Journal of Ethnopharmacology 221 (2018) 86–90

Contents lists available at ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jethpharm

Harvest and trade of caterpillar mushroom (*Ophiocordyceps sinensis)* and the implications for sustainable use in the Tibet Region of Southwest China

Jun He[a,b,c,*]

[a] National Centre for Borderland Ethnic Studies in Southwest China, Yunnan University, Kunming 650091,China
[b] School of Ethnology and Sociology, Yunnan University, Kunming 650091,China
[c] The Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle (Saale), Germany

ARTICLE INFO

Keywords:
Commercial non-timber forest products
Customary tenure
Medicinal plants
Value chain
Tibet region

ABSTRACT

Ethnopharmacological relevance: Caterpillar mushroom (*Ophiocordyceps sinensis*) is a unique medicinal fungi which is only found in alpine grasslands in Himalayan mountain regions and the Tibetan Plateau. Known locally as Yartsa Gunbu, it has been widely used in Tibetan and Chinese Medicine for centuries. It is crucial to understand local commercial harvest and trade practices of caterpillar mushroom to support the sustainable management of this valuable resource. However, data derived from empirically grounded research is currently limited, particularly in China.

Aim of this study: The research aims to provide the most up-to-date insights into caterpillar mushroom harvest and trade in the main production area of the Tibet Region in Southwest China and to generate policy recommendations for sustainable use.

Materials and methods: The research was conducted in 2015–2016 in six Tibetan communities located in two counties in Diqing Tibetan Autonomous Prefecture, Southwest China. Quantitative and qualitative data were collected from in-depth interviews with local households engaged in caterpillar mushroom harvesting (n = 157), local caterpillar mushroom traders (n = 14), and from focus groups discussions (n = 5) with regional caterpillar mushroom industry stakeholders.

Results: The research found large regional- and community-level differences in caterpillar mushroom harvest practices. The harvest practices of communities involved in the co-management of a Nature Reserve were more sustainable than those communities not involved in such a scheme, and this was due to the external support and training provided via the co-management scheme. Moreover, a customary tenure system was proving effective for avoiding competition over caterpillar mushroom collection. However, in both counties, narrow marketing channel and non-grading system in trade limits the possibility of improving the local benefits generated from the commercial harvest of caterpillar mushroom. Meanwhile, the local traders play an important bridging role in the value chain and generate greater benefits from product grading.

Conclusion: To support the sustainable management of the caterpillar mushroom industry in Southwest China, the prefectural governments should invest in training on appropriate harvesting techniques and the dissemination of market information. It is also critical that prefectural governments recognize and support the customary tenure system of mushroom collection to avoid competition between collectors.

1. Introduction

Caterpillar mushroom [*Ophiocordyceps sinensis* (Berk.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora] is a unique fungal organism that is only found in alpine grasslands in Himalayan mountain regions and the Tibetan Plateau at elevations ranging from 3400 to 5000 m.a.s.l. It is known locally as 'Yartsa Gunbu', which translated from Tibetan means "winter worm - summer grass" (冬虫夏草). This mushroom has been widely used for centuries in Tibetan and Chinese medicine (Cannon et al., 2009; Winkler, 2009). Nowadays, caterpillar mushroom has become a commercialized medicinal product (Winkler, 2008) and a fashionable luxury gift welcomed by the middle-class in Chinese cities (Woodhouse et al., 2014). This commercialization has led to a booming domestic and international market, and global trade estimated at about USD 5–11 billion annually (Shrestha, 2012). The rapidly growing market for caterpillar mushroom has also led to a dramatic increase in its price. In Tibet, Winkler (2009) reported a 900% price increase between 1997 and 2008, while in Nepal there was a 2300% increase

* Correspondence address: National Centre for Borderland Ethnic Studies in Southwest China, Yunnan University, Kunming 650091,China.
E-mail address: jun.he@ynu.edu.cn.

https://doi.org/10.1016/j.jep.2018.04.022
Received 22 January 2018; Received in revised form 28 March 2018; Accepted 17 April 2018
Available online 18 April 2018
0378-8741/

between 2001 and 2011 (Shresta and Bawa, 2013). More recently, official data from the China Caterpillar Mushroom Association shows a 125-fold price increase in Tibet, where prices have risen from 200 RMB/kg in 1995–250,000 RMB/kg (40,000 USD/kg) in 2012, with a particularly rapid increase after 2008 (see graphical abstract). Caterpillar mushroom is now often referred to as "organic gold" or "soft gold", given its high market value that now actually exceeds that of gold at the same weight (Woodhouse et al., 2014; Yeh and Lama, 2013; Pouliot et al., 2018).

The commercial collection of caterpillar mushroom is of great importance to local livelihoods in Southwest China, Tibet and Himalayan regions. For example, the mushroom contributes between 40% and 90% of collector households' cash income in these regions (Winkler, 2008; Weckerle et al., 2010). In Nepal, Shrestha and Bawa (2014) reported the income from caterpillar mushroom became the second largest source for collector households, contributing 21.1% of total household income and 53.3% to the total cash income. Similarly significant contributions to the economy of collector households have been found in other parts of the Himalayan region, such as in Bhutan (Cannon, 2009; Wu et al., 2016) and India (Negi et al., 2015; Caplins and Halvorson, 2017). However, the growing commercial collection of caterpillar mushroom can have a great impact on its sustainability. Hu et al. (2005) reported a decline in production in Tibet from 100 t in the 1950s to 5–10 t in the 1990s. The growing commercial collection is also resulting in substantial habitat disturbance. For example, Xu et al. (2015) reported there has been a 21–46% decrease in aboveground biomass in collection areas and an 11–19% decrease in the overall collection area. Based on harvester perceptions, Shrestha and Bawa (2015) reported a decline in caterpillar mushroom production in Nepal. There are also increasing concerns about the sustainability of the market for caterpillar mushroom (Shrestha and Bawa, 2013; Yeh and Lama, 2013).

Existing literature on caterpillar mushroom has predominately focused on quantifying its volume and value at the regional and community levels, and most up-to-date research has been conducted in South Asia (e.g. Negi et al., 2015; Shrestha et al., 2014; Wu et al., 2016; Caplins and Halvorson, 2017). In China, Winkler (2008) has provided an excellent overview of the role of caterpillar mushroom in household income along with its dramatic increase in price based on the data from Tibet. Winkler (2009) has also estimated the level of production in the broader Tibetan Plateau and Himalayan regions. At a finer scale, Woodhouse et al. (2014) conducted a detailed analysis of household-level economic gains from the collection of caterpillar mushroom. With a focus on trade, Yeh and Lama (2013) used an ethnographic approach to outline the mushroom's value chain from harvesters to consumers and argued the role cultural politics in the formation of the value chain. More recently, Cunningham and Long (in press) used long-term data to document the boom in price and markets for caterpillar mushroom from 2002 to 2017. Among the studies conducted in China, Weckerle et al. (2010) were the first to focus on a combination of household economic analysis and institutional analysis, to document how a protected area status led to an inclusive management approach for enabling local access to a caterpillar mushroom resource. Although there is rich body of existing literature, there is still insufficient understanding of harvest practices and trade, and little is known about the impacts of harvest and trade practices on the sustainability of the caterpillar mushroom resource. In particular, there is a lack of up-to-date information from China, which is the world's largest caterpillar mushroom production area.

Building on the existing studies, this research examined the harvest and trade practices associated with the commercial collection of caterpillar mushroom in Southwest China. To extend the work of Weckerle et al. (2010), the study compared the harvest and trade practices in two counties – one located within a protected area and one located outside of the protected area. The aim was to understand the effects of different institutional settings on people's behavior in terms of harvest and trade practices. As such, the research reported here provides the first empirically grounded analysis of caterpillar mushroom harvest and trade practices in China following the mushroom's rapid market boom since 2008. The research provides the most up-to-date insights into caterpillar mushroom harvest and trade in the main production area of the Tibet Region in Southwest China, from which we generate policy recommendations for the sustainable use of this valuable resource.

2. Methodology

This research was carried out in Diqing Tibetan Autonomous Prefecture in Yunnan Province, Southwest China. This study site is located in the heart of the Himalayan ranges and is rich in biocultural diversity (Loh and Harmon, 2005; Gorenflo et al., 2012). Tibetan people are the dominant ethnic group in the prefecture and have practiced agropastoralism for centuries. Currently, with rapid economic development, the people are increasingly engaged in the market economy including via ecotourism (Zinda et al., 2014) and the commercial collection of matsutake mushroom (Yeh, 2000; Arora, 2008; He, 2010) and caterpillar mushroom (Weckerle et al., 2010). With this rapid development of the commercial use of natural resources, little study has taken a grounded approach to understanding the implications for resource sustainability. To understand the harvest and trade of Diqing's most valuable resource, caterpillar mushroom, this research focuses on six Tibetan communities in two of the prefecture's counties. This includes three communities in Shangri-La County (i.e. Shanyou, Zhongxing and Yuejing) and three communities in Deqin County (i.e. Shusong, Dari and Yeri). The communities in Deqin are located in the buffer zone of Beimaxueshan Nature Reserve, where The Nature Conservancy and World Wildlife Fund have implemented a co-management project to mitigate the negative impacts on local livelihoods following the establishment of the protected area. The communities in Shangri-La County are situated outside of the protected area in the region's most productive areas for caterpillar mushroom, which are close to the border with Sichuan Province.

Data collection was undertaken in July-August 2015 and March–April 2016. Primary data consisted of three components. First, a questionnaire survey was conducted in the six Tibetan communities. This survey work involved interviewing the heads of households to understand caterpillar mushroom harvest practices and trade at the village level. A total of 157 households from the 6 communities were randomly selected for interviewing. The interviewed household heads included 57 females and 100 males, all of whom were Tibetan. In Shangri-La County, the age of interviewees ranged from 19 to 67 with an average of 45.65 (S.D. = 14.0). They had an average of 4.1 years of education (S.D. = 3.1), indicating many of them had completed primary school, while the remainder were largely illiterate. Caterpillar mushroom collection played an important role in their household economy, comprising up to 20% of household annual income. In 2015, this equated to average earnings of approximately 7671 RMB (1237 USD). The highest was RMB 26,000 (4126 USD) and the lowest RMB 500 (79 USD). In Deqin County, the age of interviewees ranged from 23 to 67, with an average age of 42.9 (S.D. = 10.26). They had an average of 3.6 years of education (S.D. = 3.3), indicating a similar level of education as the interviewees in Shangri-La County. For the Deqin County households, caterpillar mushroom collection accounted for an average of 13.9% of household annual income, equating to 9015 RMB (1430 USD). The highest was 25,000 RMB (3968 USD) and the lowest 200 RMB (31 USD).

Second, a total of 14 local traders were interviewed. These traders were all Tibetans and had an average age of 46 years (S.D. = 10.5) and an average of 4.1 years of education (S.D. = 3.6). Most of these interviewees had extensive experience in the caterpillar mushroom trade, with an average of 9.8 years (S.D. = 6.2). The interviews with the local traders focused on understanding how their businesses operate and the prices they receive for the caterpillar mushroom. The third component