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REVIEW ARTICLE

STATUS AND ECONOMIC IMPACT OF YARSAGUMBA (OPHIOCORDYCEPS SINENSIS) COLLECTION IN DOLPA DISTRICT OF NEPAL: A DETAIL REVIEW

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ABSTRACT

The high-altitude grasslands of the Tibetan Plateau and the Himalayas are home to the endemic species complex known as Chinese caterpillar fungus, which has a number of distinctive characteristics belonging to the order Hypocreales of the family Ophiocordycipitaceae. Yarsagumba is a valuable, low-volume organic Himalayan medicinal herb that is becoming more and more popular abroad, greatly boosting the local economies of the mountain people. It has been used as a tonic and aphrodisiac to treat a variety of conditions, such as cancer or tumor diseases, respiratory issues, liver or kidney problems, and hyperglycemia. A total of thirty-five published publications were taken out and examined from websites like Research Gate and Google Scholar. The morphology, distribution, status, therapeutic relevance, and economic significance of the species have all been investigated in this study.

KEYWORDS

Hypocreales, Ophiocordycipitaceae, hyperglycemia, morphology

1. INTRODUCTION

It appears that Himalayan medicinal herbs have been traded for centuries. However, it has only been in recent years that commercially traded Himalayan plant species have drawn scientific interest as their potential to support rural lives as well as the effects of collection and trade on conservation have been examined. Recent studies have concentrated on identifying the species and products in trade, outlining trade patterns, evaluating policy and legislative environments, investigating local resource management systems; and examining cultivation and domestication issues (Farooquee; 1996; Holley and Cherla, 1998). The fact that goods from hundreds of species are traded, that trade extends from far-off forests and meadows to consumers worldwide, that almost all traded goods are harvested in the wild, that markets function even when they are not perfect, and that harvest and sale serve as a significant source of income for a significant number of rural households.

According to CBS, about 65% of Nepalese people actively participate in farming as a means of supplying their basic requirements (CBS, 2012). These individuals are 50.53 men and 73.57 women. As an agrarian nation, Nepal's rural communities rely heavily on forest resources for their subsistence. For rural communities, woods and their products not only provide for basic requirements but also create jobs and revenue. Rural communities can become self-sufficient in forest products if they are educated about the value of forests and forest resources and if those resources are mobilized. For rural developers, it could as well be the start of a new age in forestry. The gathering and trading of non-timber forest products (NTFPS) and medicinal and aromatic plants (MAPS) is a major source of income for the people living in the mountains. There are three ways why Nepali MAPS are important. First off, due to limited access to contemporary medical facilities, wild medicinal herbs play a significant role in the community's healthcare system. Second, rural collectors rely heavily on the trade of MAPS as a raw and processed commodity to pharmaceutical companies and the perfume industry. Thirdly, MAPS have a significant role in Nepal's species richness.

1.1 General background of Yarsagumba

The high-altitude grasslands of the Tibetan Plateau and the Himalaya are home to the endemic species complex known as Chinese caterpillar fungus, which has a number of distinctive characteristics belonging to the order Hypocreales of the family Clavicipitaceae (Sung et al., 2001). It is a parasitic complex made up of a parasitic fungus (*Ophiocordyceps sinensis*) and the host caterpillar of a species of moth from the genus Thitarodes. It is locally known as Yarsagumba in the Dolpa dialect, which is derived from the Tibetan word yartsa gunbu, which means “summer grass winter worm” (Winkler, 2008). One of the costliest natural medicinal resources available worldwide is Yarsagumba (Shrestha, 2012).

1.1.1 Taxonomical classification of yarsagumba

Kingdom: Fungi

Phylum: Ascomycota

Class: Ascomycetes

Order: Hypocreales

Family: Ophiocordycipitaceae

Genus: Ophiocordyceps

Species: O. sinensis

Yarsagumba, scientifically known as *Ophiocordyceps sinensis*, formerly *Cordyceps sinensis* is a tiny parasitic fungus found in the Himalayan region that thrives inside a variety of caterpillars. It destroys the caterpillar and

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resurfaces as a thin stem from the corpse. Yarsagumba is a valuable, low-volume organic Himalayan medicinal herb that is becoming more and more popular abroad, greatly boosting the local economies of the mountain people. The yak herders of ancient Tibet and Nepal found the enigmatic Yarsagumba, which resembles a hybrid of a mushroom and a caterpillar, in the Himalayas. Yarsagumba is a rare but extremely valuable medical plant. More specifically, its sinsness makes it the most valuable non-timber forest product in the Himalayan region of Nepal.

The Yarsagumba is picked by the poorest populations in the Himalayas and Tibetan plateau despite the market price being extremely high. After the restriction on harvesting and trading was abolished in 2001, Yarsagumba harvesting in Nepal became a significant source of monetary revenue for indigenous tribes. Collection takes place in the alpine and sub-alpine meadows from late spring to early summer when the snow begins to thaw (Thapa, 2014). In Nepal, the Yarsagumba gathering season often begins in the second week of May and lasts until the end of July, depending on the local climate, the amount of snow on the pasture, and the location's height (Thapa, 2014).

YARSAGUMBA is a significant herb with a high market value in Nepal. The mountain residents of the Himalayan region, where YARSAGUMBA is located, rely on the collection and sale of YARSAGUMBA to support their way of life. It commands the greatest price, ranging from Rs. 1200000 to Rs. 1800000 lakhs per kg, and is highly sought after in both the domestic and international markets (DFO, Profile 2072). According to report of Youth Partnership Program (2068 B.S), Yarsagumba also called as follows: China- Yarshakumbu English name- Caterpillar fungus Botanical Term- Cordyceps Scientific Name- *Cordyceps sinensis* Japanese name- Totsukasu, Local Dolpali name- Jeevan-Buti / Kira / Chyau

2. METHODOLOGY

The article's findings and all of its facts were derived from secondary sources. A total of thirty-five published publications were taken out and examined from websites like Research Gate and Google Scholar. Yarsagumba, medicinal plants, ghost moths, and traditional remedies were the search terms utilized to find publications. The morphology, distribution, therapeutic relevance, and economic significance of the species have all been investigated in this study.

3. IMPORTANCE OF YARSAGUMBA

3.1 Economic Importance

Due to geographical complexities, the Dolpa district is still facing the problems of food scarcity, transportation, communication and literacy. According to the indicators developed by the International Centre for Integrated Mountain Development (ICIMODE) Dolpa is a latest developed district of the country. The main income generating activities of people residing Dolpa are agriculture, animal husbandry, NTFPs collection and trade etc. (Budha, 2014). While Nepal has a wide variety of medicinal herbs, yarchagumba is the most well-known. The yarsagumba commerce has grown during the past few decades. It's been called a costly tonic that can save lives. It's also thought to be a Himalayan herbal Viagra remedy for impotence. Villagers in Nepal harvest yarsagumba with the intention of selling it for more than $25 per gram (retail prices can reach $150 or more per gram). It has been stated that the shortage of its supplies is a result of the increase in demand (Rajbhandari, 2019).

A single 5 cm long caterpillar fungus a of fraction of a gram has been said to be sold in China for as much as USD 50, more than the international gold price (Chapagain et al., 2021). Each year in May and June, many people from distant places trek to Nepal's high mountains to collect YARSAGUMBA. Commercial collection of O. sinensis is a critical source of income for people in Dolpa (53.3 percent of total family income), Darchula, and other districts in Nepal, especially in the northern high Himalayan region (Shrestha and Bawa, 2015; Amatya, 2008; Chhetri and Lodhiyal, 2008).

O. sinensis market pricing, trade, and collecting routes are still unknown in Nepal since commercial trading occurs illegally because of the possibility of increased taxes. (Banjade and Paudel, 2008). Cordyceps intensity has been considerably reduced each year, according to the majority of collectors (95.1 percent), necessitating its immediate conservation (Shrestha and Bawa, 2015). Due to its high demand and tight host specificity deterioration, the IUCN has classified it as vulnerable until 2020. It has been out of reach for the common person due to its expensive cost. Because of its unparalleled medicinal potential, Cordyceps spp. have become a highly valued mainstay of Traditional Chinese Medicine despite its high cost and rarity. (Holliday and Cleaver, 2008).

Yarsagumba is the primary source of income for rural residents in several high Himalayan alpine districts. Yarsagumba is becoming harder to find for collectors as demand outpaces supply. The collectors are a group of people with low economic status who endure harsh living conditions at high altitude, including inadequate housing and yarsagumba harvesting conditions, demanding work, and little access to food. Resources for healthcare are extremely scarce. Significant dangers of disease, harm, and demise exist. In order to address the needs for health care, government agencies and nonprofit organizations should focus their efforts (Koirala.et.al, 2017).

3.2 Traditional medicinal importance

A pricey medication, Yarsagumba is frequently used in China, Hong Kong, Singapore, and other places. They are used to treat a variety of conditions related to age, including heat, kidney, lung, and heart problems; male and female sexual dysfunction; exhaustion; headaches; toothaches; cancer; hiccups; and major injuries. They are also used to reduce pain and the symptoms of TB and hemorrhoids; to improve overall health and appetite; and to extend life. The species known as the "gold rush" of Nepal finds a home in alpine pastures and meadows above an elevation of 3,500 meters. According to secondary sources, Yarsagumba is primarily found in Nepal's central and western Himalayas. particularly in the districts of Dolpa, Mugu, Jumla, Rukum, Darchula, Bajhang, Manang, and Rasuwa. It used to be believed to be a mythical plant-insect hybrid that transitioned from one form to the other over the summer. Traditional Chinese Medicine (TCM) has been using it for hundreds of years as a tonic to treat a variety of conditions, such as cancer or tumor diseases, respiratory issues, liver or kidney problems, and hyperglycemia (Das et al., 2021).

It has been used for ages by both sexes as a sexual stimulant. For this reason, it's called the "Himalayan herbal Viagra". It is used to treat a variety of conditions, including headache, irregular menstruation, sexual impotence, asthma, cough, headache, rheumatism, allergic rhinitis, diarrhea, and liver issues. Different people view this in different ways for different kinds of illnesses (Devkota, 2006; Sharma). In regions of Nepal, Dactylorhiza hatagirea's rhizome is combined with powdered C. sinensis for culinary purposes (Adhikari, 2000). C. sinensis is ingested in boiled milk along with rice flour. It has historically been taken as a medicinal soup with various meats, such as chicken, duck, and hog, depending on the type of disease (Zhu et al., 1998; Winkler, 2004). It is also used as a tonic to sheep and yaks. D. hatagirea (D. Don) is consumed as a tonic and aphrodisiac when mixed with honey and cow's milk (Lama et al., 2001). It is widely used as a tonic and aphrodisiac in the Thak districts of Mustang. It is swallowed whole along with cow's milk and honey (Devkota, 2006).

O. sinensis has been shown to have numerous health benefits in studies conducted globally. These benefits have been observed in patients with asthma, chemical-induced renal injury, chronic bronchitis, coughing, allergic rhinitis, poor renal function, poor respiratory tract resistance, blood pressure regulation, irregular menstruation, anti-aging, immune system strengthening, weakness, lowering elevated blood lipid levels, poor kidney and lung's function, and decline in sex drive (Zhu et al., 1998; Francia et al., 1999; Halpern, 1999; Mizuno, 1999).

4. YARSAGUMBA HARVESTING TREND

In Dolpa, people went for collecting yarsagumba illegally in the middle of April, while the collection season is officially open from the last week of May to the first week of July. Each year, thousands of people from far-off places risk their lives to travel to high mountains in May and June in order to gather Yarsagumba. Although Yarsagumba has been collected and traded from 1998 in the Dolpa district, the Government of Nepal (GoN) has lawfully prohibited its collection, usage, transportation, and commerce in Nepal until 2001 and has levied a 500 NRs per piece fine to regulate its trade. The government of Nepal removed the ban on the gathering, use, and trading of yarsagumba in 2001, but it nevertheless maintained control over trade by prohibiting the export of raw materials and levying a hefty royalty fee of 20,000 NRs per kilogram. This encouraged local traders to smuggle goods into Tibet across the upper open border. However, the export processing legal clause was eliminated in 2006, and the high royalty fee was likewise lowered to NRs 10,000 per kg, where it remains to this day. According to a number of news reports, local dealers have been selling yarsagumba to Tibet illegally without a collection permit or release order, which has a direct negative impact on national revenue. Dolpa, 2010 (DFO). Following the government's lifting of the ban for collection and trading in Dolpa, harvesters have been actively involved in the process, receiving a set amount of royalty in return.

These days, the majority of Forestry Users Groups have assumed responsibility for managing NTFPs and collecting royalties under the

direction and control of the District Forest Office (DFO) for the past few years. However, the illicit collection and export of this priceless medicinal herb has the authorities extremely concerned. Those harvesters, who come from outside the VDC and area, found it extremely challenging to go to the Yarsagumba site while carrying food, clothing, medication, and other necessities for a week on their backs (Bhakta and Budha, 2017). The villagers are now lucky to discover 10 to 30 pieces of the fungus, compared to 150 to 200 pieces they used to gather in a month. Numerous researches have suggested that one of the main causes of this drop could be climate change. Over the previous few years, there have been less snowfall and rainfall events as well as greater temperatures in the areas where the fungus often develops (Sahi, 2016; Singh 2016; and Bhatta 2016). People more than two and a half of months remain in yarsagumba site making temporary shelter with their family members and livestock. During this period all the school, government office remains closed for specific dates. Every year hundreds of thousands of people rush themselves to high pasture meadows to harvest yarsagumba leaving their home in Dolpa. So, it has become good cash income for the local and other harvesters as well.

5. Market Chain of Yarsagumba

In Dolpa district, there were more than 10,000 local level and national district level traders involved in yarsagumba trade. The products were transported from the collection sites in two ways: first, directly to Tibet via the VDCs of Phoksundo, Saldang, Tinje, and Vijer (a route to connect with the district headquarters and the transient Tibetan market, which is only open for short-term trade); second, via Nepalgunj to Kathmandu, from where they were transported to China, Hong Kong, Singapore, and Thailand. The overseas market, which includes China, Hong Kong, Thailand, Singapore, the UK, and Taiwan, is where Yarsagumba ultimately ends up (TEPC, 2013). The Yarsagumba market can be characterized as an oligopoly, with thousands of collectors and a small number of traders at the upper echelons of the supply chain (GON, 2013). The collectors from different VDCs and Municipality collects yarsagumba at collection sites, generally there are two types of collectors, (Type-I; who collects and sell yarsagumba on their own) and (Type-II; who receive advance for the collection expenses from the village and district level traders).

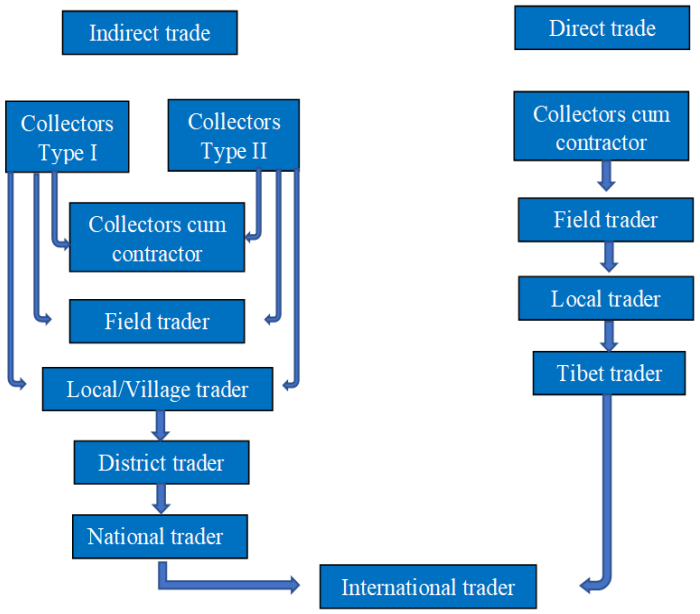

Figure 1: Market chain of yarsagumba related to Dolpa district of Nepal.

6. Challenges Faced by Dolpali People in Collecting Yarsagumba

Gathering Yarsagumba is a highly dangerous and challenging task. There were numerous difficulties and issues that collectors, kids, and other passive populations in collection zones had to deal with during the collection period. It was exceedingly challenging for the collectors to get there while riding hills and navigating a trail made of rocks, carrying food, clothing, and infants on their back. Harvesters must trek on foot every day, which is quite challenging because there isn't another way to get around. They have, however, benefited in some way by the usage of mules, donkeys, and horses in the import and export of products. Conflicts arise between locals and non-locals are caused by people coming here to collect yarsagumba, not just from Dolpa but also from across other districts (Bhakta and Budha, 2017). In addition to this, the main issues that the Dolpali people face are inadequate yarsagumba harvesting practices, shortage of harvesting equipment, shelter, inadequate clothing, and fuels for cooking food.

7. Conclusion

As a conclusion, we can say that the yarsagumba is a foundation of the Dolpa district's economy. It is the primary source of income of people in Dolpa. A variety of illnesses can be treated using the medicinal fungus yarsagumba. Dolpali people consider it as a lifesaving tonic and use in curing different types of ailments (Traditional medicine). Little school-age children were taken to yarsagumba collection site because of the thinking that they have sharp eyes which can finds the yarsagumba(fungus) quickly as compare to others. Collection season starts from the last week of May to the first week of July. Some collectors collect and sells yarsagumba to trader in field and some sells after returning from collecting site to local trader. Then local trader either sells directly to Tibet or sells to district trader and then it reaches to international market through Kathmandu.

People of Dolpa faces different problems while collecting yarsagumba. In order to manage the disagreement, define rights, duties, and obligations, and create institutions that can settle conflicts in the future, the national government may need to get involved. To manage and cultivate the most valuable and effective NTFPs and MAPs, a clear policy must be developed and put into action. The knowledgeable trainers should provide collectors with enough instruction in collecting, cleaning, drying, and storing methods. Enforcing stringent laws and policies is necessary to stop the illicit gathering and sale of yarsagumba to Tibet. Additionally, a suitable market chain needs to be established to facilitate the smooth import and export of yarsagumba.

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