

Morels as a source of Food, Medicine and Income in Himachal Pradesh: A North West Himalayan Region, India

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Abstract

Himachal Pradesh is situated in north India between 30° 22' to 33° 12' N latitudes and 75° 47' to 79° 04' E longitudes within the Western Himalayas in northern India. The elevation varies from 450 meters to more than 7,026 meters above the mean sea level. Tribal and indigenous communities of Himachal Pradesh are associated with collection of wild mushrooms for edible, medicinal and sale purpose. The Morels (*Morchella* spp.) are fungi belong to family Morchellaceae commonly known as *Guchhi* in Himachal Pradesh. The traditional people of Himachal Himalayan Region (HHR) cooked it as food and used in medicine and health care system. Traditionally, it has been used for gastric problems, as a tonic, to cure cuts and wounds, and reduce joint pain. The native people gather it from the forest regions and sold it to nearby merchants after drying it at home. Presence of nutrients like amino acids, vitamins and minerals, the *Guchhi* mushrooms are in high demand not only in India but also in various foreign markets such as Switzerland, France, the USA, Italy etc. Commercial cultivation of *Guchhi* mushrooms will help rural masses and farmers obtain benefits due to their high demand.

Keywords: Morel, Guchhi, Fungi, Edible mushroom, Himalayan Region, Nutritional value.

Introduction

People have been gathering and eating wild edible mushrooms for thousands of years¹. The collection of edible wild mushrooms is both a pleasure activity and a source of sustenance for different ethnic and cultural groups. Its nutritional value is extremely high, almost twice as much as any vegetable. All over the world edible mushrooms are considered a good source of food as it is rich with vitamins B, C, D, mineral elements.^{2,3} The eating of wild fungi was first reliably noted several hundred years before birth of the Christ in China.⁴ Of the 14,000 mushroom species, more than 3000 species spread over in 31 genera are regarded as prime edibles⁵. However, only 200 species of them are experimentally cultured, 100 species economically cultivated, approximately 60 species commercially grown and about 10 species have reached an industrial scale.^{6,7} In India around 850 mushrooms species are observed.⁸ In

addition to being an important source of wild food and medicine for people worldwide, mushrooms are a key component of biodiversity.

Wild edible mushrooms fall under the category of non-timber forest products (NTFP) which have been untapped resources because a wide variety of wild mushrooms are still unexplored.⁹ Gathering and scientific study of mushrooms in India began in 19th century and continued till date¹⁰. In the North-West Himalayan region of India many species of mushrooms are collected and consumed. Many morel species cooked as food and used in medicine and health care system in Himachal Himalayan Region (HHR). Himachal Pradesh is situated in north India between 30° 22' to 33° 12' N latitudes and 75° 47' to 79° 04' E longitudes within the Western Himalayas in northern India. The total area of Himachal Pradesh is 55, 673 Sq. Kms. The state is surrounded by Jammu & Kashmir in the north, Punjab in the west, Haryana in the south, Uttarakhand in the south-east and China in the northeast (Figure 1). Himachal Pradesh is inhabited by different tribal and indigenous communities who are associated with collection of wild mushrooms for edible, medicinal and sale purpose. These indigenous and tribal populations of Himachal Pradesh have expertise in gathering, identifying, and classifying edible, toxic, and therapeutic mushrooms. Many *Morchella* species have been reported with high nutritional and medicinal values. The native people of Himachal Himalayan Region cooked the Morels species as food and used in medicine and health care system. The Morels (*Morchella* spp.) commonly known as common morel, true morel and morel mushroom have been the most highly prized of all the wild harvested mushrooms, and rank first in choice and delicacy.

Methodology

The present information on the Morels species was collected by using both primary and secondary sources. In primary source information were directly collected from the native inhabitants of the Himachal region about the use, collection, storage of the morels. In secondary sources all the information collected from forest department's reports, journals and published articles. The data were compiled to get comprehensive information on the status of morels use and utilization and their marketing value in Himachal Himalayan region (HHR).

Habitat and ecology

Being saprophytic in nature, the Morels get nourishment from decaying organic substances. The Morels grows in clusters normally in shady moist places on logs of decaying wood, forest litter, mosses burnt areas, decaying leaves or humus rich forest. If the food supply is sufficient, it collectively forms a compact mycelium on the surface soil. The ascocarp (fruiting body) appears above the soil soon after the rains. However, the habitats of species *Morchella* in forest are often distinguished by the dominance of tree species, viz. *Abies pindrow*, *Betula utilis*, *Cedrus deodara*, *Cupressus juniperus*, *Picea smithiana*, *Pinus wallichiana*, *Rhododendron arboreum*, *Rhododendron lepidotum*, *Taxus baccata*, *Cupressus* species and important medicinal and aromatic plants viz. *Aconitum* species, *Arnebia benthamii*, *Angelica glauca*, *Dactylorhiza hatagirea*, *Podophyllum hexandrum*, *Picrorhiza kurrooa*, *Rheum emodi*, *Saussurea costus*, *Selinum wallichianum* and *Polygonatum* species and rarely found in other habitats such as community land and agricultural field boundary¹¹. Heavy snow followed by hail and thundershowers, made conditions ideal for this crop, where it grows naturally.

Distribution

Morchella spp. reported from North western Himalayan region especially in temperate zone of Jammu and Kashmir, Uttarakhand and Himachal Pradesh. In the higher-altitude villages of North-West Himalayan region of Himachal Pradesh especially from Shimla, Kullu, Kinnaur, Mandi and Chamba, and. The Morels in Himachal Pradesh are locally known with different names such as Guchhi, Chiaun, Chaeu, Chyau, Rangmuts, Jangmuts, Dhunghloo, Jamchu, Chunchroo, Chauhar khukh. Higher altitudes regions with cool climate at an altitude range from 1800–3600 m are favorable climatic condition for its flourish growth. *Morchella conica*, *Morchella deliciosa*, *Morchella esculenta*, was recorded from the Kinnaur district and Chamba (Pangi) districts of Himachal Pradesh. In Garhwal Himalaya it was observed at Niti Valley, Tapoban, Joshimath, Pouri Gahrwal, Naagdev & Jhandidhar, Kumaun and in J&K Poonch, Mahore, Doda, Bhaderwah, Kishtwar, Udampur and other high altitude forests¹².

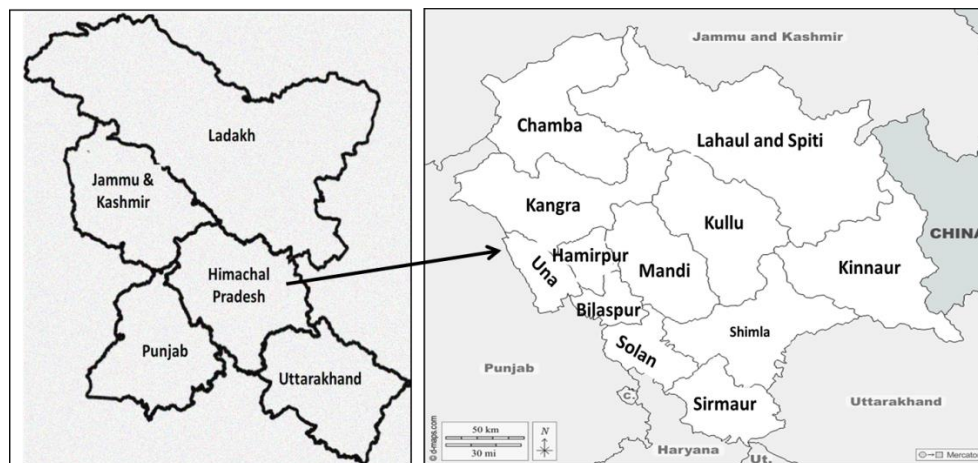


Figure 1–Map showing Himachal Pradesh position in India.

Botanical description

The genus *Morchella* is the species of fungus of family Morchellaceae. Six species namely *Morchella esculenta*, *M. angusticeps*, *M. conica*, *M. crassipes*, *M. deliciosa*, and *M. semilibera* have been reported from Himachal Pradesh¹¹. Morels exhibit cylindrical structures. Fruit body small to medium size. Pileus is the upper part of a morals and weight about 70 to 80% of the total weight of the plant. The color of pileus is imparted by pigmented oil droplets present in the cells of pileus, which vary from species to species. The stalk or stipe of morel is hollow, variable in shapes. The stalk supports the pileus which is about 20 to 30% of the total morel weight. Description of different species of Morel in Himachal Pradesh is as below.^{12,13}

Morchella esculenta (L.) Pers. Fr. (Common morel) Native Place is Kullu District of Himachal Pradesh (Western Himalaya); found solitary or scattered in near lightly burned grassy area, in coniferous forest and swampy ground. Pileus sub-globose, 7-9 cm long and 4-5 cm wide; pits rounded, irregular or longitudinally elongated, yellowish or become light brown when dry; stipe slightly enlarge at the base.

M. angusticeps Peck (Black morel):- Pileus 1-5 cm, elongated, , narrowly conical, young grayish, boards of pits darken to black at maturity; stipe nearly as thick as pileus; ribs irregular and longitudinal; stipe smooth and hollow; found in coniferous and mixed coniferous forests.

M. conica (Pers.).Fr (White morel):- Pileus 4-10 cm, spindle shaped cone, cone having honey coloured vertical ridges with cross connection, turned brown after maturity; stipe 2-4 cm, circular, hollow, whitish

yellow with rough surface; found on soil in open forest often a year or two year after forest fire; occur in open forests, frequently one or two years after a forest fire.

M. crassipes (Vent.) Pers. (Yellow morel):- Pileus elongated, sub-conic, upto 6-12 cm long, 4-6 cm broad; pits large, shallow, ridges thin; stipe hollow, stout, upto 10-11 cm long, 5-6 cm at the base, yellowish or whitish, base swollen; found in coniferous and mixed coniferous forests.

M. deliciosa (Fr.) Jct. (Delicious morel):- Pileus 2-3 cm long, pits of pileus elongated, whitish to yellowish, ridges much thicker than pits; whitish yellow stipe upto 2/3 time thick as pileus; found solitary or scattered in coniferous and mixed coniferous forests.

Morchella hybrida (Sowerby) Pers. (The half-free morel):- Pileus with conspicuous ridges pits elongated, dull yellowish brown; ribs longitudinal to irregular with rounded edges; stipe 8-10 cm long, hollow, tapering upwards, apex 1-2 cm thick; found in oak or spruce -silver fir forests.

Morels as a source of food and their nutritional value

The fruit bodies of all the species of the genus are edible and are mainly consumed fresh or processed as flavoring agent in soups and gravies. The rich dietary fiber and bioactive compounds found in edible morels have been proposed to support digestive health by regulating gut microbiota¹⁴. The nutritional value of morels is highly valued mainly because they are rich in protein, fiber, necessary vitamins and minerals, and low in calories and fat¹⁵. In far flung area of Himachal native people collect morels species for marketing purposes but sometimes, they are used it edible purpose and flavoring agent. The local people of Himachal Pradesh cook ascocarps (the fruiting body) mixed with rice and vegetables, and consider it as nutritious as meat or fish. The bioactive components present in *M. esculenta* are responsible for the nutraceutical potential.¹⁰ *Bhotiya* tribes of N.W. Himalaya boil the fruiting bodies of *M. esculenta* in water and consumed as soup. Morels are spongy, have a meaty flavor, and taste umami. These special qualities set morels apart as meat alternatives for vegetarian and flexitarian diets. Protein (10–25%) comes in second place to water (50–80%) in a normal meat analog recipe¹⁵. With nice flavor and 39.4% crude protein content, fermented *M. esculenta* mycelia could potentially replace animal protein as a novel source of protein.^{16,17} A variety of *Guchhi* based recipes prepared in three-star or five star hotels. *Morchella esculenta*, *M. conica*, and *M. crassipes* are the top morel species studied in terms of their nutritional value¹⁴.

Traditional uses of Morels as medicine

The Morels species are used in medicine and health care system by the traditional hills societies and also considered important for clinical use. Information about the use of mushrooms as drugs dates back to the Charaka Samhita (3000–500 BC), an ancient medicinal text from India. Presence of bioactive compounds such as polysaccharides, phenolics, tocopherols, and ergosterols in morels contribute to the immunoregulatory, fatigue resistance, antiviral, antioxidant properties, anti-inflammation, gut health preservation, and anti-cancer abilities.^{14,18} It is considered highly nutritious for pregnant women. It is also used in health care, and medicinal purposes differ among traditional hill societies. Traditionally, Morels has been used for gastric problems, as a tonic, to cure cuts and wounds, and reduce joint pain. Native people of Kullu and Shimla district boiled the fruiting body of *M. esculenta* and decoction is prepared and consumed to cure cold and cough. The paste of the mushroom is applied to skin problems.

Morels as source of income

The Morels Himachal commonly sold with its trade name *Guchhi*. Local collectors, local purchasers and exporters of *Morchella* were interviewed in order to get information on morel collection, storage, preservation and marketing. Collection of *Guchhi* constitutes a vital source of livelihood for forest-based native people living in remote and high hills of North West Himalaya. The poor residents in the hills area depend heavily on gathering forest products for trade and subsistence. These operations normally fall under informal or unorganized sector. The main profession of the villagers of remote and hilly region of Shimla, Kullu, and Chamba is sheep rearing, agriculture and collection of *Guchhi* and other medicinal plants for sale. Other than farming and raising cattle, some people collect *Guchhi* as a part-time activity. People residing in the fringes of forest of high altitudes generally collect it while they are with their cattle in the forest and sometime when they are extracting other medicinal plants. As fresh and dried fruiting bodies are edible, but *Guchhi* are rarely used as supplementary food by local people since these have high market value. It is locally sold to middlemen and traders. Thus it is providing a vital source of income to the poor population of hilly areas of Himachal Pradesh. During interviews with some local collectors from Shimla district, particularly in the high altitude villages of Chuhara valley, Ransar valley and its adjacent areas, it is found that one or two people of a family are actively involved in *Morchella* collection. It appears in a large scale during the month of March and local people start collection from the forests from April and May. The gathering continues till May-end. *Guchhi* is also collected during the rainy season in the month of July, August, September in Shimla, but the quality is not good as compared to *Guchhi* collected in the spring season and sold at a low rate. *Guchhi* collection is time-consuming and arduous work and usually collectors spend about 11-12 hours every day for this activity. The locals call someone who finds the *Guchhi* "the Luckiest Person". Local people often hide the place from where they pluck it. Accordingly, a collector, one person, on an average, may collect up to 1 kg *Guchhi* which is reduced to almost half that weight on drying. It was estimated, on an average, a family gathers up to 3 kg of *Guchhi* (on air-dry-weight basis) every year. The best size of *Guchhi* ascocarp collected may be 6 to 10 cm in height and 4.5 -7.5 cm in diameter.¹⁸ However, to make more money, the locals uproot these fungi bodies at any stage of growth. Local people tag ascocarps and hang them for 15 to 20 days in a room for drying (Figure 1). It can be stored for a few months in dry form at normal room temperature especially when packed in air-dry packs.



Figure-2: Local people of Himalaya collected, dried and sold *Guchhi* in market:- a) *Morchela esculenta* in natural habitat; b) Various *Morchela* spp; c,d,e) Dried Morels (*Guchhi*) ready to sold in market.

Commercial status of Morels (*Guchhi*)

In India best source of morels are Utrakhand, Jammu and Kashmir & Himachal Pardesh, Jammu & Kashmir state. Morels are actually the growing gold of these mountain ranges. All the species collected and sold but *Morchella esculenta*, a mushroom variety which commands a huge demand globally. It is an expensive product all the wild harvested mushrooms because of its rich nutritional value coupled with a unique flavor. The trade and earnings depends upon the export of *Guchhi* which is based on quality control. In most cases, the collectors sell morels in to the middle man or to the shopkeeper. They pay to the collectors on morels quality i.e. good quality fetch high prices while inferior fetch low. These purchases are made under certain rules made by dealers of morels. When the shopkeepers or middle men have sufficient stock, they sold it to exporters in the markets to Chandigarh, Amritsar and Delhi. Middlemen may earn 35–40% of the total profit. One middle man said that in the US and European markets, it sells like hot cakes. Most traders in Delhi are exporting it. A marketing chain of morels is given in Figure 2. Almost every year it is illegally extracted from the forest, air dried and sold in the market at very high rates. Some pharmaceutical companies were also engaged in purchasing.

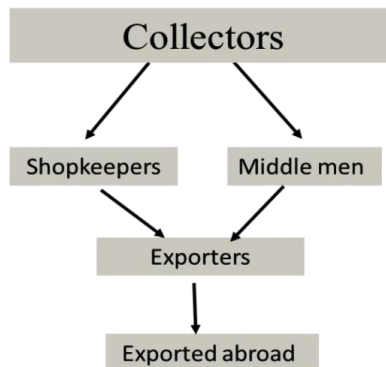


Figure 2: A marketing chain of morels

Prices of morels

Prices of *Guchhi* greatly depend upon the quality, size, processing and area of collection. The prices also vary from species to species, 30,000 INR or sometimes even more. In simple terms, One kg of dried morel fetches upto Rs. 30,000 to collector depend on quality, the wholesaler sell it in the national and in the international markets with high prize.¹⁸ The exporters are the main beneficiaries followed by middle men. The collector get nominal benefits as prices are very low in the area as compared to international markets. Fresh morels prices can fluctuate daily. In India all major exporter/trader start booking their orders from April onwards and start shipping *Morels* from May end onwards. Quantity which is nearly exported at a time is 500 Kg keeping the best freight cost utilization in mind. As the price of this commodity is really high even an order of 500 Kg is equivalent to INR 1 Crore as per RGSL AGRO- a Exporter, Importer and Trading company in agro products in India. Due to its high prize morel mushrooms also come in smaller packs consisting of only a few grams of them. Table 1 show year-wise extraction of *Guchhi* from Himachal Pradesh in quintals.

Table 1: Year-wise extraction in Himachal Pradesh Quantity in quintals

Sr. No.	1	2	3	4	5	6	7
Years	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91

Qty.	267.44	154.66	1,280.34	560.02	402.99	137.68	2,800.89
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Sr. No.	8	9	10	11	12	13	14
Years	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1998-99
Qty.	1,492.31	1,209.38	475.00	490.00	363.00	329.3	145.1

Sr. No	15	16	17	18	19
Years	1999-2000	2000-2001	2001-2002	2002-03	2003-04
Qty.	96.16	45.3	77.1	141.5	25.4

Source: Forest Department Record, Himachal Pradesh and State of Environment Report, Himachal Pradesh

Exporters of Morels

The main growing countries of Morels grade mushroom are India, Pakistan, China, Turkey, Canada, USA. It is believed that India, Pakistan, Nepal, Afghanistan and possibly Iran collect around 2000 tonnes fresh weight of Morels in a year¹⁹. Morels are exported to France, Belgium, Switzerland, Austria, Germany and other super rich & developed nations. Table 2 shows major *Guchhi* exported from Himachal Pradesh in quintals.

Table 2: Major Guchhi exported from Himachal Pradesh in quintals

Sr. No	1	2	3	4
Years	1988- 89	1989 -90	1991-92	1994-95
Qty.	402	137	2800	490

Source: Biotechnology Policy of Himachal Pradesh, Department of Biotechnology & Govt. of H.P. 2001

Conclusion

Morels are excellent nutritional and economic values. Presence of nutrients like amino acids, vitamins and minerals, the morel mushrooms are in high demand not only in India but also in various foreign markets such as Switzerland, France, the USA, Italy etc. There has been a recent shift in the diet toward more plant-based meals and less meat, so morels can substitute the meat. As a result of the high demand of Morels in national and international market, commercial cultivation of Morel is need of hour. The Indian mushroom industry can be revolutionized by commercial cultivation of *Guchhi* mushrooms, which also aids farmers in obtaining benefits.

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