



Review Article

Trade and Conservation of Morel Mushrooms in Nepal

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Abstract: In Nepal morel mushroom is one of the most important wild edible fungi, which is exported, in larger quantities. They have been collected, consumed and traded for more than two decades. The morel mushroom trade is worth a multi-billion dollar industry worldwide. This study was carried out to elucidate the current harvest and trade of morel mushrooms, the prospects for commercial morel industry development and the resource management in Nepal. Wild morels are harvested commercially and exported extensively from west Nepal especially from Karnali and Far West Province which share 58% and 29% of total national output respectively. Most commonly found and traded species are *Morchella conica* and *M. esculenta*. In most cases, the collectors sell morels in fresh form to the local dealers or in the local markets from where they are exported to different parts of the world. A bulk of morel mushrooms is traded via Nepalgunj and Mahendranagar routes. The local collectors get nominal benefits as prices are very low in the local area as compared to international markets. The price of *M. conica* is always higher than other morel species. There is neither processing nor any kind of value addition works currently being done in Nepal except drying, grading and packaging. The present study reveals that Nepal has a huge potential to become a major global producer of high quality morels. There is no serious concern about the overexploitation of the resource at the moment. However, a reliable local monitoring system and a scientific intervention for the artificial cultivation are inevitable for the sustainable management.

Keywords: Bioresource, Ethnomycology, Gucci Chyau, Livelihood, Management, Morel Industry, NTFPs, Wild Edible Fungi

1. Introduction

Species of *Morchella* (Morchellaceae, Pezizales, Ascomycota) are known as true morels. True morels look very similar to false morels which belong to the genus *Verpa*, and several species of the genus *Gyromitra* [1]. True morels are recognized as one of the most economically important wild edible mushrooms worldwide, given their demand as a gourmet product [2]. There is huge demand for the resource worldwide particularly in regions where French cuisine is

practiced. The morel mushroom trade is worth a multi-billion dollar industry worldwide [3]. The Index Fungorum online database (<http://www.indexfungorum.org/Names/Names.asp>) lists 315 *Morchella* species, subspecies, and varieties worldwide.

Most of them were described from Europe, with only few described in Asia and North America [4]. These are normally found in both conifer and broad-leaved temperate forests of the world. They are mostly distributed in Nepal, Bhutan, India, Pakistan, Afghanistan, China, Turkey, Canada, USA and many

European countries. On the Tibetan Plateau, morels are called “gugu shamu” meaning the “cuckoo mushroom,” because they fruit when the cuckoo bird returns in spring [3]. Nepal, with area 147,181 sq. km occupies the central part of the Himalayas standing between the Palaearctic (Holarctic) and Palearctic (Indo-Malayan) regions. The extreme altitudinal gradient (67–8,848 m) has resulted in 11 bio-climatic zones ranging from tropical to nival within a short horizontal span. Nepal’s biodiversity is a reflection of its unique geographic position and variations in altitude and climate [5]. Morel mushrooms (*Morchella* spp.) collected in the Nepal are a non timber forest products (NTFPs) having considerable economic significance (Figure 1). They occur from temperate to sub-alpine in the wet and shady areas at an altitude of 1,800–3,500 m. To date six species of *Morchella* (*M. angusticeps*, *M. elata* (= *M. conica*), *M. esculenta*, *M. smithiana*, *M. umbrina*, *M. vulgaris*) are reported from Nepal. They are generally known as Khoya Chyau, Guchhi Chyau, Phuikhane Chyau, Chhohada Chyau by different communities in Nepal [6]. It is noticed that they appear in a large scale during the month of March and the collection starts between April and June. It is one of the most important and prioritized NTFPs listed by Ministry of Forest and Environment of Nepal [7]. Very little attention has been paid towards the fungal conservation in the country and has yet to prepare a red list data for fungi. Fungi are least explored biological resource and most of the parts of the country are still virgin. Such valuable treasure might be disappearing from their natural habitat before their discovery due to climate change, rapid deforestation and urbanization, landslides, grazing, unscientific harvesting etc. Thus, comprehensive exploration is essential in order to understand the status of such biological treasure for effective conservation and sustainable utilization [8–9].



Figure 1. Ascocarps of Black morel from Jumla, Western Nepal.

Recently, several countries have attempted to promote the emergence of a wild edible mushroom industry as a means of providing incentives for forest conservation and improving the earning opportunities of people living in marginal rural areas. International trade provides a very important contribution to the livelihoods of the collectors [10]. Sustainable conservation and utilization of bioresources, socioeconomic sustainability and respect for the rights of actors participating in biotrade are the most basic tenets of biotrade. Thus, the goal of this study is to analyze the current status of harvest and trade of morel mushrooms, the prospects for commercial morel industry development and the resource management in Nepal.

2. Materials and Methods

A thorough and extensive search of the literature and database for relevant works was performed during the study. In order to collect the most reliable and useful information regarding the study, primary data were collected by using consultative and participatory approaches. Both formal and informal discussions with forestry professionals, forest user groups, community based organization’s committee members, village elders, farmers, local leaders, women, school teachers, social workers, members and the staff of local NGOs, were conducted to gather the information about the collection and trade of morel mushroom in the area. Traders, collectors and other concerned stakeholders were also individually consulted. The information was further validated by common responses and considered as insignificant for single response. The existing trade routes were identified and documented with extensive consultations with stake holders and direct observation. The traded names were cross-verified by field visits and consultation with relevant literatures. The data were also verified from secondary information and legitimate records (Department of Forest, Department of Plant Resource, Customs, Nepal Herbs and Herbal Products Association and Jadibuti Association of Nepal). Further, different published documents, reports, books, journals and articles related to NTFPs and MAPs were consulted for data verification.

3. Result and Discussion

3.1. Collection and Trade

Wild morels, the main source of edible morels, are harvested commercially and exported extensively from China, India, Pakistan, Turkey, Mexico, and the United States [3]. In China, the annual export of dried morels has increased five times from 181 to 900 tons over the past few years [4, 11]. Likewise, in Nepal also morel mushroom has been one of the most important wild edible fungi, which is exported, in larger quantities. They have been collected, consumed and traded in Nepal for around 20–25 years. They are mainly found in pine forest between 1,800 and 3,500 m

and are mostly abundant in the western part of Nepal. Commercial harvest has been carried out in Jumla, Humla, Mugu, and Dolpa districts of western Nepal for decades. Most commonly found and traded species of morel mushrooms are *M. conica* and *M. esculenta* [12]. Morels collected from the forests are sold in the market from where they are exported to different parts of the world. Europe, especially France, Switzerland, Germany, Belgium, and the Netherlands are the major export markets for Nepalese morels [13]. They fetch high price and thus play an important role in the country's economy. Morel collection is a hectic job and requires a lot of physical exertion, devotion and passion. Sometimes the collectors have to spend days in the forest collecting morels. One collector can normally harvest 2-6 kg. of fresh morels/day depending upon the habitat, quantity and its availability [14-15]. Collected morels are dried by hanging morel garlands in well ventilated part of their houses and sometimes nearby hearth. They are not dried in sun in order to protect their flavor and color [16].

In Nepal generally morels are collected for trade but sometimes, they are used as traditional medicine and flavoring agent. In most cases, the collectors sell morels in fresh form to the local dealers or in the local markets. In several areas morels have become the main source of cash income for the poorest households [12-13]. There is no exact figure available for the collection and export of morels from Nepal. It is estimated that 1.7 to 6.5 tons of dried morels exported annually [13]. Contrary to the data obtained from private sectors [17], government official data [18] differs to some extent (Figures 2, 3). Morels are traded under the trade name of Himalayan Mushrooms with minimal royalty of NRs. Rs 300/kg contributing in the generation of state revenue significantly.

Currently, most of the morels have been extracted and traded from Karnali and Far West Province of Nepal (Figure 4) [18]. Morels are collected mostly from national forests, protected areas, and community forests, but the collection is rarely included in community forestry operational plans meaning that collection is nominally regulated by the forest authorities. The government has identified 10 important NTFPs, but separate management plan has been prepared only for Jatamashi (*Nardostachys grandiflora*), and Yarsagumba (*Ophiocordyceps sinensis*) so far [5, 18]. Though, concerns of over exploitation of morel are being raised in some area. It has not been found serious issue at the moment [13]. Due to high market demand collection of morels unsustainably or at a premature stage is increasing in some parts. In 2017, the restructuring of the country brought several changes in the government institutions from federal to state level that are responsible and accountable for forest biodiversity and agriculture biodiversity in Nepal. As per the provisions in the Constitution of Nepal (CoN 2015), Ministry of Forests and Environment is formed at the federal level with its Environment and Biodiversity Division designated to take stewardship to all environment and biodiversity issues.

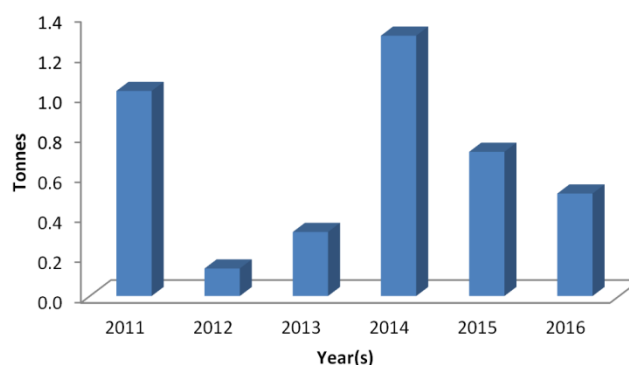


Figure 2. Extraction of wild morels for international trade in Nepal (Source: Hamro Ban; Annual report 2011-2016) Department of Forest, Babarmahal Kathmandu, Nepal.

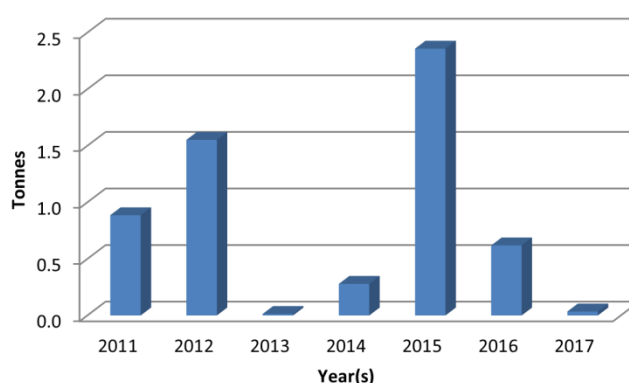


Figure 3. Traded morels from Nepalgunj, Banke, Nepal. Source: Jadibuti Association of Nepal (JABAN), Nepalgunj, Banke, Nepal.

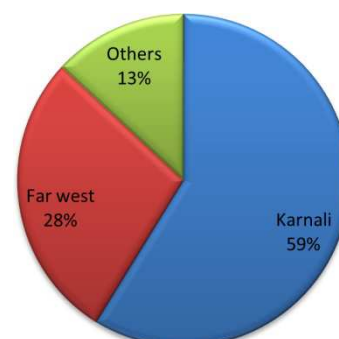


Figure 4. Share of wild morels extraction by Provinces (2016).

3.2. Trade Routes of Morel from Nepal

The harvesters of morel mushrooms are poor local people and morel harvest is their part time activity besides their regular job of farming and animal husbandry. They harvest morels during spring and early summer season which starts from March and occasionally up to August and sell them in the local market to earn their livelihood. A bulk of morel mushrooms is traded via Nepalgunj and Mahendranagar routes. Most of the traders at Nepalgunj are also the exporter themselves. Thus the exporters are the main beneficiaries followed by middlemen. The collector get minimal benefits as prices are very low in the local areas as compared to international markets [10]. Road head traders purchase morels from collectors and sells directly to regional traders

(Figure 5). These road head traders, in most of the cases have their own retail shop. For instance, few exporters have direct contact with farmers or collectors group. Prices of morels greatly depend upon the quality, processing and area of collection. The prices also vary from species to species. The price of *M. conica* is always higher than other species. One kilogram of dried morel accounts for in average NRs. 5,000 to collector, NRs. 16,000 to the wholesaler, NRs. 20,000 in the National market and NRs. 30,000 to 40,000 in the International markets. There is neither processing nor any kind of value addition works currently being done in Nepal except drying, grading and packaging. For trade, freshly collected morel is well dried and graded carefully to avoid rejection by the buyers

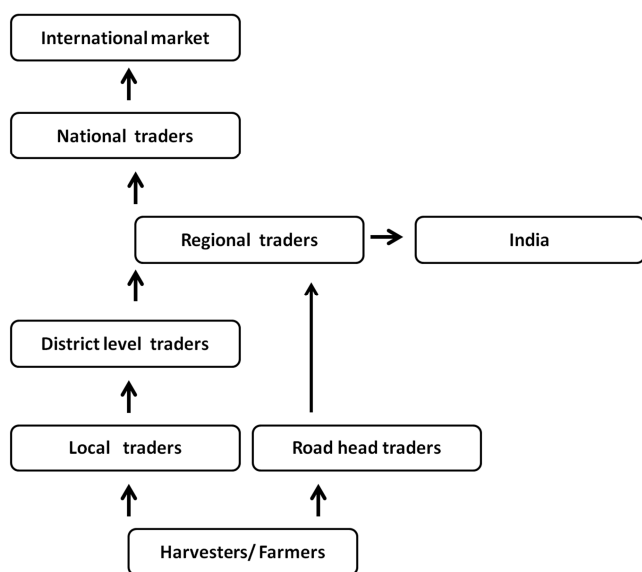


Figure 5. Morel trade network.

3.3. Artificial Cultivation of Morels

Though there is increasing market of morel mushroom in the world, its distribution pattern, cultivation and conservation measures have not yet properly been implemented in Nepal. The collection of such mushroom is limited only from natural stands. However, in recent years, the outdoor artificial cultivation of morel mushrooms has rapidly developed in China. Commercial outdoor cultivation of *M. rufobrunnea* in USA, *M. importuna*, *M. sextalata* and *M. eximia* in China is expanding rapidly [11]. According to a recent Chinese survey fresh morel cultivation expanded rapidly from 200 ha in 2011 to 1600 ha in 2016 amounting approximately 500 tonnes fresh morels production during 2015-2016. However, to date, indoor cultivation has not been successful and deserves further research [4, 11].

4. Conclusion

Morel is one of the most important wild mushrooms from economic, social and ethno-mycological perspectives in Nepal. It plays vital role to the people of Himalayas dwelling adjacent to the forest. It is one of the main sources of income of the

rural people for their livelihood. Nepal has the largest potential to become a major global producer of high quality morels. Educating the local community on proper harvesting and post harvest handling, the effects of free grazing, deforestation, floods and encroachment could help to ensure a succession of harvests over time. Further studies towards finer assessment of the resources may also be desirable, especially as they could be built on the present knowledge on the dynamics of forest stocks. Furthermore, there are ample opportunities for the value addition by establishing processing units and promoting locally affordable micro-enterprise technologies. Value addition technologies of different capacity should be established in order to provide sustainable earnings to the poor collectors. The collectors, because of their ignorance, often do not get reasonable price for their product and the middlemen tend to exploit them. This necessitates better market information system. The worldwide demand for these delicious and highly prized edible mushrooms has stimulated intense efforts to cultivate morels. Long-term research input is also required to understand taxonomy, physiology and ecology of morels in an attempt to develop methods to grow them in artificial media at a commercial level. After restructuring of the country institution setup at Federal, State and Local level has been established and at each level comprehensive inventory of species in localized areas is recommended. It is also recommended that the morel resource should be listed and quantified in the forest operational plans at each level for the sustainable management. Furthermore, the major supply countries (China, India, Nepal, Bhutan, and Pakistan) should consider developing a regional forum for discussing conservation and sustainable utilization of morel species.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Biography



Jay Kant Raut is a senior mushroom scientist. He has received his PhD degree in Mushroom Science (2011) from Graduate School of Horticulture, Chiba University, Japan. After completing his Master Degree in Botany (1997) from Tribhuvan University, he has been actively working in the field of Mycology. He is a founder member of International Society for Fungal Conservation and member of several other professional societies. Dr. Raut has around two decades of teaching & research experiences. Mushroom systematic & nomenclature, mushroom biotechnology, mushroom cultivation, mushroom diversity & conservation are the research fields of his interest.