba (Aba) in Sichuan as well as Bde chen TAP in Yunnan. The mushroom is ecto-mycorrhizal; it grows in root-association with evergreen oaks (*Quercus* spp.),<sup>18</sup> which can grow as high as the treeline at 4600 meters in southeast TAR, although *matsutake* grow only below 3500–4000 meters. Oaks growing in the Tibetan areas are usually secondary canopy trees under conifers on mostly very steep, south-facing slopes. However, in many valleys conifers were removed for timber and firewood or eliminated by fire. On these sites, oak stands occur without the potential spruce, fir, or pine top canopy. Oaks are very resilient to impact; after forest fire or cutting, oaks regenerated from the rootstock. Close to villages, oaks are managed in coppice, cut periodically for firewood. Today, many villages try to minimize impact in their oak forests. To date, oaks have not been commercially logged for lumber or flooring.



Photo 2: A Tibetan woman holding a large *matsutake* (*Tricholoma matsutake*). In the background is a pile of fresh mushrooms for export to Japanese markets. Photo: Daniel Winkler.

<sup>18</sup> In warm temperate Yunnan, *Tricholoma matsutake* also grows with pines, as it does in Japan and northeast China. In Japanese, “*matsutake*” means “pine mushroom,” and both these terms are commonly used in English.

Matsutake (*Tricholoma matsutake*, Photo 2) is economically the most valuable true mushroom<sup>19</sup> in Tibet due to the demand for *matsutake* from Japan, to which most production is exported. Japanese import of *matsutake* from Tibetan areas commenced in the mid-1980s and moved quickly from dried and preserved mushrooms to fresh mushrooms,<sup>20</sup> a much more lucrative business. Export to Japan skyrocketed in the early 1990s. However, economic collection of *matsutake* dates back long before direct Japanese imports. For example, according to “Forestry History of Ganzi TAP,”<sup>21</sup> between 1909 and 1912 ten tons of *matsutake* at a total value of four hundred kilograms of silver were exported from Kangding (Tib. Dar rtse mdo, the contemporary capital of Dkar mdzes TAP, Sichuan). For the early 1990s, Liu reported an annual production of over seventy-five tons of *matsutake* in Dkar mdzes TAP.

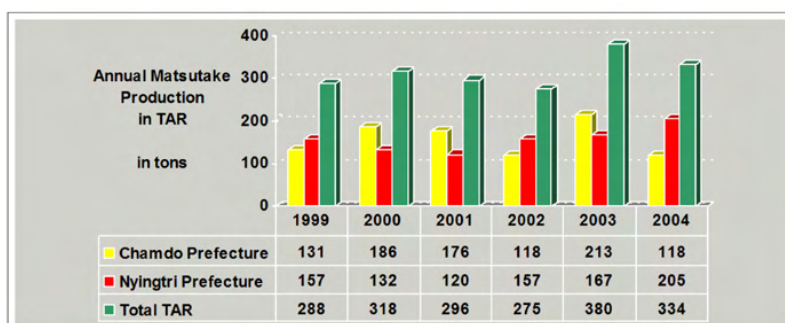


Figure 1: Official Matsutake Production in the TAR, 1999-2004.<sup>22</sup>

In the TAR all *matsutake* harvest is in Nying khri and Chab mdo Prefecture, with the exception of a negligible amount (0.37 ton in 2004) collected in Lha ri (Jiali Xian) County in southeastern Nag chu Prefecture. Between 1999 and 2004 official average annual production was around 315 tons in the TAR. For comparison, 2005 annual production in Bde chen TAP (Yunnan) was 611 tons, and Yunnan Province’s total export was thirteen-hundred tons<sup>23</sup> (Yunnan is China’s leading *matsutake* producing and exporting province). However, most of Chab mdo’s production, especially the Markham County (*smar khams rdzong*, *mangkang xian*) harvest (eighty tons in 2004), is exported through Gyeltang County (*rgyal thang rdzong*; the Chinese name is Xianggelila – that is, Shangri-la – although

<sup>19</sup> *Tricholoma* belongs to the phylum *Basidiomycota* (“true mushrooms”), which includes most culinary mushrooms. Notable exceptions are morels and truffles, which are classified with *Cordyceps* as *Ascomycota* (“sac fungi”).

<sup>20</sup> See Emily Yeh, “Forest Claims.”

<sup>21</sup> Liu Jianbang, *Ganzi Zangzu Zizhizhou Lingyezhi* [Forestry History of Ganzi Tibetan Autonomous Prefecture] (Chengdu: Sichuan Kexue Jisu Chubanshe, 1994), 323 (in Chinese).

<sup>22</sup> Figures from 1999-2003 and Nying khri 2004 were provided by the TAR Agricultural Bureau in Lha sa. However, their Chab mdo 2003/2004 figures were triple the figures provided by several Chab mdo prefectural offices. One Chab mdo official even provided an annual production of 2269 tons of *matsutake*. Apparently *matsutake* production figures are not yet collated.

<sup>23</sup> Yang et al., “Management of Matsutake.”

until recently it was Zhongdian County, Bde chen TAP) as is *matsutake* from neighboring counties in southern Dkar mdzes TAP, Sichuan. The total annual *matsutake* production in the southeastern Tibetan Plateau<sup>24</sup> is estimated at 2,000-2,500 tons,<sup>25</sup> and generates between ¥150–¥300 million (\$20-40 million) for rural households alone.

Chab mdo Prefecture Township Enterprise Department reported that ninety-three tons of *matsutake* generated ¥11.2 million (\$1.5 million) of direct rural household income from *matsutake* in 2004, implying a per kilogram value of around ¥120 (\$16) per kilogram. Based on this official value the overall TAR *matsutake* harvest amounted to ¥40 million (\$5.3 million) in 2004. Besides direct income from selling the crop there is also income generated from dealing, brokering, and exporting; from cleaning, sorting and processing; as well as from logistics such as transport, ice production, cool storage, and so forth. Government agencies are working to increase local economic benefits through improving local processing by subsidizing processing facilities in Smar khams, Spo mes (Bomi), and Nying khri Counties. These facilities were scheduled for completion in 2004 and 2005.

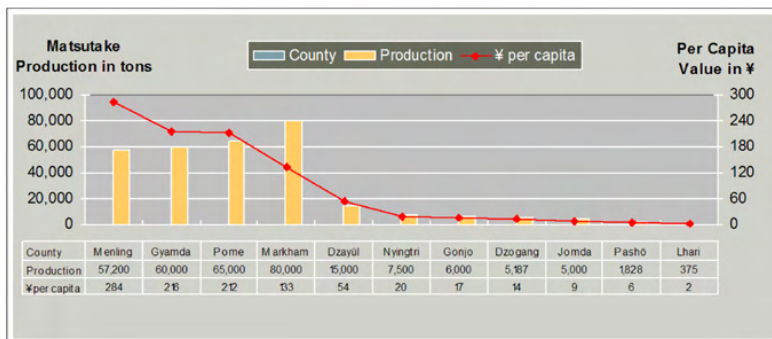


Figure 2: TAR Matsutake Production and Per Capita Value by County, 2004.<sup>26</sup>

In 2004, the TAR's most productive county was Chab mdo Prefecture's Smar khams followed by Nying khri Prefecture's Spo mes, Kong po rgya mda' (Gongbujiangda), and Sman gling (Milin). These four counties together produced 87 percent of all TAR *matsutake* with an average per capita value of ¥182; for comparison, TAR average per capita income was ¥1,984 in 2004. However, this figure also includes subsistence production. Sman gling generated the highest per capita value with ¥284. This figure is likely skewed by Sman gling's low population,

<sup>24</sup> The region is also referred to as *Hengduan* Mountains and falls within Yunnan, Sichuan, and the TAR. It is southwest China's *matsutake* production base. According to Yang et al., "Management of Matsutake," this region contributes almost 80 percent of PRC's overall *matsutake* production, with most of the rest being sourced in northeast China's Jilin and Heilongjiang Provinces.

<sup>25</sup> For comparison, annual production of the North American *matsutake* (*Tricholoma magnivelare*) averaged 144 tons between 1993 and 1997, with a maximum of 284 tons in 1997 (Boa, *Wild Edible Fungus*).

<sup>26</sup> Data for Nying khri Prefecture's Metok County (*me tog rdzong, mutuo xian*) was not collected because 1) it is sparsely populated due to its dense inhospitable rainforest, which also includes some tropical stands along the lower Gtsang po River Gorge and 2) it is closed to migrant Tibetan collectors.

since average per capita value does not reflect the fact that collection is also carried out by migrant collectors. In addition, *matsutake* is only encountered in warm temperate evergreen oak forest. Therefore, some communities have access to *matsutake* oak forests while others do not. Counties with low production figures have substantially less *matsutake*-suited forests. In addition, to fetch top prices *matsutake* must be sold the same day they are gathered, making collection harder and market logistics more difficult in comparison to *Cordyceps*, which can be stored for months without losing value and thus can be collected in a more decentralized way.

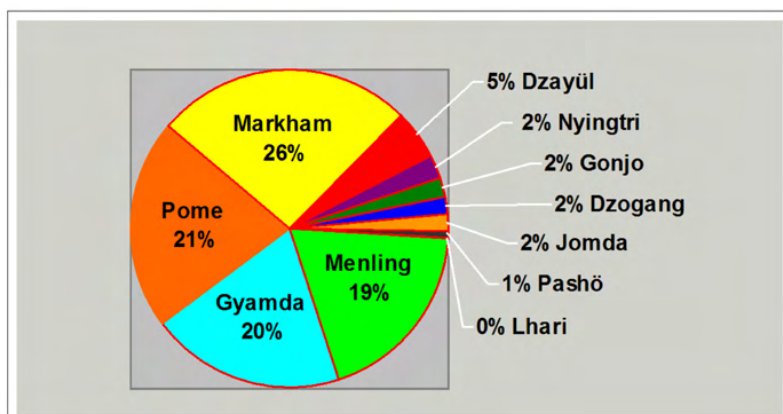


Figure 3: TAR Matsutake Production Percentage by County, 2004.

### ***Matsutake trade in Nying khri Prefecture***

Before economic liberalization in 1984, *matsutake* was not of importance in Nying khri. Traditionally it was not of relevance in Kong po, as Tibetans know this area. After 1984 traders from Jilin, Sichuan, and Yunnan Province (all of which are *matsutake*-producing provinces) came into the area to buy it. It was then transported to China dried or in brine. Locals would receive up to ¥30 per kilogram. Once conserved in brine, dealers would sell the saltwater-soaked mushroom for ¥26 per kilogram. Kong po *matsutake* is reputed to be whiter and larger than *matsutake* in Sichuan and Yunnan. Japanese traders praise it as the third-best *matsutake*, after that from Japan's Fujiyama and from Korea. In 1991, cooling trucks began to operate and ice production was introduced to cool the mushrooms during long-distance transport. After presorting the fresh *matsutake* in Brgyad gcig grong (Bayi), Nying khri County (Linzhi), they were packed with ice and trucked to Dgong dkar (Gongga) airport near Lha sa, a day's journey from Brgyad gcig grong. Most mushrooms were flown to Chengdu, while some went to Kunming, Yunnan, before export to Japan. Ninety percent of the trade was controlled by Bde chen TAP-based companies, which have Chengdu airport offices and operate cooling houses there. Norbu and Pan report that in Spo mes County "local people increased

their annual income from ¥600 per person in the early 1990s to ¥1,676 in 1996,” mostly due to *matsutake* harvest.<sup>27</sup>

Beginning in 2003, Nying khri-based companies acquired their own export licenses, a prerequisite to enter the international trade. The licenses are issued by the central-level Bureau of Trade of Endangered Species, since *matsutake* is classified as a second-class protected species and thus requires an export permit. These companies were able to receive financial support from poverty alleviation funds and investors. Natural production in Nying khri Prefecture is estimated to be at least four-hundred tons; the actual harvest figures at around 120-205 tons (see Figure 1). The average price ranges from ¥60-100 per kilogram, which is lower than in Chab mdo or Bde chen Prefectures where it is around ¥120 per kilogram. However, with the acquisition of export licenses by companies based in Nying khri, prices are expected to increase. The trade in southern Chab mdo Prefecture developed differently due to its proximity to Bde chen TAP.

In 2005, eight companies were involved in the trade in Nying khri Prefecture. The overall annual harvest quota was two-hundred tons. The largest company is Tibet Linzhi Yasheng Food Ltd (TLYF), based near Brgyad gcig grong, which had a quota allotment of seventy tons in 2004 but could not fulfill it. Its Chinese managers raised ¥100 million to build a new facility. A 3,600 square meter processing facility was close to completion in 2005. It includes three cooling rooms, one of which is able to sustain a temperature of -20° C to produce ice for transport. Before 2005, TLYF flew the product from Gdong dkar to Chengdu for final sorting before export, but has now entered the direct export business. With the new facility, the final sorting as well as cleaning, slicing, and canning of lower qualities is carried out in Brgyad gcig grong. Vacuum packaging is planned for the near future. The facility will employ one-hundred workers, eighty of them locally sourced, and twenty technicians from Sichuan will oversee the process. Also in Pomé County (*spo mes rdzong, bomi xian*) a new facility was nearing completion in 2005, and the facility owners had successfully applied for an export permit. Of great importance for the success of these export businesses is the opening of the Brgyad gcig grong airport, which finally took place in September 2006. Daily flights during the summer to Chengdu are planned. While the *matsutake* season coincides with the tourist season, in cash terms tourism is the most important industry in Nying khri, surpassing WUF and MAP. However, most of the tourist income does not reach rural households but rather is captured by elites and urban, often Han-Chinese, households.

### ***Two Mushroom Collectors: Sbom po and Rdo rje***

To illustrate the WUF collection in Nying khri Prefecture, I will present two mushroom hunters, Sbom po and Rdo rje, who were both interviewed in June 2005. Sbom po is from Mkhar Itag Village in Tramok Township (*spra rmog shang, zhamu xiang*), Pomé County. Rdo rje, a man in his thirties from Sakya County (*sa skya*

<sup>27</sup> C. Norbu and Pan H. P., “Bustling Family Business,” *China’s Tibet* 6 (1998), 8-9.

*rdzong, sajjia xian*), Gzhis ka rtse (*rigazi*) Prefecture, TAR, spends most of his year accompanied by his wife in Lunang Township (*klu nang shang, lulang xiang*), Nying khri County, where his sister married a native. In Nying khri he has better income opportunities than in his home county, where his two children live with their grandparents.



Photo 3: *Sbom po* collects *matsutake* and morels as a side business. Photo: Daniel Winkler, June 2006, *Spo mes, TAR*.

*Sbom po* (Photo 3) is in his forties and is married with nine children. Judged by local standards, he is a well-off farmer. Mushroom collection is a sideline business, since he bought a truck some years ago that provides most of his cash income. Presently, fungus income contributes 15-35 percent of the household cash income. *Sbom po* collects mostly *matsutake* and morels but no MAPs. On a normal day during morel season in spring he finds about 1-2 pounds of fresh morels, worth ¥30-80. *Sbom po* and other family members collect about three to ten kilograms of dried morels per year at a value of ¥2,100-7,000. During the two months of the *matsutake* season (roughly July and August) *Sbom po*

goes collecting nearly every day unless it rains too heavily. On some days he is accompanied by one of his teenaged children if he is not hiking more than five kilometers from the village. When *Sbom po* goes alone he collects on average about one kilogram; if another person accompanies him, they do not necessarily collect more mushrooms. He sells his mushrooms daily, as soon as he returns. His village is visited every afternoon by a small dealer. Sometimes *Sbom po* takes the mushrooms to *Spo mes* town, but the price difference is relatively small.

In 2004, the local government began to inform collectors about sustainable harvesting techniques. *Sbom po* stated: “If we do not destroy the duff layer, it will grow back bigger next year. People who don’t care about the future will not cover holes; we do think about the future and restore the site.” As a local he doesn’t need a permit. *Pomé* County does not allow any outsiders to collect, but *matsutake* dealers need a license and checkpoints enforce these regulations. *Sbom po* states: “Mushroom collection is hard work; we don’t love it. It is a pain! Long walks, no water, no food, there are dangerous bears, the hands get all scratched up. Still it is better than road work, since I have my freedom and I take breaks when I want to! Also, I get my money right away.”

*Rdo rje* first came to Nying khri County to collect mushroom and herbs six years ago and has returned every year since. The collection of fungi and herbs provide over 80 percent of his annual cash income. To collect WUF and MAPs he



has to buy a permit every two months for ¥300, the lower rate for locals due to his family connections. Upon picking up his permit a district official gives him instruction on how to collect fungi and plants in order to minimize environmental damage and secure sustainability, and the importance of not making fires in or near the forests. Rdo rje's year is structured by the collection season. In May and June, he collects mostly fungi, morels (*Morchella* spp.), and especially caterpillar fungus (*Cordyceps sinensis*). The best source of income is collecting caterpillar fungus, at ¥1,500 in one month. But it is very exhausting climbing mountains with supplies for ten days and coming down several times to restock. He taught locals where to search for caterpillar fungus, and in exchange they taught him where and how to collect *Gastrodia elata* orchids. When collecting forest fungi, Rdo rje is constantly worried about encountering bears; several of his friends have been badly mauled. In July *matsutake* starts fruiting. Rdo rje collects *matsutake* for only three days and makes ¥100 that way. He thinks *matsutake* collection is hampered by too much competition in the area he collects, aside from the high risk of bear encounters. In July he also collects boletes (*Boletus* spp.) and some other WUF. Most of his time in summer he spends digging marsh orchid (*dbang lag*, *Gymnadenia* spp., *shouzhang shen*), a local specialty that can be collected into the fall. Rdo rje also digs Sdong po, the tubers of the mycotrophic orchid *gastrodia* (*Gastrodia elata*, *tian ma*), which grows in warm-temperate and subtropical forests. Over a period of four months he earns about ¥2,000. At the end of summer snow lotus (*gangs lha me tog*, *Saussurea medusa*, *xuelian hua*)<sup>28</sup> is collected high up in the mountains, but it is only worth ¥1 per kilogram. In the fall, Rdo rje works at a lumberyard where he makes ¥12 a day<sup>29</sup> manually loading timber on trucks. In winter there is no work available and he returns to Sakya County to see his children and family over the Tibetan New Year (*lo gsar*).

### ***Sustainability Issues and Permits***

The latest research<sup>30</sup> on the long-term impact of harvest on production of root-associated mushrooms indicates that responsible collection of ectomycorrhizal mushrooms such as *matsutake* does not impact future fungus fruiting. However, Japanese consumers prefer buying *matsutake* as young as possible, especially before their caps have opened and lost their partial veil, which is a membrane that protects the gills below. The search for these immature mushrooms can be a

<sup>28</sup> Collectors referred to *Saussurea medusa* most commonly as *gangs lha me tog*. However, Dga' ba'i rdo rje lists this wooly *Asteraceae* as *bya rgod sug pa* and gives as an alternate name *me tog gangs lha*, which translates as "glacier/snow deity flower" (Dga' ba'i rdo rje, 'Khrungs dpe dri med shel gyi me long [Beijing: Mi rigs dpe skrun khang, 1995]).

<sup>29</sup> This is basically as low a daily wage as one encounters in the TAR. County government-sponsored rural road work pays ¥15-35, and most commonly ¥20-30 per day.

<sup>30</sup> S. Egli, M. Peter, C. Buser, W. Stahel, and F. Ayer, "Mushroom Picking Does Not Impair Future Harvests: Results of a Long-term Study in Switzerland," *Biological Conservation* 129, no. 2 (2006), 271-76; D. L. Luoma, J. L. Eberhart, R. Abbott, A. Moore, P. Amaranthus, and D. Pilz, "Effects of Mushroom Harvest Technique on Subsequent American Matsutake Production," *Forest Ecology and Management* 236 (2006), 65-75.

challenge to the sustainability of the harvest. These buds are more valuable than mature specimens. However, the difference in value is not great enough to balance the loss from picking small mushrooms rather than letting them grow to a larger size. Beside the negative economic aspect of this practice, there is very possibly a negative impact on the overall production as well. In order to find these budding mushrooms, pickers often expose the area of fruiting by removing the duff layer. If it is not covered up again, the mycelium is exposed and the fungal organism is negatively impacted by the exposure. Harvest quantities primarily depend on temperature and precipitation, but continued inappropriate harvesting techniques are detrimental to production of *matsutake*<sup>31</sup> and are likely a contributing cause to dwindling local production as reported in Bde chen TAP, Yunnan in the early 2000s.<sup>32</sup> Similar reports of reduced output were reported in some forests with easy access in Pomé County as well. In recent years, general awareness has developed regarding this issue in the region and government officials are looking for ways to address the issue. The trade is being increasingly regulated, although often these regulations are not necessarily enforced in the most remote areas.

At the TAR level no *matsutake*-specific management or protection regulations have been formulated, in contrast to the case of *Cordyceps*, for which there have been regulations since 2006. In Nying khri Prefecture the necessity of management and protection of the *matsutake* resource has been realized, and an effort to regulate the trade and improve collection practices in order to improve sustainability and local income generation is underway. In June 2005, Nying khri Prefecture Township Enterprise office was sending out experts to train village leaders in appropriate harvesting techniques, with the expectation that they would disseminate this knowledge to their communities. An overall production output has been set at two-hundred tons with the intention to ensure sustainability. Also in 2005, Nying khri Prefecture established a regulation stipulating the minimum size of a *matsutake* at six centimeters in height. Although this height is really too small to make a lasting difference (cap diameter would be a more appropriate measurement to curb fungal infanticide), it is an important first step. Some critics have referred to the six-centimeter size and the two-hundred tons harvest quota as figures suggested by the export industry. Not surprisingly, these production quota and size limits are supported by the export company managers interviewed. A collector breaking the minimum size rule is supposed to be fined ¥5 per specimen; traders caught with such *matsutake* should be fined ¥1000/*jin* (one *jin* = five-hundred grams). The prefecture is in the process of establishing 3,333 hectares of *matsutake* conservation area, where harvest will be regulated and monitored in order to implement sustainable harvesting techniques. Of the 3,333 hectare area, 1000 hectares are located in Spo mes, 333 hectares are in Rdza yul (Chayu)'s Wuyi, and the rest are in Kong po rgya mda', Nying khri, and Sman gling Counties. In addition, these new regulations instruct counties to establish *matsutake* checkpoints along the

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<sup>31</sup> Luoma et al., "Effects of Mushroom Harvest Technique."

<sup>32</sup> Winkler, "Matsutake Mycelium under Attack in SW China"; see also Yang et al., "Management of Matsutake."

roads in production areas. The regulation is very specific regarding which offices have to man these checkpoints. The regulations allow for management fees of ¥2 per pound for county and district administrations and another ¥2 for the township enterprise department, which is in charge of developing the trade overall to supplement local income. These fees are collected from dealers at the checkpoints. All dealers must be licensed and first-point buyers must be local. According to these regulations, locals do not need a license for *matsutake* collection. County administrations can regulate the number of dealers if necessary. County officials or cadres are not allowed to engage in the trade.

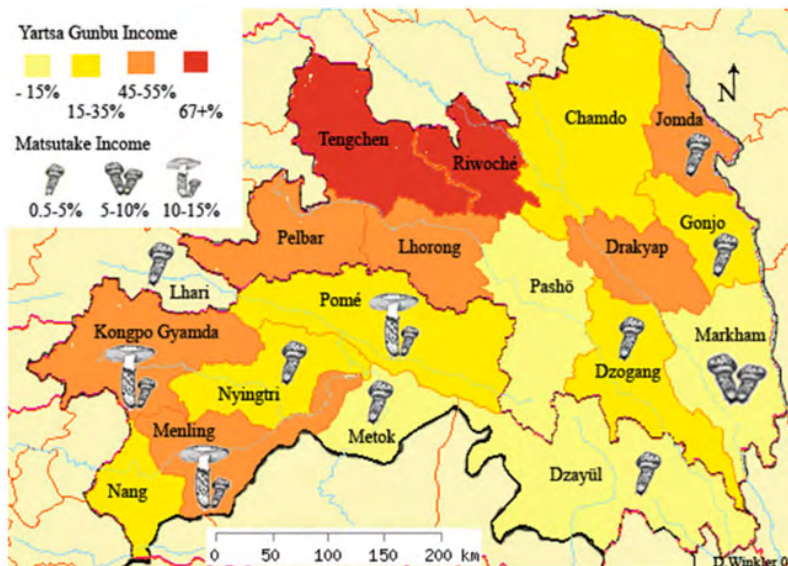


Figure 4: Per capita income in percentage of average rural prefectural income from caterpillar fungus (*Cordyceps sinensis*) and matsutake (*Tricholoma matsutake*)<sup>33</sup> by county, Nying khri and Chab mdo Prefectures, southeast TAR (based on prefectural production figures for 2004).

Figure 4 maps out the income contribution of caterpillar fungus and *matsutake* to average annual rural income. Please note that values are derived from county harvest figures and not from income statistics, which do not report the harvest value.

This map clearly shows that caterpillar fungus harvest is much more valuable, especially in the northern prefectures, although it is necessary to point out that the habitat of *matsutake* is much smaller and thus its importance in terms of per capita income is diluted substantially. Where *matsutake* habitat is abundant, I would estimate that its contribution is at least double to triple the average countywide income contribution. Furthermore, the per capita income is based on inhabitants and does not account for migrant collectors, which might skew per capita data as in the case of Sman gling, where the *matsutake* per capita contribution seems

<sup>33</sup> For exact values please see Figure 2.

elevated, due to increased harvest by migrant collectors. Similarly, the income contribution from caterpillar fungus in Chab mdo County seems reduced, probably by Chab mdo's relatively populous urban population. Pashö County (*dpa' shod rdzong*) has neither good caterpillar fungus nor *matsutake* habitat due to untypical low precipitation caused by its location in a strong rain shadow.

### Dbyar rtswa dgun 'bu (*Cordyceps sinensis*)



Photo 4: A specimen of Dbyar rtswa dgun 'bu (*Cordyceps sinensis*) in its habitat, partially excavated and cleaned. The larva has been cleaned from an outer enmeshing layer of hyphae; its deep orange eyes are visible at the base of the stroma, the fruiting body of the fungus with its grainy spore-producing tissue. Bar la, Mal gro gung dkar (Mozhugongka) County, June 2006. Photo: Daniel Winkler.



Photo 5: A family taking a break while searching for caterpillar fungus at Bar la (altitude 4500 meters). Children are welcome help; their eyes are sharp and closer to the ground. Photo: Daniel Winkler, Mal gro gung dkar County, June 2006.

The collection and trade of Dbyar rtswa dgun 'bu (see Photo 4), “summer grass, winter worm” as caterpillar fungus is known to Tibetans (in Mandarin it translates as *dongchong xiacao*), reaches back centuries. Written records documenting the medicinal use of *Cordyceps sinensis* in Tibet date back at least to Zur mkhar mnyam nyid rdo rje (1439-75),<sup>34</sup> who lived during the fifteenth century and is renowned as the founder of Tibet's Zur medicinal tradition (see the appendix for the Tibetan text and a translation by Jakob Winkler). Interestingly, the first record in China

<sup>34</sup> Mnyam nyid rdo rje, *Man ngag bye ba ring bsrel pod chung rab byams gsal ba'i sgron me* [Instructions on a Myriad of Medicines] (Lanzhou: Kan su'u mi rigs dpe skrun khang, 1993), 417-19. My thanks to Yonten Gyatso, who informed me of this earliest reference to caterpillar fungus in a Tibetan document, and to Olaf Czaja, who shared the Tibetan source text.

seems to be more than two-hundred years later, in the 1694 text *Essentials of a Compendium of Materia Medica (ben cao bei yao)* by Wang Ang.

With economic liberalization caterpillar fungus has developed into the most important source of cash income for rural Tibetan households. Between 1998 and early 2008, its value increased more than eight-fold, from an average price of ¥4800 per pound to an average price of ¥40,000 (one *jin* = one metric pound = five hundred grams), at an average annual rate of 22.8 percent. While individual specimens were sold for ¥1-5 in 1998, in June 2008 prices had risen to ¥30-60. In Lha sa prices peaked at ¥80,000 per *jin* for the best quality in late 2007. The market is mainly driven by demand from Han Chinese both within and outside China. However, those involved in caterpillar fungus collection are overwhelmingly Tibetan communities in the TAR, Sichuan, Qinghai, Gansu, and Yunnan, who have access to fertile alpine grasslands between three-thousand and five-thousand meters.<sup>35</sup>

### ***The Sale of Dbyar rtswa dgun 'bu***

Three main factors enable rural households (see Photo 5) to participate successfully in the harvest of Dbyar rtswa dgun 'bu: 1) widespread knowledge about 'Bu (the abbreviation Tibetans generally use to refer to Dbyar rtswa dgun 'bu), and how to find it, 2) access to the grasslands where it grows, and 3) little or no capital is needed to participate (at least locally). In other words, resource access is assured (at least to local people) and the usual barriers to economic success – for example, lack of formal education, lack of access to credit – are absent. As a result, within the distribution area of 'bu nearly all rural households who practice traditional subsistence herding and agriculture participate in its collection.<sup>36</sup>

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<sup>35</sup> A distribution map is published in Winkler, “Yartsa Gunbu Fungal Commodification,” and also on [http://www.danielwinkler.com/caterpillar\\_fungus\\_in\\_tibet.htm](http://www.danielwinkler.com/caterpillar_fungus_in_tibet.htm).

<sup>36</sup> See also Winkler, “Forest Use.”

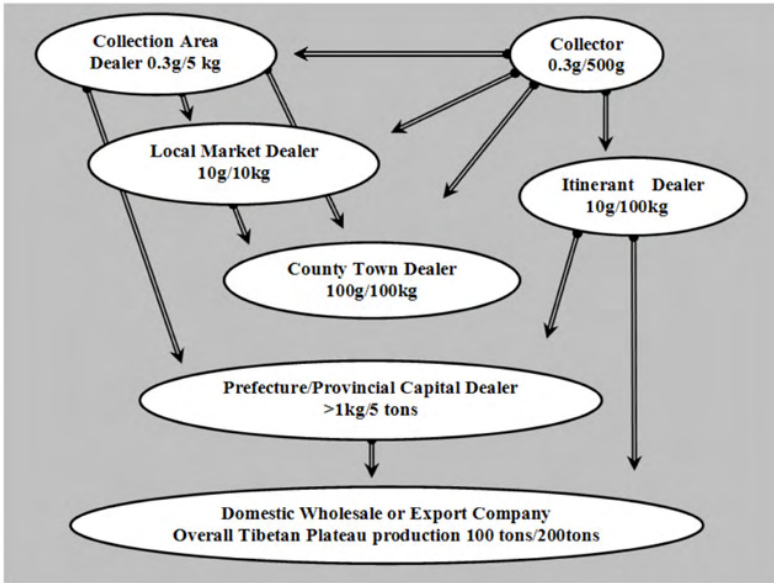


Figure 5: Dbyar rtswa dgun 'bu Trade Flow Chart. The first figure indicates minimum weight of a transaction; the second figure is the estimated average total of the season.



Figure 6: Dbyar rtswa dgun 'bu wholesale prices in yuan per pound in recent years for medium size in Lha sa, TAR.

Typically, small quantities of 'bu are sold after seller and buyer have agreed on a price per specimen and both parties have counted the specimens. In June 2005, prices in Tibet ranged from ¥3 to ¥30 per specimen, which equals a metric pound price of ¥5,000–¥30,000 (\$656-\$4000) at 900 big to 1800 small specimens per jin, with most specimens trading for ¥8 to ¥15. Collectors have three options for selling caterpillar fungus. One is to sell the freshly collected 'bu right on the grasslands or in the collectors' camps. This is often done early in the season to generate some quick cash to pay for living expenses in the camps. However, by selling small, uncleaned quantities on the slopes or in the camps, collectors forgo 10-30 percent in profit, since this is the difference in mark-up between uncleaned,

fresh 'bu sold by piece and cleaned, dry 'bu sold in market towns to dealers or brokers by weight. A third option is to sell to itinerant 'bu dealers who ply the roads.

### Market Control and Brokering

Lha sa now has ten to twenty large brokers of 'bu who buy from smaller brokers or middlemen. These large brokers also maintain a network of buyers, some of whom are their relatives, in areas such as Nying khri and Nag chu. Brokering entails multi-million *yuan* transactions. In Lha sa, the market is now dominated by Chinese Muslims (Hui) dealers, many of them originally from Gansu Province; these Chinese Muslim brokers typically sell their 'bu to even larger Chinese Muslim brokers in Xining, Qinghai Province. Tibetan brokers control less than half of the approximately thirty tons of caterpillar fungus dealt annually in Lha sa. When one Chinese Muslim broker was asked why the Chinese Muslims dominate the brokering of *Cordyceps* in Lha sa, he replied that the Chinese Muslims are clever at business, willing to take risks, and have a close network in their communities. A successful Tibetan broker answered similarly: "The Chinese Muslims have an advantage due to their reliable business relationships, and most Lha sa Tibetans lack the guts for this high-stake business."

Within the TAR, however, there are regional differences in brokering and market share. In Chab mdo Prefecture, the market is controlled by Tibetan brokers because Khampas (Tibetans from eastern Tibet including western Sichuan and northwest Yunnan) prefer selling their 'bu to Tibetans, and the Khampas are renowned in Tibet for their willingness to take risks. Several Chinese Muslim dealers in Lha sa even reported losing market share to Khampa dealers.

### Dbyar rtswa dgun 'bu Diversity



Photo 6: White caterpillar fungus ('bu dkar po, bai chong cao) growing on white larvae from Nying khri and for comparison regular-colored larvae. Photo: Tony Migas, 2006.



Photo 7: Himalayan "red-head" *Cordyceps* (mgo dmar po) from the Himalayan valleys in southern Gzhis ka rtse Prefecture. Photo: Daniel Winkler, 2006.

In general the quality and thus the value of caterpillar fungus is determined by the size of the larva. Further criteria include having a saturated yellowish-brown tone and being firm. Specimens harvested too late in the season are of lesser quality because they spend all their resources on sporulation and the larva becomes hollow and collapses. In addition, dealers in Lha sa recognize regional differences in types of caterpillar fungus. The caterpillar fungus collected in Nepal, Bhutan, India, and Himalayan habitats in southern Gzhis ka rtse, Lho kha (*shannan*), and Nying khri is known as *mgo dmar po* – “red-headed” caterpillar fungus.<sup>37</sup> The name is derived from the color of the eyes of the larva, which are brighter dark red than commonly seen in the larvae collected on the Tibetan Plateau. Although Himalayan *Cordyceps* has been described as *Cordyceps nepalensis*,<sup>38</sup> this differentiation was not confirmed by a recent phylogenetic study of *Cordyceps*.<sup>39</sup> In addition, it seems that the traditional differentiation is based on features of the insect host and not of the fungus itself. In Lha sa, *mgo dmar po* is valued about 10-20 percent less than the lowest quality of regular caterpillar fungus, a surprisingly low value. It is perceived as inferior to and with lower healing capacity than regular caterpillar fungus. Another caterpillar fungus, regarded as even inferior to *mgo dmar po*, is *'bu dkar po*. It is collected on the slopes in the Himlayan areas of Nying khri. The larva is only about two to four centimeters long and whitish brown in color, which is the source of its Tibetan name, *'bu dkar po*, meaning “white caterpillar”<sup>40</sup> (see Photo 6).

### ***Local Income Generation and Economic Impact***

It is difficult to overstate the importance of *'bu* to income generation in contemporary rural Tibet. Areas rich in *'bu*, such as northern Chab mdo Prefecture and southeastern Nag chu Prefecture, have experienced a visible boom in discretionary spending, but other areas have also, such as the *'bu* producing prefectures outside of the TAR like Skye rgu mdo (Yushu),<sup>41</sup> Mgo log (Guoluo), Rnga ba, and Dkar mdzes.<sup>42</sup> The income generated from *'bu* collection and trade

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<sup>37</sup> I have encountered two Chinese names for *mgo dmar po*: *hong chong cao*, “red caterpillar fungus,” and *hong tou*, “red head.”

<sup>38</sup> See Zang Mo and N. Kinjo, “Notes on the Alpine *Cordyceps* of China and Nearby Nations,” *Mycotaxon* 66 (1998), 215-29.

<sup>39</sup> See G. H. Sung, Nigel Hywel-Jones, J. M. Sung, J. Luangsa-ard, B. Shrestha, and J. Spatafora, “Phylogenetic Classification of *Cordyceps* and the Clavicipitaceous Fungi,” *Studies of Mycology* 57, no. 1 (2007), 5-59.

<sup>40</sup> Its local Chinese name is *bai chong cao*, a literal translation of the Tibetan name.

<sup>41</sup> See Andreas Gruschke’s contribution in this volume on the role of caterpillar fungus in Skye rgu mdo Prefecture: Andreas Gruschke, “Nomads without Pastures? Globalization, Regionalization, and Livelihood Security of Nomads and Former Nomads in Northern Khams,” in “In the Shadow of the Leaping Dragon: Demography, Development, and the Environment in Tibetan Areas,” special issue, *Journal of the International Association of Tibetan Studies*, no. 4 (2008), <http://www.thlib.org/?tid=T5570>.

<sup>42</sup> See Winkler, “Yartsa Gunbu - *Cordyceps sinensis*: Economy, Ecology & Ethno-mycology,” on the situation in Dkar mdzes TAP.



is used as start-up capital for entrepreneurial activities.<sup>43</sup> Not surprisingly, the traditionally self-sufficient cash-strapped subsistence economy is now sprinkled with small shops and other economic activities. Many households with access to electricity are buying TV sets and DVD players. The trade in caterpillar fungus has provided most of the cash for the proprietors and customers of these businesses and has spurred local economic development in a way that no other government policy has. Capital is also accumulating locally. Farmers are building new houses, nomads and farmers alike are able to finance motorcycles, Beijing jeeps, and trucks, and generous donations are being made for the reconstruction of religious infrastructure. Travelling through 'bu country, one is immediately struck by the abundance of new 125 cc motorcycles, which are crowding the streets of market towns. Apparently, nomadic men invest in mobility before home improvement. In the late 1990s, before the price of caterpillar fungus skyrocketed, motorcycles were used mostly by dealers because collectors did not make enough money to afford them. However, the immense increase in the value of caterpillar fungus is causing rapid change, and now many collectors have motorcycles as well. What we are witnessing today is a dramatic commodification of the rural Tibetan economy fuelled by caterpillar fungus.

**Table 2a: County-Level Official Income from Dbyar rtswa dgun 'bu, 2004**

County, Prefecture	'Bu Harvest (Pounds)	Reported Value Per Pound	Official Average Income	Average Income			
				Non Fungus Income		Fungus Income	
Steng chen (Dingqing), Chab mdo	9,214	¥5,401	¥1,612	¥822	51%	¥790	49%
Ri bo che (Leiwuqi), Chab mdo	4,213 <sup>44</sup>	¥9,662	¥1,950	¥850	44%	¥1,100	56%

**Table 2b: Per Capita Income from Dbyar rtswa dgun 'bu Based on Harvest and Market Prices in Selected TAR Counties, 2004**

County, Prefecture	Population	'Bu Harvest (Pounds)	Official Average Income	Fungus Income Per Capita	
				At ¥11,000 Per Pound	Percentage of Official Income
Steng chen, Chab mdo	62,996	9,214	¥1,612	¥1,608	100%

<sup>43</sup> For a detailed account on such entrepreneurial activities in pastoral Skye rgu mdo, see in this volume Gruschke, "Nomads without Pastures?"

<sup>44</sup> The value of 4,213 pounds for Ri bo che's caterpillar fungus production was provided by the vice-governor of Ri bo che County. Chab mdo Prefecture's Township Enterprise Bureau had recorded 3,200 pounds as Ri bo che's 2004 production.

Ri bo che, Chab mdo	37,000	4,214	¥1,950	¥1,253	64%
Dpal 'bar, Chab mdo	30,006	2,430	¥1,650	¥890	53%
'Bri ru, Nag chu	44,293	10,390	¥2,807	¥2,580	92%
Lha ri, Nag chu	24,198	4,462	¥2,257	¥2028	90%
Sog, Nag chu	34,939	4,368	¥1,743	¥1,375	79%

Tables 2a and 2b show income from caterpillar fungus for selected counties in the core distribution area of *Cordyceps sinensis* in the TAR. Both tables show that caterpillar fungus is the most important source of income in these counties. However, the percentage of per capita cash income from caterpillar fungus differs. The data available does not allow for a clear income figure, since there are too many inconsistencies in reporting. Underreporting local income is a widespread practice in Tibetan areas, since “poverty counties” receive special support from the central government.

Table 2a is based on official data collected at the county and prefecture levels in June 2005. The output value of caterpillar fungus was defined by the reporting county governments. Table 2b, on the other hand, uses a value of ¥11,000 (\$1,375) per pound to show projected income based on the reported harvest amounts. ¥11,000 was the official value used in most county statistics in Chab mdo Prefecture in 2004. It must be pointed out that ¥11,000 is still a very low figure, since the average price in Lha sa for medium-quality caterpillar fungus was ¥18,000 at the same time (over 60 percent higher) and the market price in Chab mdo town is comparable to Lha sa, since transport costs are minimal and dealers are in steady communication with brokers by cell phone. Thus, ¥11,000 is a low estimate and might be partially explained by the fact that it accounts for the harvest, which is sold for a lower per piece price on the slope. However, despite discrepancies, different accounting methods, and the lack of clear financial transaction data, since the fungus trade is a cash business, both tables clearly demonstrate the paramount importance of caterpillar fungus for local income generation. In both tables the contribution ranges from 49 to 100 percent of total income.

An income contribution from caterpillar fungus harvest of around 50 percent in the core distribution area may well be the result of underreporting fungus income. The income percentages of 90-100 percent<sup>45</sup> are a direct result of underreporting fungus income. A fungus income percentage over 90 percent is not realistic given that nearly all rural households are still involved in traditional subsistence agriculture and pastoralism (which is also included in the overall income statistics). Based on available data, then, the caterpillar fungus harvest likely accounts for between 50 percent and 80 percent of the overall rural income in the areas where it grows. However, the higher figures apply to counties with excellent growing conditions such as in southeast Nag chu and northern Chab mdo Prefectures.

<sup>45</sup> Assigning to the collected caterpillar fungus a value higher than ¥11,000 per pound, which is still very realistic, would produce percentages over 100 percent. Such a percentage value seems to point to underreporting of income rather than overvaluing of production.

## Contribution to the Gross Domestic Product of the TAR

In 2004, fifty tons of caterpillar fungus were officially collected in the TAR. Using a conservative value of ¥11,000 per pound represents an overall value of ¥1.1 billion, which equals a per capita income of ¥463 for the approximately 2.4 million rural and small-town Tibetans (92 percent of the Tibetan TAR population). In 2004, per capita income in rural and small-town Tibet was officially<sup>46</sup> ¥1,861. Thus, 25 percent of this overall figure can be attributed to caterpillar fungus income. However, there is no statistical data available that breaks down income into cash, barter, and subsistence categories. For most households, an estimated 40 percent of the income is subsistence production (non-cash), mostly food.<sup>47</sup> Based on this data, the caterpillar fungus income comprises 40 percent of all the cash income for rural/small-town TAR.

In reality, this percentage could be lower or higher. The estimated market value used (¥11,000 per *jin*) is low. Also, over 50 percent of TAR territory, much of it sparsely inhabited, does not provide habitat for caterpillar fungus. In those areas the people either do not pick caterpillar fungus or travel elsewhere to collect it, where they face high permit fees for outsiders that substantially reduce their income. On the other hand, the cash income from caterpillar fungus is frequently underreported. As a result, the per capita income figures may not reflect actual income (as in the cases of Steng chen and Ri bo che in Table 2a).

To date, Tibetan and Chinese administrators, statisticians, and economists<sup>48</sup> have overlooked the value contributed by the fungus industry to TAR's gross domestic product (GDP). It is not clear if the production value is included in the *Tibet Statistical Yearbook* (2005). The value of *Cordyceps* production should be accounted for in the primary sector (agriculture, livestock, forestry, and so forth). However, this sector has been basically flat in recent years, although the value of *Cordyceps* production has been increasing at least 20 percent per year. The neglect of income from fungus collection seems further substantiated by the fact that the 2003/2004 increase in rural income is mostly accounted for by labor remuneration. To calculate the contribution of caterpillar fungus one needs to account for at least ¥1.8 billion (US\$225 million) – a figure based on the average price in Lha sa and not the selling price of rural collectors. Thus, the value of *Cordyceps* production would figure at 42 percent of the complete primary sector (¥4.3 billion) and would exceed the total of the secondary sector (industry and mining, ¥1.5 billion) by

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<sup>46</sup> *Tibet Statistical Yearbook*, Lhasa (2005).

<sup>47</sup> This figure is derived from the fact that 43 percent of rural household expenditure was non-cash in 2004 (*Tibet Statistical Yearbook* 2005).

<sup>48</sup> One exception is my research counterpart *Luorong Zhandui* who, after hearing my presentation on caterpillar fungus as source of rural income at the IATS conference in Oxford in 2004, initiated this research collaboration. He has published the results of our collaboration as *Luorong Zhandui* and *Dawa Ciren*, "The Research Report on the Chinese Caterpillar Fungus Strategic Position and Impacts on Tibetan Economy and Society" (paper presented at the International Conference for the Western Development and TAR Rural Development, Chengdu, Sep. 23-25, 2005), 40-48 (in Chinese with English abstract).

nearly 20 percent. The overall *Cordyceps* contribution to TAR's GDP (¥21.1 billion) figured at 8.5 percent in 2004.<sup>49</sup>

### Annual Production

An unpublished 1989 report from the Plateau Biology Research Institute in Lha sa<sup>50</sup> estimated total potential production of about seventy tons annually for the TAR, and reported an average annual harvest of 13.4 tons for 1957-1974 and of 15.1 tons for 1975-1983. This might have been the amount of caterpillar fungus going through the state quota system,<sup>51</sup> while additional amounts might have been traded informally. While it is unclear how reliable these figures are,<sup>52</sup> the official amounts are fairly consistent with information provided by brokers in Lha sa who estimated the annual trade in Lha sa alone at thirty tons.

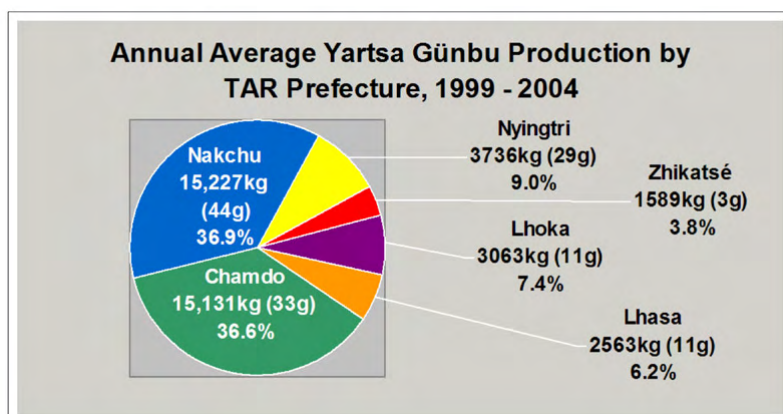


Figure 7: *Dbyar rtswa dgun 'bu* Production in TAR Prefectures,<sup>53</sup> 1999-2004, with TAR average annual per capita production in parentheses.

Figure 7 shows the distribution by prefecture of caterpillar fungus harvest, 2004. While Nag chu and Chab mdo each produced over one-third of the TAR harvest between 1999 and 2004, Nying khri, Lho kha, and Lha sa each produced between 6 and 9 percent.

<sup>49</sup> It is interesting to note that in comparison *matsutake* provided ¥20-40 million to rural household income, which figures at 1.8-3.6 percent of the value of caterpillar fungus contribution to local income in 2004.

<sup>50</sup> Unpublished brochure from Plateau Biology Research Institute, Lhasa, TAR (1989), in Chinese.

<sup>51</sup> During the commune period (1956-1981), *Cordyceps* collection was dominated by state-decreed quotas that had to be fulfilled. An informant reported in Sbra chen (Baqen) County that each household had to hand over to local authorities three specimens per person per day during the collection season. Surplus was traded. During the Cultural Revolution (1966-1976), the *Cordyceps* market nearly collapsed.

<sup>52</sup> In December 2006, the TAR government convened a caterpillar fungus meeting in Lha sa in order to improve data collection and to initiate resource management, which should improve data accuracy in the future.

<sup>53</sup> Arid Mnga' ris khul (Ali Diqu) is not included in the table, since there is no caterpillar fungus harvest, but its population of 77,747 people is figured in all the TAR averages presented.

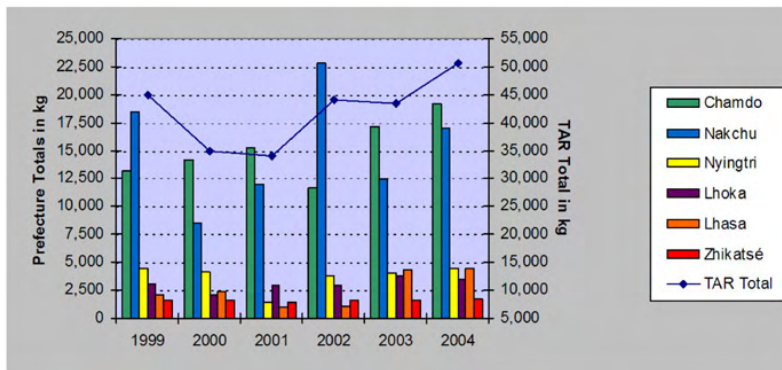


Figure 8: Annual Dbyar rtswa dgun 'bu Production by Prefecture<sup>54</sup> in the TAR.

Figure 8 shows a trend toward increased harvest of caterpillar fungus in recent years. Increasing numbers of collectors (see below) and discovery of new (previously unpicked) production areas could have caused this trend. However, the spiraling value of the caterpillar fungus may result in more attention being paid by authorities to its collection, so the apparent trend may be somewhat biased. In addition, prefectural production figures show strong annual fluctuations, most likely correlated to regional precipitation and temperature regimes. However, at the TAR level these fluctuations are buffered, as shown by the Nag chu and Chab mdo production figures.

### ***Collection Pressure, Migration, and Permits***

During interviews, many 'bu collectors complained that each year there are more people collecting. In the past, collectors were able to collect larger quantities. However, thus far the increasing value of 'bu has compensated for the reduced individual harvests. The increase in the number of individuals collecting is exemplified by Steng chen County in Chab mdo Prefecture. A Steng chen County official in charge of 'bu collection stated that the county had mobilized 60 percent (thirty-seven thousand) of its sixty-three thousand inhabitants for collection in the 2005 season, since 'bu income is the most important source of money in the county (see Table 2b). Though most counties have not yet made similar efforts to optimize the search for 'bu, recognition of the economic importance is increasing along with increased value and importance for local income generation.

In most areas there are non-local as well as local collectors. Non-local collectors can be Tibetans from neighboring counties or from other prefectures. For example, in Nag chu and Nying khri prefectures most Tibetan outsiders were from Gzhis ka rtse Prefecture, which is rich in people but relatively poor in economically valuable plants and fungi. Nevertheless, some TAR counties, such as Ri bo che

<sup>54</sup> Production data for Gzhis ka rtse (1999, 2000) and Lho kha (2000) was missing and the average of the following years was entered for completeness.

and Steng chen, phased out permits for any outsiders and declared a complete ban on 'bu collection for non-residents.

Hundreds of thousands in Tibet migrate to collection areas to venture deep into forests and high into the mountains to collect WUF and MAP in order to generate cash income. Some of these migrating collectors come from far away, including from other provinces.<sup>55</sup> Seasonal migration within counties, prefectures, or within the TAR is a common phenomenon with a long-standing history often regarded as part of the widespread semi-nomadic lifestyle. To date, each county has its own approach to handling the issue. While seasonal migration to resources within a relatively small radius is part of traditional land-use strategies, nowadays county boundaries have to be respected and county-to-county migration for collection of WUF and MAP requires permits. Within the TAR, in particular people from the relatively populous and impoverished Gzhis ka rtse Prefecture traditionally take to migrating to improve their economic situation. Many of them secure cash income by working in road construction and WUF and MAP collection all over the TAR. In Nying khri Prefecture, which has a low population density and abundant natural resources, outsiders can purchase permits for herb and mushroom collection. During *matsutake* season it is estimated that at least twenty thousand non-residents, many from Gzhis ka rtse Prefecture, migrate to Nying khri Prefecture. However, Spomes County, according to its Township Enterprise Department, does not allow any outsiders to collect.

As of yet there is no overall policy in Tibet for non-local collectors, but in recent years counties have been much stricter in regulating access to outsiders. Outsiders are now only permitted to collect caterpillar fungus after purchasing a collection permit, which in 2006 cost anywhere from ¥300 (\$37) to over ¥1500 (\$188) per person for what is usually a one-month season.<sup>56</sup> During the 1990s, such permits for outsiders either did not exist or were much cheaper (for example, ¥10-¥30). In recent years most caterpillar fungus-producing counties began requiring permits

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<sup>55</sup> Intra-provincial migration cannot be discussed here and is not an issue for *matsutake* collection in the TAR. However, in the case of caterpillar fungus collection it needs to be mentioned that people from far away are attracted, often enduring several days on a bus to reach collection areas. In southern Qinghai, along the TAR border, Chinese Muslims (Hui) and Han from northeastern Qinghai and the neighboring provinces of Gansu and Ningxia were coming by the thousands to collect caterpillar fungus every year, in some places even outnumbering the local population during collection season (see Winkler, "Yartsa Gunbu - *Cordyceps sinensis*: Economy, Ecology & Ethno-mycology"). This is especially problematic in Qinghai but is much less of an issue in the TAR. Frequently, these outsiders are not welcome by locals since the locals feel cheated out of their resources by their county administrations who charge sometimes enormous fees for permits. This can result in tensions that cause serious problems. Apparently, each year people get killed struggling over resource access. Deadly clashes have been reported in 2005 from Rdza stod (Zaduo) County, Skye rgu mdo TAP, Qinghai, as well as in Steng chen and Nying khri Counties in the TAR. Restricting access for people from other provinces and spreading the word in the media before the season in the home provinces of migrant collectors would help resolve this problem. The plateau region is clearly moving towards restrictions on migrating caterpillar fungus collectors and in April 2008 Mgo log Prefecture announced a ban on all non-resident collectors. This is also politically opportune under the label of "keeping ethnic harmony."

<sup>56</sup> In 2006, the most expensive permit on the Tibetan Plateau about which I was informed cost ¥4000 (nearly \$500) in Mgo log Prefecture, Qinghai Province.

and local officials are dispatched to patrol collection areas. Also, fees are being raised annually, often much faster than the increasing value of the fungus. In some counties it seems like a misplaced taxation which should be collected from dealers rather than from rural households. Table 3 shows permit fees for selected TAR counties between 2004 and 2006.

**Table 3: Cost of Dbyar rtswa dgun 'bu Collection Permits in Selected TAR Counties, 2004-2006**

Residence of Collector		Home Township ( <i>Xiang</i> )			Other Township ( <i>Xiang</i> )			Non-Residents		
		Cost in Yuan			Cost in Yuan			Cost in Yuan		
County	Prefecture	2004	2005	2006	2004	2005	2006	2004	2005	2006
Kong po rgya mda'	Nying khri		80	100				250	800	1000
Nying khri	Nying khri	no fee	100	200		100	200		200	500
Ri bo che	Chab mdo		300			300		300	300	not permitted
Steng chen	Chab mdo		50			100			not permitted	not permitted
Nag chu	Nag chu	10	10		10	10			1200	
Mal gro gung dkar	Lha sa	50	50	100	50	400	1000	600	1000	1500

Most counties in Tibet also require their own residents to purchase collecting permits, but these are much cheaper, costing ¥10-¥300 per person. Many county officials insist that permit recipients, whether local or non-local, are instructed in how to minimize grassland destruction while digging 'bu – for instance, by filling the holes created by digging, keeping campsites clean, and not using local vegetation as fuel for campfires. Steng chen County even specifies that the size of the hoe used for digging 'bu cannot exceed five by fifteen centimeters.

Many county officials also explain that the money generated by permit fees is used for environmental protection, by which they mean garbage clean up after the collectors break camp. However, it could not be verified if clean-up of campsites is actually taking place. Campsites visited during break-up in Ri chu Valley (north Se da shang, Steng chen County) were marked by empty and broken beer bottles, discarded instant noodle containers, and plastic bags. The bottles pose a hazard to the hooves of grazing livestock and plastic bags are being eaten by yaks, causing gastroenteritis and even death.

As a result of our research collaboration, *Luorong Zhandui* submitted a policy advisory to the TAR government. According to Byams pa phun tshogs, chairman of the TAR, a regulation on the protection and collection of caterpillar fungus was issued and published in the Tibet Daily on May 14, 2006. In brief, the regulation

includes a stipulation for surveying the resources and developing a protection program and standardized permit system. Collectors are required and local government shall enforce the filling of dug holes and proper disposal of trash. Still lacking is a complete prohibition on outsiders collecting within the TAR.

### **Collection in Sacred Areas**

Namkhai Norbu<sup>57</sup> reports that “Rigya, the general [traditional Tibetan] laws that govern relations with the environment,” forbid the digging of caterpillar fungus, and that nomads regard it as a treasure of “the earth spirits.” Digging *'bu* or medicinal plant roots is believed to provoke these earth spirits who will then strike the offender, his family and clan with sickness and punish his livestock with ill health. Nowadays, *'bu* is collected by a majority of rural Tibetans, but the traditional taboo against digging *'bu* is still maintained at some sacred sites, especially sacred mountains. Following ancient traditions, every Tibetan community worships a mountain in its environs as the seat of a deity, a protective spirit whose benevolence is believed to be crucial for a community to thrive. When locals in several different localities were queried about the occurrence of *'bu* on these sacred mountains, they responded by saying that there was none. When I responded that *'bu* must be there because the habitat was right and neighboring areas were productive, the locals would modify their statement, saying, “It might be, but nobody is collecting it here.” However, the current widespread collection all over Tibet demonstrates that the economic realities are clearly sinking this taboo into oblivion, except in sacred sites.

### ***Sustainability of the Harvest***

The annually increasing harvest pressure of caterpillar fungus is alarming and unprecedented. This commodification of caterpillar fungus has become rural Tibetans' access ticket to a steadily expanding cash-dependent lifestyle. With steadily increasing numbers of Tibetans searching for *'bu* and even some local governments now facilitating searches in more remote places, the issue of sustainability looms large. Although *Cordyceps sinensis* is listed as a second-class protected species (as is *matsutake*) in the PRC, in actuality second-class status means that while exploitation is still feasible, for export a license is needed and the government might set a quota. However, the market is driven by domestic consumption rather than export.<sup>58</sup> Thus, it does not protect *Cordyceps sinensis* in any concrete sense at this point.

*Cordyceps sinensis* has been collected for centuries and the same sites have been searched for hundreds of years; an example is Li thang (Litang), Dkar mdzes

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<sup>57</sup> Namkhai Norbu, *Journey among the Tibetan Nomads: An Account of a Remote Civilization* (Dharamsala: LTWA, 1997), 1-88.

<sup>58</sup> PRC's pharmaceutical administration reports an export of 4,795 kilograms in 2004 (Chris Buckley, “Tibetan Herders Join Rush for Prized Fungus, Yajiang, China,” Reuters, June 13, 2006), which represents 2.5 to 5 percent of the annual harvest.



TAP, Sichuan.<sup>59</sup> These are still highly productive areas, a testament to the resilience of this fungus and its host larvae to human predation. Interviewed collectors do not report reduced output, but complain about reduced harvesting rates per individual due to steadily increasing competition. Similarly, dealers and brokers do not lament reduced output rates, but report increased competition. In addition, most statistics still report increased production, though this could simply be the result of more people searching in addition to the discovery of new collection areas.

One could speculate that collectors might be finding just a fraction of the crop because the fungus is so small and very difficult to spot. In addition, its production area is so vast and remote. Thus, it seems plausible that reservoir populations remain that will produce spores for future generations. Also, the constant handling and transport of 'bu might aid its spore dispersal. However, nearly all *Cordyceps* gathered early in the season has not begun to sporulate, and it is estimated that 40-70 percent of those gathered in mid-season are likewise immature. Towards the end of the season, nearly all fungi are sporulating and the search is terminated although there are still healthy fruiting bodies in the ground. These are left behind since the larva is so deteriorated that the fungus becomes nearly worthless.

The issue of sustainability is discussed by several authors.<sup>60</sup> However, research on the harvest effects of *Cordyceps sinensis* is noticeably lacking. Studies of ecto-mycorrhizal mushrooms (see above) suggest that production sustainability is secured when appropriately harvested, but *Cordyceps sinensis* has a very different life cycle. The fungal organism dies after producing its fruiting body. In addition, the fungus is completely dependent on the availability of its host organisms, *Thitarodes* ghost moths. Although there is no data available on the impact of grassland degradation on *Thitarodes* populations, be it through overgrazing or desiccation, it can be speculated that a healthy grassland ecosystem is favorable to larval development. The fact that several informants reported strongly reduced production in degraded grasslands also seems to point in this direction.

Overall, it is necessary to state that the long-term impact of the intensive collection of *Cordyceps sinensis* is still unknown and that a credible assessment of the sustainability of current harvesting levels is not possible based on the research available. In the absence of definitive research, however, a "best guess" assessment

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<sup>59</sup> Alessandro Boesi, "The dByar rtsawa dgun 'bu (*Cordyceps sinensis*): An Important Trade Item for the Tibetan Population of the Li thang County, Sichuan, China," *Tibet Journal* 19, no. 1 (2003); Winkler, "Forest Use."

<sup>60</sup> He and Sheng, "Utilization and Conservation of Medicinal Plants in China"; Bhattarai, "Biodiversity - People Interface in Nepal"; P. A. Shei, Wang Sung, and Xie Yan, "Fifth Annual Report of the Biodiversity Working Group (BWG)/CCICED," in *Conserving China's Biodiversity II* (Beijing: China Environmental Science Press, 2001), 78-100; Zhang, Wang, and Geng, "A Case Study on the Exploitation and Management of NTFP"; Nigel Hywel-Jones, "*Cordyceps sinensis*: An Extraordinary 'Herb' and Its Poaching by Tibetans in Bhutan," *Bhutan Society Newsletter* 26, no. 8 (London: Bhutan Connections, 2003); S. Sharma, "Trade of *Cordyceps sinensis* from High Altitudes of the Indian Himalaya: Conservation and Biotechnological Priorities," *Current Science* 86, no. 12 (2004), 1614-19; Winkler, "Matsutake Mycelium under Attack in SW China"; Winkler, "Yartsa Gunbu Fungal Commodification."

can be arrived at by applying “Rapid Vulnerability Assessment.”<sup>61</sup> RVA integrates indigenous and scientific knowledge, drawn from ecology, socio-economics, and economics, to facilitate a quick and broad assessment of sustainability. Using RVA for *Cordyceps sinensis* indicates a moderate degree of vulnerability.

It is evident that more research is necessary to reliably assess the situation. Field trials of different harvesting schemes over at least five years need to be carried out to address the question of sustainable management. TAR and central government agencies need to provide funding for scientific long-term studies on the sustainability of harvesting techniques to optimize resource management and protection. The current permit system needs to be standardized and regulations developed to ensure resource protection.

## Conclusion

Rural Tibet increasingly relies on the mushrooming fungus trade and boasts a fungus economy that is unique. In no other region of the world is an economy as dependent on mushroom income. For rural communities, fungus income is of immense importance, offering badly needed cash income necessary to pay for health services, schooling, transportation, and goods. Rural Tibetans have come to rely on this resource increasingly in recent years. Fungus income enables rural households, which are too often neglected in current development schemes that focus on urban economic development, to hold on to their preferred lifestyle and participate in a world transformed by commodification. It also offers capital to diversify their economic activities. Should this source of income dry up, be it through resource destruction or a market crash, the impact on rural Tibetans would be devastating.

Tibet’s fungus resources need to be monitored. More reliable baseline data is needed. While it has been recognized in the TAR that *Tricholoma matsutake* can be harvested sustainably using appropriate techniques, as outlined by western scientific studies, there is hardly any scientific knowledge regarding sustainable collection of *Cordyceps sinensis*. Collection pressure is steadily increasing. While collectors and dealers are concerned about increased competition, hardly any informant worried about future harvests. The establishment of a permit system in most TAR counties for *Cordyceps sinensis* and in some counties for *Tricholoma matsutake* collection is an important step, especially to communicate annually with collectors and disseminate information regarding appropriate resource use and environmental protection. Efforts are being made to increase local benefits from the *matsutake* trade in the TAR by providing subsidies for *matsutake* processing and establishing TAR-based export companies. However, there is still opportunity for improvement. Thus far there are no guidelines at the TAR level regarding

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<sup>61</sup> After Wong (J. L. G. Wong, “The Biometrics of Non-Timber Forest Product Resource Assessment: A Review of Current Methodology,” in *Research paper ETFERN* [UK: DFID, 2006], <http://www.etfn.org/etfn/workshop/ntfp/text.pdf>). More details are published in Winkler, “Yartsa Gunbu Fungal Commodification.”

*Tricholoma matsutake* collection and trade. The TAR government initiated better monitoring of *Cordyceps* and an information exchange between relevant agencies in 2006. It remains to be seen if this actually will lead to the formulation of a resource management plan.

**Appendix: Mnyam nyid rdo rje’s Text**

Mnyam nyid rdo rje’s fifteenth-century text appears in Mnyam nyid rdo rje, *Man ngag bye ba ring bsrel pod chung rab byams gsal ba’i sgron me* [Instructions on a Myriad of Medicines] (Lanzhou: Kan su’u mi rigs dpe skrun khang, 1993), 417-19.<sup>62</sup>

རོ་རྩ་<sup>63</sup>ཡོན་ཏན་གྱ་མཚོ་ཞེས་བྱ་བ་དཔལ་ལྷན་ཟུར་མཁར་བའི་བྱུང་བཅོས་བཞུགས།

ཨོ་ཨེ་མུ

འཇིག་རྟེན་འདི་ན་ཕྱན་ཚོགས་གྱི།

བདེ་བ་ཀྱན་ལས་མྱད་བྱུང་བ།

འདོད་པའི་ཡོན་ཏན་གྱི་གྱིས་ནི།

མྱིང་པོ་རོ་རྩ་འི་སྐྱུར་བ་ལ།

བསྟན་བཅོས་ཡན་ལག་བརྒྱད་པ་ལས།

འདམ་བུ་བྱུར་གིང་འཇག་མ་ཅ།

དེ་ཡང་དབྱར་རྩ་དགུན་བྱ་ཞེས།

ཞེས་གསུངས་སྟན་གྱི་འབྲུངས་དཔེ་ནི།

ཅ་སྒྲུམ་པོ་ལ་སོགས་གྱི།

རི་པོ་དཔེན་པའི་ལྗོངས་སུ་སྐྱེ།

དབྱར་དུས་འབྲུ་ལ་ལོ་མའི་རྩ།

རི་སྐོག་འདབ་མ་འདྲ་བ་ལ།

62 My thanks to Yonten Gyatso, who informed me of this earliest reference to caterpillar fungus in a Tibetan document, and to Olaf Czaja, who shared the Tibetan source text.

63 This reading should likely be emended to རོ་ཅོ་.

མེ་ཏོག་ཨ་བ་དར་ལྷུང་འབྲུ།  
 ཅ་བ་སྟོན་བཞུགས་གོ་སྟོན་འབྲུ།  
 རོ་ནི་མངར་ངང་ཅུང་ཟད་བསྐྱ།  
 ལྷུང་མངར་ཞིང་རྩམ་པ་བསྐྱུམ།  
 རོ་ཞིང་ཅུང་ཟད་ཡང་དག་ལྷན།  
 ལྷུང་འཛོམས་མ་ཞེས་པ་སེལ་བྱེད་ཅིང་།  
 བད་ཀན་མི་སྐྱེ་འོ་མཚར་སྐྱེན།  
 ལྷུང་པར་བྱང་སེམས་རབ་ཏུ་འཕེལ།  
 ཉེས་མེད་ཡོན་ [page 418] ཉན་རྒྱ་མཚོའི་གཏིར།  
 དེ་ལ་སྐྱེར་སྤྲིའི་མན་རག་ནི།  
 དུས་སྟུ་བསྐྱེས་པའི་ཅ་བ་དེ།  
 ས་མེད་ཁྲིམ་ཁྲོམ་བརྟུངས་པ་ལ།  
 གཙང་གཡེར་ཞིབ་བཞུགས་པའམ་ཅི་བྲན།  
 འཚིལ་པའི་ཁོག་པ་བཀའ་ལ་བཅོས།  
 གསེར་མདོག་བཟང་པོ་གཅིག་གི་ཕྱི།  
 ལྷུག་གི་འོ་མ་སྤེལ་གང་ན་མས།  
 ལྷུགས་སྟོན་ལྷུང་པར་མེས་བཅོས།  
 དེ་ནས་སྐར་ཡང་མ་ཚོག་པར།  
 དལ་ལུས་མི་ཡི་རྟོན་ལ་སྐྱུམ།  
 ལྷུང་དང་པལ་ནས་ཞིབ་པར་བཞུགས།  
 ལ་ཚར་བཟང་དུག་ཕོ་བ་རྩིལ།  
 གི་མི་དོམ་མ་ཞེས་ཚིག་སྐབ་འབྲུ།  
 གསང་བ་སྐྱེན་གཅིག་སྐྱེན་བཟང་རེ།

བཀའ་སྤྲུལ་བཟང་པོ་རྟེན་གྲུང་བསྐྱེས།  
 ཞིབ་བཏགས་སྤྲང་ཚིས་རིལ་བུ་ནི།  
 ལྷག་གི་རིལ་བཙམ་དུ་བྱིས།  
 ཐོ་རངས་ལ་རག་གར་ཆང་གཉིས།  
 བཀའ་འབྲེལ་ཀར་སྤྲར་བས་ལུལ།  
 དེར་ཁོར་དུལ་མ།  
 ཟླ་བར་བསྟེན་ལ་ཆགས་སྤྱོད་དང་།  
 བརྟེན་དང་རུལ་སྤངས་སྤོད་སྤང་།  
 དཀར་དང་མངར་གསུམ་གསར་བརྟུན་བསྟེན།  
 བན་ཡོན་བསམ་གྱིས་མི་བྱལ་གྱི།  
 ལུས་གྱི་ལྷངས་བདུན་རྒྱས་པ་ལས།  
 བྱུང་པར་ལོ་རྩའི་དོན་མཚོག་བྱེད།  
 རིགས་བརྒྱད་འཕེལ་དང་མདངས་བཀག་རྒྱས།  
 དབང་པོ་ལྗེ་ནི་རྣམ་པར་བཀ།  
 འདི་ལ་ཡོན་ཏན་མཐའ་ཡས་པ།  
 ཚོགས་གི་བརྗོད་པ་ཟད་མཐའ་མེད།  
 ཉམས་སྤྲུངས་ན་བདེ་ཆེན་གྱིས།  
 ལྷག་རྒྱ་གར་མཁན་རྣམ་དཔྱོད་གྱིས།  
 མཚོས་མ་འབྲུམ་གྱི་དགའ་བ་འཕྲོག།  
 ཞལ་གདམས་མཐོང་བརྒྱད་མེད་པ་ན།  
 རི་ལྗར་འདོད་པའི་འབྲས་མི་སྟེར།  
 འདི་ན་དད་མོས་ཕན་པ་ཡིས།  
 སེམས་སྤལ་སྤྱན་པོ་རང་འདོད་དང་།

གྲིན་འི་གདོན་གྲིས་གཟེར་བ་རྣམས།

སྣོད་མིན་ཉ་ལ་ནག་པོ་དེ།

དགེ་ཞིང་བཟུ་བོར་གནས་པ་དང་།

དམ་ཚོག་གཞུང་བཟང་བསྐལ་པ་ཅན།

ཡོད་ན་ཟབ་གནད་འདི་ཡིན་ཞེས།

རྣམ་སྐྱེ་མིས་གྲིས་འདི་དགེས།

འགྲོ་ཀུན་བདེ་བ་མཚོག་ཐོབ་ཤོག།

ཞུསྟེ་སང་རྩ་གཞི་

### ***An Ocean of Excellent Aphrodisiac Qualities: A Special Work by Zur mkhar mnyam nyid rdo rje***

*Translated by Jakob Winkler*

In this world [sexual] bliss is  
 The most marvelous of all pleasures,  
 The essence of the enjoyment of the all senses.  
 As for the recipes which increase libido  
 In *The Treatise of Eight Branches*  
 The *Aṣṭāṅga Śāstra* states:  
 “*Dam bu bur shing ‘jag ma rtsa*”  
 Is also called Dbyar rtswa dgun ’bu.

Concerning this medicinal substance:  
 It grows in beautiful mountain regions  
 On remote grass-covered slopes.  
 In the summer it is a blade of grass on a worm  
 Similar to the leaf of mountain garlic.  
 The flower resembles a silken green sedge.  
 The root resembles cumin seed at the end of autumn.  
 The taste is sweet and a little astringent.  
 The post-digestive taste is sweet and the quality is oily.  
 It has a slightly warm quality.  
 It removes *prāṇa* diseases, cures bile diseases and  
 Without increasing the phlegm; a marvelous medicine.  
 In particular, it increases especially semen.  
 It is a faultless treasure of an ocean of good qualities.

The secret instruction on the preparation:  
 Pick the root at the right time and

After having cleaned it from all soil,  
 Crush the bunch of *dbyar rtswa* and  
 Grind into a clean, smooth powder and add yeast.  
 Fill the chest of a sparrow with it and boil it.  
 Then open the chest with a golden instrument and  
 Add a liter of sheep milk.  
 Boil it in an iron kettle until the liquids disappear.  
 Then again, without burning it  
 Slowly dry it with the heat of fire.  
 After all moisture is evaporated, grind it to a fine powder.  
 As additional ingredients [add]: the “six excellent medicinal ingredients,” black  
     pepper, bezoar stone, bear’s bile, *chig thub* seed,  
 A good dose of secret medicine (*gsang ba sman*)  
 And also add a fine snow lizard when obtainable.  
 Grind it to a fine powder and  
 Roll it into pills the size of sheep dung.  
 Take it at dawn either with arrack or strong beer  
 Whatever you can obtain and add sugar to it.  
 Take it for one month and abstain from intercourse  
 And avoid raw foods and spoiled vegetables.  
 Rely upon the Three Whites [milk, butter, curd] and  
 The Three Sweets [sugar, honey, molasses].  
 It bestows inconceivable advantages.  
 Thus, it increases the Seven Bodily Constituents.  
 Among these, particularly it serves best for the purpose of libido,  
 Increasing offspring and improving vitality.  
 It completely sharpens the five sense faculties.  
 It has innumerable qualities; to praise it in words would be endless.

When one practices the method of Great Bliss,  
 A yogi knowing how to dance with the consort  
 Clearly discerning lust from the Yoga of Union  
 Will enjoy the delight of hundreds of thousands of beautiful women.  
 Without having the authentic transmission of the oral instructions  
 The fruit of whatever one wishes for is not attained.  
 Here foolish and selfish people engaging without faith and devotion,  
 Being afflicted by negative influence  
 Are not suitable recipients (like vessels) poisoned with aconite.  
 The crucial point is to be virtuous, honest  
 And to have the fortune of heeding the sacred commitment.

By these words written by Dharma Svāmi, the Lord of Phenomena,  
 May all beings achieve supreme bliss!

*Astu sarva jagatām*

## Glossary

**Note:** these glossary entries are organized in Tibetan alphabetical order. All entries list the following information in this order: THL Extended Wylie transliteration of the term, THL Phonetic rendering of the term, the English translation, the Sanskrit equivalent, the Chinese equivalent, other equivalents such as Mongolian or Latin, associated dates, and the type of term.

Ka					
Wylie	Phonetics	English	Other	Dates	Type
<i>kan su'u mi rigs dpe skrun khang</i>	Kensu Mirik Petrünkhang				Publisher
<i>kong po</i>	Kongpo		Chi. <i>Gongbu</i>		Place
<i>kong po rgya mda'</i>	Kongpo Gyamda		Chi. <i>Gongbujangda</i>		Place
<i>klu nang shang</i>	Lunang Shang	Lunang Township	Chi. <i>Lulang Xiang</i>		Place
<i>dkar mdzes</i>	Kandzé		Chi. <i>Ganzi</i>		Place
<i>skye rgu mdo</i>	Kyegundo		Chi. <i>Yushu</i>		Place
Kha					
Wylie	Phonetics	English	Other	Dates	Type
<i>kham</i>	Kham				Place
<i>khu khu sha mo</i>	khukhu shamo	morel	Chi. <i>yangdu jun</i> Lat. <i>Morchella spp.</i>		Scientific Name
<i>mkhar ltag</i>	Khartak				Place
<i>'khrungs dpe dri med shel gyi me long</i>	<i>Trungpé Drimé Shelgyi Melong</i>				Text
Ga					
Wylie	Phonetics	English	Other	Dates	Type
<i>gangs lha me tog</i>	ganglha metok	snow lotus	Chi. <i>xuelian hua</i> Lat. <i>Saussurea medusa</i>		Scientific Name
<i>dga' ba'i rdo rje</i>	Gawé Dorjé				Author
<i>dgong dkar</i>	Gongkar		Chi. <i>Gongga</i>		Place
<i>mgo dmar po</i>	go marpo	red head caterpillar fungus	Chi. <i>hong chong cao, hong tou</i>		Name
<i>mgo log</i>	Golok		Chi. <i>Guoluo</i>		Place
<i>rgyal thang rdzong</i>	Gyeltang Dzong	Gyeltang County	Chi. <i>Xianggelila Xian</i>		Place
<i>brgyad gcig grong</i>	Gyechik Drong		Chi. <i>Bayi Zhen</i>		Place
Nga					
Wylie	Phonetics	English	Other	Dates	Type
<i>mnga' ris khul</i>	Ngari Khül		Chi. <i>Ali Diqu</i>		Place
<i>mnga ba</i>	Ngawa		Chi. <i>Aba</i>		Place



Cha					
Wylie	Phonetics	English	Other	Dates	Type
<i>cha phreng</i>	Chatreng		Chi. <i>Xiangcheng</i>		Place
<i>chab mdo</i>	Chamdo		Chi. <i>Changdu</i>		Place
<i>chig thub</i>	chiktup				Term
Nya					
Wylie	Phonetics	English	Other	Dates	Type
<i>nying khri</i>	Nyingtri		Chi. <i>Linzhi</i>		Place
<i>mnyam nyid rdo rje</i>	Nyamnyi Dorjé			1439-75	Person
Ta					
Wylie	Phonetics	English	Other	Dates	Type
<i>steng chen</i>	Tengchen		Chi. <i>Dingqing</i>		Place
Da					
Wylie	Phonetics	English	Other	Dates	Type
<i>bde chen</i>	Dechen		Chi. <i>Diqing</i>		Place
<i>'dam bu bur shing 'jag ma rtsa</i>	dambu burshing jakmatsa				Term
<i>rdo rje</i>	Dorjé				Person
<i>sdong po/sdong phung</i>	dongpo/dongpung	gastrodia	Chi. <i>tian ma</i> Lat. <i>Gastrodia elata</i>		Scientific Name
Na					
Wylie	Phonetics	English	Other	Dates	Type
<i>nag chu</i>	Nakchu		Chi. <i>Naqu</i>		Place
Pa					
Wylie	Phonetics	English	Other	Dates	Type
<i>dpa' shod rdzong</i>	Pashö Dzong	Pashö County			Place
<i>dpal 'bar</i>	Pelbar				Place
<i>spo mes</i>	Pomé		Chi. <i>Bomi</i>		Place
<i>spo mes rdzong</i>	Pomé Dzong	Pomé County	Chi. <i>Bomi Xian</i>		Place
<i>spra rmog shang</i>	Tramok Shang	Tramok Township	Chi. <i>Zhamu Xiang</i>		Place
Ba					
Wylie	Phonetics	English	Other	Dates	Type
<i>bar la</i>	Barla				Place
<i>be shing sha mo</i>	beshing shamo	matsutake, pine mushroom	Chi. <i>songrong</i> Lat. <i>Tricholoma matsutake</i>		Scientific Name
<i>bya rgod sug pa</i>	jargö sukpa				Scientific Name
<i>byams pa phun tshogs</i>	Jampa Püntsok				Person
<i>dbang lag</i>	wanglak	marsh orchid	Chi. <i>shouzhang shen</i> Lat. <i>Gymnadenia spp.</i>		Scientific Name
<i>dbyar rtswa</i>	yartsa		Lat. <i>Cordyceps</i>		Term

<i>dbyar rtswa dgun 'bu</i>	yartsa günbu	caterpillar fungus	Chi. <i>dongchong xiaocao</i> Lat. <i>Cordyceps sinensis</i>		Term
'bu	bu	caterpillar fungus			Term
'bu dkar po	bu karmo	white caterpillar	Chi. <i>bai chong cao</i>		Term
'bri ru	Biru				Place
<i>sbom po</i>	Bompo				Person
<i>sbra chen</i>	Drachen		Chi. <i>Bachen</i>		Place
<i>sbra chen</i>	Drachen		Chi. <i>Baqen</i>		Place
<i>sbra chen</i>	Drachen		Chi. <i>Baqian</i>		Place
<b>Ma</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>man ngag bye ba ring bsrel pod chung rab byams gsal ba'i sgron me</i>	<i>Menngak Jewa Ringsel Pöchung Rapjam Selwé Drönmé</i>	<i>Instructions on a Myriad of Medicines</i>			Text
<i>mal gro gung dkar</i>	Meldro Gungkar		Chi. <i>Mozhugongka</i>		Place
<i>mi rigs dpe skrun khang</i>	Mirik Petrünkhang				Publisher
<i>me tog gangs lha</i>	metok ganglha	glacier/snow deity flower			Scientific Name
<i>me tog rdzong</i>	Metok Dzong	Metok County	Chi. <i>Mutuo Xian</i>		Place
<i>smam gling</i>	Menling		Chi. <i>Milin</i>		Place
<i>smar khams</i>	Markham				Place
<i>smar khams rdzong</i>	Markham Dzong	Markham County	Chi. <i>Mangkang Xian</i>		Place
<b>Dza</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>rdza stod</i>	Dzatö		Chi. <i>Zaduo</i>		Place
<i>rdza yul</i>	Dzayül		Chi. <i>Chayu</i>		Place
<b>Zha</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>gzhis ka rtse</i>	Zhikatsé		Chi. <i>Rigazi</i>		Place
<b>Za</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>zur mkhar mnyam nyid rdo rje</i>	Zurkhar Nyamnyi Dorjé			1439-75	Person
<b>Ra</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>ra mo shag chen</i>	ramo shakchen				Term
<i>ri chu</i>	Richu				Valley
<i>ri bo che</i>	Riwoché		Chi. <i>Leiwuqi</i>		Place
<b>La</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>li thang</i>	Litang		Chi. <i>Litang</i>		Place

<i>lo gsar</i>	Losar	the Tibetan New Year			Festival
<b>Sha</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>shang</i>	shang	township	Chi. <i>xiang</i>		Term
<b>Sa</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>sa skya rdzong</i>	Sakya Dzong	Sakya County	Chi. <i>Sajia Xian</i>		Place
<i>se da shang</i>	Seda Shang				Place
<i>ser sha</i>	sersha	golden mushroom	Chi. <i>huanghuan jun</i> Lat. <i>Floccularia luteovirens</i>		Scientific Name
<i>sog</i>	Sok				Place
<i>gsang ba sman</i>	sangwa men	secret medicine			Term
<b>Ha</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Other</b>	<b>Dates</b>	<b>Type</b>
<i>lha ri</i>	Lhari		Chi. <i>Jiali Xian</i>		Place
<i>lha sa</i>	Lhasa		Chi. <i>Lasa</i>		Place
<i>lho kha</i>	Lhokha		Chi. <i>Shannan</i>		Place
<b>Latin</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Latin</b>	<b>Dates</b>	<b>Type</b>
			<i>A. caesarea</i>		Scientific Name
			<i>A. hemibapha var. ochracea</i>		Scientific Name
		Field mushroom	<i>Agaricus campestris</i>		Scientific Name
		Button mushrooms	<i>Agaricus spp.</i>		Scientific Name
			<i>Amanita</i>		Scientific Name
			<i>Amanita hemibapha</i>		Scientific Name
		Grisettes	<i>Amanita vaginata</i>		Scientific Name
			<i>Armillaria</i>		Scientific Name
			<i>Armillaria luteovirens</i>		Scientific Name
			<i>Ascomycota</i>		Phylum
			<i>Asteraceae</i>		Scientific Name
		Wood ear	<i>Auricularia auricula</i>		Scientific Name
			<i>Basidiomycota</i>		Phylum
		King bolete	<i>Boletus edulis</i>		Scientific Name

		Boletes	<i>Boletus spp.</i>		Scientific Name
		Chanterelle	<i>Cantharellus cibarius</i>		Scientific Name
		Chanterelle	<i>Cantharellus minor</i>		Scientific Name
			<i>Cervus albirostris</i>		Scientific Name
			<i>Cervus elaphus macneilli</i>		Scientific Name
			<i>Cordyceps nepalensis</i>		Scientific Name
		Basket stinkhorn	<i>Dictyophora indusiata</i>		Scientific Name
			<i>Floccularia</i>		Scientific Name
			<i>Floccularia luteovirens</i>		Scientific Name
			<i>Fritillaria</i>		Scientific Name
			<i>Ganoderma</i>		Scientific Name
		Lacquered bracket	<i>Ganoderma lucidum</i>		Scientific Name
			<i>Gentiana</i>		Scientific Name
		Lion's mane	<i>Hericium erinaceous</i>		Scientific Name
		Hedgehog	<i>Hydnum repandum</i>		Scientific Name
		Brittlegill Waxcap	<i>Hygrophorous russula</i>		Scientific Name
			<i>Kobresia</i>		Scientific Name
		Milkcaps	<i>Lactarius spp.</i>		Scientific Name
		Scaly boletes	<i>Leccinum spp.</i>		Scientific Name
		Shitake	<i>Lentinula edodes</i>		Scientific Name
		Puffball	<i>Lycoperdon spp.</i>		Scientific Name
		musk deer	<i>Moschus berezovskii</i>		Scientific Name
		musk deer	<i>Moschus crysogaster</i>		Scientific Name
			<i>Morchella conica</i>		Scientific Name
		Morel	<i>Morchella conica/elata</i>		Scientific Name
			<i>Morchella elata</i>		Scientific Name

			<i>Morchella esculenta</i>		Scientific Name
		Brown Rollrim	<i>Paxillus involutus</i>		Scientific Name
			<i>Polygonum bistortum</i>		Scientific Name
		Corals	<i>Ramaria spp.</i>		Scientific Name
			<i>Rhodiola</i>		Scientific Name
		Gypsy	<i>Rozites caperata</i>		Scientific Name
		Tibetan Gypsy	<i>Rozites/Cortinarius emodensis</i>		Scientific Name
		Brittle gills	<i>Russula spp.</i>		Scientific Name
		Hawkwing	<i>Sarcodon imbricatus</i>		Scientific Name
			<i>Saussurea</i>		Scientific Name
			<i>Selenarctos tibetanus</i>		Scientific Name
			<i>sensu lato</i>		Term
		musk deer	<i>Moschus sifanicus</i>		Scientific Name
		Slippery jacks	<i>Suillus spp.</i>		Scientific Name
		Termite mushroom	<i>Termitomyces striatus</i>		Scientific Name
		Soap knight	<i>Tricholoma cf saponosum</i>		Scientific Name
		Zang's knight	<i>Tricholoma zangii</i>		Scientific Name
			<i>Ursus</i>		Scientific Name
			<i>Ursus arctos</i>		Scientific Name
<b>Chinese</b>					
<b>Wylie</b>	<b>Phonetics</b>	<b>English</b>	<b>Chinese</b>	<b>Dates</b>	<b>Type</b>
			<i>Beijing</i>		Place
		<i>Essentials of a Compendium of Materia Medica</i>	<i>Ben Cao Bei Yao</i>		Text
			<i>Chengdu</i>		Publication Place
			<i>Dai Xiancai</i>		Author
			<i>Dawa Ciren</i>		Author
			<i>Gansu</i>		Place

		<i>Forestry History of Ganzi Tibetan Autonomous Prefecture</i>	<i>Ganzi Zangzu Zizhizhou Lingyezhi</i>		Text
			<i>Geng Yunfen</i>		Author
			<i>Han</i>		Ethnicity
			<i>He Jun</i>		Author
			<i>Helongjiang</i>		Place
			<i>Hengduan</i>		Geographic feature
		Chinese Muslim	<i>Hui</i>		Ethnicity
			<i>J. L. G. Wong</i>		Author
			<i>Jiang Changpin</i>		Author
			<i>Jilin</i>		Place
		five-hundred grams	<i>jin</i>		Term
<i>dar rtse mdo</i>	Dartsendo		<i>Kangding</i>		Place
			<i>Kunming</i>		Publication Place
			<i>Lanzhou</i>		Publication Place
			<i>Li Chun</i>		Author
			<i>Liu Jianbang</i>		Author
			<i>Lu Rongsen</i>		Author
			<i>Luorong</i>		Author
			<i>Luorong Zhandui</i>		Author
			<i>Ma Jianzhong</i>		Author
			<i>Mao Xiaolan</i>		Author
			<i>Ningxia</i>		Place
			<i>P. A. Shei</i>		Author
			<i>Qinghai</i>		Place
			<i>Sichuan</i>		Place
			<i>Sichuan Chishu Chubanshe</i>		Publisher
			<i>Sichuan Kexue Jisu Chubanshe</i>		Publisher
		<i>Mushroom Key of Ganzi Prefecture</i>	<i>Sichuan Zhen Ganzi Zhou Jun Leizhi</i>		Text
			<i>Sun P. Q.</i>		Editor
			<i>Wang Ang</i>		Author
			<i>Wang Lan</i>		Author
			<i>Wang Sung</i>		Author
			<i>Wang Wenbing</i>		Author
			<i>Wong</i>		Author
			<i>Xie Yan</i>		Author
			<i>Xu Jianchu</i>		Author
			<i>Yang</i>		Author

			<i>Yang Xuefei</i>		Author
			<i>Yang Yongping</i>		Author
			<i>Yang Zhanchang</i>		Author
			<i>Yang Zhuliang</i>		Author
			<i>yuan</i>		Term
			<i>Yuan M. S.</i>		Editor
			<i>Yunnan</i>		Place
			<i>Zang Mo</i>		Author
			<i>Zhang Jinfeng</i>		Author
		<i>Illustration for China Popular Edible Mushroom</i>	<i>Zhongguo Changjian Shiyong Jun Tujian</i>		Text

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