



Distribution of *Morchella esculenta* a wild edible mushroom in Chir Pine forests of Nowshera Forest Division, district Rajouri, J&K

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Abstract

Mushrooms have recently emerged as the most nutrient-dense food on the planet. *Gucchi* Mushrooms are an edible fungus with the scientific name *Morchella esculenta*. It is one of the most economically important and noteworthy wild mushroom species. It is the costliest vegetable in the world, costing between Rs 20000 and Rs. 30000 per kilogramme. It flourishes in a cold environment and on a steep slope. It may be found at elevations of 2500-3500 meters in a forest habitat. It is primarily found in India in the districts of Doda in Jammu and Kashmir (J&K) and Kullu in Himachal Pradesh (HP). As a result, J&K's production of *Gucchi* Mushrooms has been granted the Geographical Indications (GI) tag. (Prafull Kumar, 2020) Due to its high price, it plays a vital role in the economy of the country. The present study aims to identify the habitat of *Guchii* mushroom in Chir Pine forests of Nowshera Forest Division, its culinary uses among the locals, storage and marketing. More study in this sector has a lot of promise, and we need to develop *Gucchi* Mushroom production technology. In the future, the *Gucchi* mushroom will transform the Indian mushroom business, assisting farmers in their economic development.

Keywords: *Morchella*, *Guchhi*, Wild edible mushroom, *Morchella esculenta*, Nowshera Forest Division, Chir Pine Forest, Rajouri

Introduction

Morchella esculenta is an economically important wild mushroom. This mushroom is locally known as 'Guchhi'. *Morchella* as a genus is fairly easy to recognize, but species recognition within genus is difficult task and need expert handling. Six species, namely *Morchella esculenta*, *M. conica*, *M. deliciosa*, *M. angusticeps*, *M. arassipes* and *M. hybrid (M. semilibera)* have been reported from India. The fruit bodies of all the species of the genus are edible and are mainly used as a flavoring agent in soups and gravies. *M. esculenta* is an expensive mushroom because of its rich nutritional value coupled with a unique flavor. The local people cook ascocarps (the fruiting body) mixed with rice and vegetables, and consider it as nutritious as meat or fish. It is used as herbal medicine also all over the Himalayan region. While the Bhotiya tribes (Central Himalaya) use a decoction of *M. esculenta* by boiling the fruiting bodies in water, local communities in the Kullu District of Himachal Pradesh (Western Himalaya) boil it in milk for the medicinal purposes. Mushroom metabolites are also used as adaptogens and immunostimulants, and now are considered to be one of the most useful anti-tumor agents for clinical use. This fungus grows naturally on the forest floor rich in humus. If the food supply is sufficient, it collectively forms a compact mycelium on the surface soil. The ascocarp appears above the soil soon after the rains. However, the habitats are often distinguished by the dominance of tree species, viz. *Rhododendron arboreum*, *R. lepidotum*, *Taxus baccata*, *Pinus wallichiana*, *Cedrus deodara*, *Betula utilis*, *Cupressus juniperus*, and important medicinal and aromatic plants, viz. *Podophyllum hexandrum*, *Dactylorhiza hatagirea*, *Picrorhiza kurroa*, *Rheum emodi*, *Pleurospermum angelicoides*, *Angelica glauca*, *Arnebia benthamii*, *Saussurea costus*, *Megacarpa polyandra*, *Selinum wallichianum*, *Nardostachys jatamansi*, *Aconitum* species and *Polygonatum* spp. It is noticed that it appears in a large scale during the month of March and its collection starts between April and June.

The genus *Morchella* is one of the oldest genera of Perizales which primarily occurs in North -West Himalayan region, though reported by some researchers from sub-hilly as well as plains. *Morchella*, the true morels belonging to family Morchellaceae is commonly known as Guchhi in India. *Morchella* are commonly traced at high altitudes with cool microclimatic conditions. They are also reported growing in abandoned orchards, gardens, landscape area, melting snow around wood piles or tree trunks, and in sandy, loamy and organic rich matter soil.

The genus *Morchella* was reviewed in India by Warairchi in the year 1976. According to him, six species namely *M. esculanta*, *M. conica*, *M. deliciosa*, *M. angusticeps*, *M. crassipes* and *M. semilibera* have been reported from India which are being reported from North Western Himalayan region especially Jammu and Kashmir, Uttranchal and Himachal Pradesh. Occasionally reported from North East also, during study of Garhwal Himalaya it was observed at Niti Valley, Tapoban, Joshimath, Pouri Gahrwal, Naagdev & Jhandidhar Forests. In J&K Poonch, Mahore, Doda, Baderwah, Kishtwar, Udhampur and other high-altitude forests.

Study area

The present study was conducted in Nowshera Forest Division of Rajouri District of Jammu and Kashmir Union Territory during September 2021 to January 2023. The study area lies between 33.366784 and 32.936094 to 73.998561 and 74.676321. The territorial jurisdiction of Nowshera Forest Division is managed by three Territorial Ranges viz: Nowshera Forest Range, Lamberi Forest Range and Sunderbani Forest Range. Nowshera is a mountainous region comprising of Lower or Shivalik Chir Pine Forest, Northern Dry mix deciduous forest, Himalayan Sub tropical Scrub, Dry Deciduous Scrub, Upper or Himalayan Chir Pine Forest and Khair Sissu Forest. Chir Pine, Sissoo, and Banj Oak are the characteristic vegetation of the study area. The mean sea level elevation of the study area ranges from 291 to 2120 mtr. The study area encompasses mountains, pasture lands, rivers, springs and number of bowlies. The mean annual temperature of the study area ranges between 15 degree Celsius to 44 degree Celsius with mean annual rainfall of 951 mm. Pool frost is one of the characteristic feature of Sunderbani Forest during the winter months, where valley areas of Nowshera, Lamberi, Seot receives frost from mid-December to mid-January.

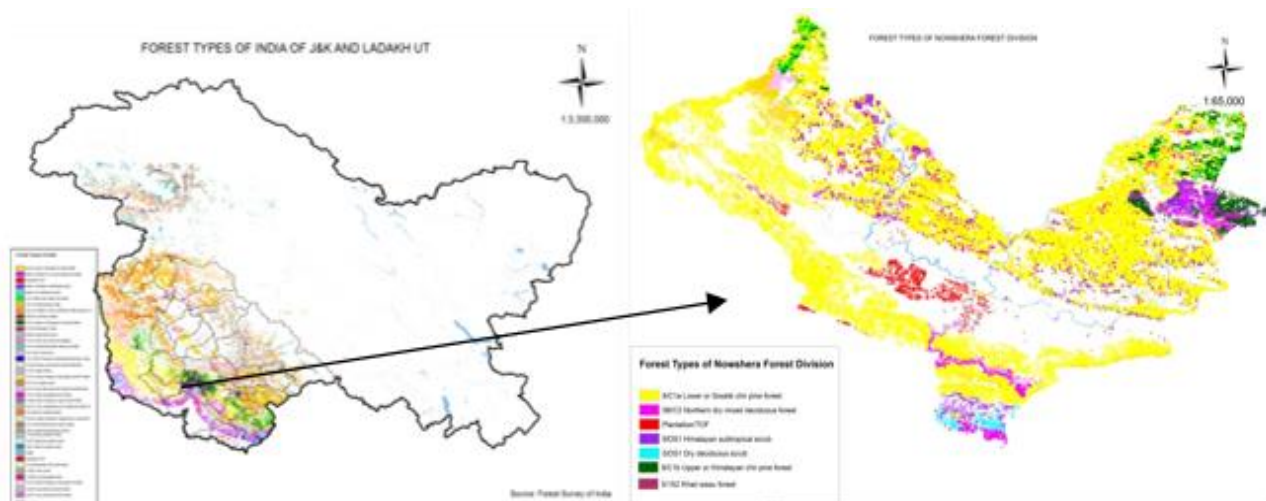


Fig 1: Map of Jammu and Kashmir showing the territorial jurisdiction of Nowshera Forest Division (Study area)

Material and discussion

Guchii is sold in market in dry form at very high rates, fresh dried Guchii is suitable for cooking as vegetable. Freshly dried Guchii is first blanched in water for few minutes then cut into small pieces and cooked like other mushrooms are cooked. They are rich in nutrients with high fiber content. It can be stored for few months in dry form at normal room temperature especially when packed in air dry packs.

Almost everywhere it is illegally extracted from the forest, air dried and sold in the market at very high rates, it may be Rs.30000.00 per kg. It is an attraction in the cuisine of most of Star Hotels. Because of its high value it is commonly illegally traded in India as no cultivation practice has yet been adopted. 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. It was estimated that on an average a family gathers about 2-3 kg of fresh morals (*M. esculanta*). Which more often is consumed by the family itself in absence of the market. It is very common vegetable of Nomads during rainy season, they also get it dried for rest of the period of the year.

It has been observed that local people who collects it from forest floor do sells it to the middlemen who arrive them to purchase high valued medicinal plants, people sell it to them which may ranges from Rs. 2000-2500/kg (dry wt.) when elsewhere, the price hovers well above Rs. 4500/kg (dry wt.). In this trade system which is very common in hilly region, middlemen sell it for Rs. 7000-7500/kg. Middlemen earn 35-40% of the total profit. Since the collection of the same is too cumbersome and tedious, the villagers prefer collecting medicinal plants and the collection of Morels is of secondary importance. Hence collection of morels is solely carried out by the deprived brethrens of the village especially graziers. It is believed that India, Pakistan, Nepal, Afghanistan and possibly Iran collects around 2000 tons fresh weight of Morels in a year. The benefits to rural livelihoods are significant and widespread and large numbers of rural folks thus earn significant amounts of money. India annually exports around 50-60 tons of dry morels.

Various workers have made significant contribution in the field of mushroom cultivation, which has provided employment to thousands of people. Efforts have been made

towards cultivation of *M. esculanata*, having a huge economic potential. This species has several-fold higher economic value compared to many importance higher Himalayan herbal plants, e.g., *Aconitum heterophyllum* (Rs. 500/kg), *A. balfourii* (Rs. 80/kg), *N. jatamansi* (Rs. 60/kg), *P. kurrooa* (Rs. 80/kg), *P. hexandrum* (Rs. 60/kg), *D. hatagirea* (Rs. 700-1000/kg), *Swertia chirata* (Rs. 350/kg) and *A. benthamii* (Rs. 80-120/kg).

While we were studying its habitat under Chir Pine forests, we observed its presence in densely populated Chir Forests having Southern aspect. Southern aspect is generally cooler than other aspects, this may be the reason behind its occurrence in the southern aspects. Its occurrence has also been observed in Oak Forest at Peer Badeshwar which occasionally receives snow fall during winters. Our study was undertaken at randomly selected 150 points throughout the territorial jurisdiction of Nowshera Forest Division. The coordinates of the randomly selected points are taken with the help of ArcGIS 10.5 software. Those points are then transferred in Garmin eTrax GPS. With the help of GPS goto feature, the selected coordinates were tracked and observations were recorded. The observations were recorded two times a year with a span of three years. As it was verified from the literature that *Morchella* are commonly found during the months of April-June in cold climates, but our study in Nowshera Forest Division shows its occurrence during the months of November-December. It is because of hot climatic conditions in the study area during April-June. All the 150 sampling points are thoroughly studied with 0.1 hectare sample plot method. The study was conducted between 2021 to 2023 during summer as well as winter months over all the 150 selected points. It has been observed that only 32 points in Chir Pine forest which are having southern aspect have its occurrence during the winter months and 13 points falling under Banj Oak forest have its occurrence during summer months. Our observations shows that the southern aspect of Chir Pine forest have its occurrence during winter months, there is no occurrence on other aspects in any of the season of the year. Its occurrence has also been observed in the Banj Oak forests of Peer Badeshwar as well Treru area where its occurrence has been observed during April-June. Chir Pine forests having southern aspect have observed its occurrence during winter months. The present study shows its collection mainly by graziers who collect it from forest floor and normally consume it locally as its production is site specific in Chir Pine forests, when interviewed the graziers said that they have marked the areas where it normally occurs and they visit those areas and collect it every year for their local consumption. On the other hand, grazer and nomads living in the fringes of Banj Oak forest collect it during the months of April-June they sell it to the local buyers at very low cost. It has been observed that a family may collect about 2 to 3 kgs dry mushroom a year and half of it is consumed by them and nearly half is sold to the buyers. None of the interviewed person knows about its artificial cultivation practices.

Artificial Cultivation

Since the foundation of the Indian Councils of Agricultural Researches (ICAR)-Directorate of Mushroom Research in Solan (HP), India has sought to domesticate *Gucchi* mushrooms (DMR). The trial, on the other hand, yielded no significant results. Based on the findings and proposals of the Research Advisory Committee, ICAR-DMR, Solan refocused its efforts in 2019 on studying the potential of

Morel farming in India (RAC). Dr. VP Sharma, Director ICAR-DMR, Solan, presented this challenge to Dr. Anil Kumar, Scientist (HP). (Prafful 2020)

An institutional research project named "Standardization of *Morchella* mushroom growing technique" was completed by Dr. Anil Kumar (Principal Investigator). We utilized *Morchella* genus cultures with high sclerotial generation capacity for our study. The method for preparing the substrate for the cultivation of *Gucchi* mushrooms was standardized. After continuing intense in vitro experiments on induction of ascoma (fruit bodies) in *Morchella* (*Gucchi*), three small ascomata of 0.5 to 1cm were generated. (Prafful, 2020)

Conclusion

Scientific interventions are needed for cultivation and availability of viable propagule material. However, a concerted effort from mycologists is needed to find suitable microcultures, which could be taken to the field, and by agronomists and ecologists to understand the mechanism of resource management. Therefore, sincere efforts are required to understand detailed systematic, ecological, physiological and genetical studies on *M. esculanata*. The life of *M. esculanata* may be studied in detail, particularly the mechanism of spore formation, spore dispersal and spore germination. Besides, studies on soil physico-chemical properties must be carried out just below the fruit-bodies so as to provide the status and quality of soil needed for spore germination. Optimal conditions for the regulation of their production should be determined. Proper identification and cataloguing of plants, which remain in close association with *Morchella* fruit-bodies, are needed. If *M. esculanata* is successfully cultivated, it will not only improve the socio-economic conditions of the locals of the higher Himalayan region, but will also help conservation of Himalayan biodiversity and ecosystem services (Pankaj Prasad et.al). Mushrooms have diverse variety of features which naturally develops in nature. Its flavor, as well as the essential compounds it contains, make it so important in pharmacology. Mushroom extract may be used to cure a number of ailments, but it is most often utilized to treat cancer. Now India is the succeeding producer of *Gucchi* mushrooms and it has joined the group of countries like United States, China, France, etc. who are successfully producing *Gucchi* mushrooms. Also, geographical indications (GI) tag has been given to the Doda district of Jammu and Kashmir to grow *Gucchi* Mushrooms. However, we must continue to improve our technology before it can be distributed to agricultural communities. It is hoped that it would be passed to the farmers in the following 2-3 years. Original *Gucchi* Mushrooms may cost anywhere between Rs. 10000 and Rs. 30000 per kilogram in India. In the future the *Gucchi* mushroom will change the Indian mushroom business, assisting farmers in their economic development.

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