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Ethnobotany of the Medicinal Plants: Case of *Ophiocordyceps sinensis* (Yarsagumba) and Its Benefits for Nepal, India, and Bhutan

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ABSTRACT. *Ophiocordyceps sinensis* (Yarsagumba) is complex combination of fungus and dead caterpillar having high medicinal and economic value. From the ancient time, it is being used as traditional medicine in countries like Nepal and India. It naturally grows in the Himalayan alpine pastures of Nepal, India and Bhutan. However, there are limited literatures which explores the people's interaction with the medicinal plants. This study focuses on availability and usage of Yarsagumba in Nepal, India and Bhutan. For this, systematic literature review was conducted to gather information from online resources using different keywords. *Ophiocordyceps sinensis* is largely used for brain and body nourishment to improve the immune system and used as a renoprotective, anti-inflammatory, anti-metastatic, and neuroprotective agent. Despite of major opportunity, India, Nepal, and Bhutan have been only contributing 1.6, 1.4, and 0.5%, respectively of the total annual production of *Ophiocordyceps sinensis*. This paper has explored details on the ethnobotany and use of medicinal plants in the context of Nepal, India, and Bhutan. Apart from this, the production, benefits, and usage of *Ophiocordyceps sinensis* have also been discussed in this paper.

Keywords: ethnobotany, medicinal plant, *Ophiocordyceps sinensis*, South Asia, Yarsagumba

1. Introduction

Yarsagumba was first described as *Sphaeria sinensis* scientifically in 1843 and later the fungus was known as *Cordyceps sinensis* (Damodar, 2019). It is the complex combination of fungus and dead caterpillar (Figure 1) and considered as rare mushroom which is highly valued as medicine (Chakraborty et al., 2014). It naturally grows in the Himalayan alpine pastures of Nepal, India and Bhutan (Adhikary, 2017). Out of total annual production of Yarsagumba globally, 1.4% of Yarsagumba from Nepal, 1.6% from India, 0.5% from Bhutan has been estimated (Thapa et al., 2014). The demand of Yarsagumba is very high for traditional Chinese medicine and in late 1900s its demand increased dramatically which led to haphazard collection in collection sites (Wallrapp et al., 2019). Though there are legal provisions for trade in India, traders and collectors are not benefited and trade is complicated too. In Bhutan, the harvest of Yarsagumba was illegal until 2004 and placed on Schedule 1 of Forest and Nature Conservation Act (Cannon et al., 2009). In Nepal, Yarsagumba is the main source of income and traditional medicine. In May and June of every year, the villagers went up to high mountains to collect Yarsagumba (Damodar, 2019).

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Yarsagumba is very important as it is a natural herbal medicine which is being used from centuries for health care, reduction of fatigue etc (Wang et al., 2016). Nowadays it is also being used for increasing physical stamina, improving heart diseases, regulating proper function of liver and kidney and so on (Seth et al., 2014). Along with its medicinal value, it is also a source of income in countries like Nepal (Damodar, 2019). Similarly, it also serves as cover up for the crop failure or like side income in seasons too (Shrestha et al., 2020). The revenue collected by the government is being used in the management of buffer zone area (Baral et al., 2015). In Bhutan, the household's numbers to harvest Yarsagumba is limited to certain extent which is useful for resource management (Winkler, 2009). Furthermore, in the era of science by the use of technology this herb is being very fruitful for medical field. Cordycepin, extract of *Cordyceps* like the normal nucleoside can perform the premature termination of transcription (Tuli et al., 2014). It can also be used to obtain nucleosides from *Cordyceps sinensis* and its nucleosides and derivatives can be used in anticancer and antiviral therapies (Liu et al., 2015). Also, in recent years, *Cordyceps* are being used for the preparation of functional foods which in other words are nutritional foods or medicinal foods (Zhou et al., 2009). Furthermore, *Cordyceps* and its extracts mixed with any other nutritional materials can produced many products that benefited people from medicinal aspects also.

The purpose of the research is to provide the general de-

scription of medicinal plants, its benefits and the history. This paper enlightens the uses of medicinal plants as a source of food, medicine and income. Also, the study is particularly focused on *Cordyceps sinensis*, its status and uses in countries like Nepal, India, and Bhutan. As *Cordyceps sinensis* is the highly valued traditional medicine, also the most beneficial and extensively herb which many health benefits, the researchers of this paper used systematic review technique to explore its benefits and usage. This research could be interesting for the ethnobotanist who takes keen interest in subject of medicinal plants particularly more in *Cordyceps sinensis* as well as for the locals who are related with the herbal species.

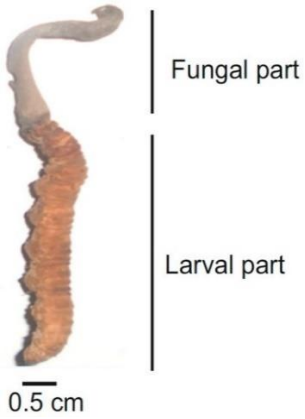

Figure 1. Morphology of *Ophiocordyceps sinensis* (Baral, 2017).

2. Methods

For this study, secondary literature review was conducted to gather information from different sources like Google Scholar, PubMed, Springer, Elsevier, and ResearchGate. This study used systematic review method to use different keywords to identify the related studies conducted mainly in last 20 years. The authors collaborated among each other via Global Research Institute and Training Center and conducted a preliminary literature review to identify the gaps in the study. After finalization of issue, search phrases like 'Yarsagumba production and usage in Nepal', 'Importance of *Cordyceps sinesis*', 'global condition of Yarsagumba', 'Yarsagumba production in Bhutan', 'roles of Yarsagumba in environmental conservation', 'history of medicinal plants in Nepal', 'ethnobotany with medicinal plants in India', 'ethnobotany and medicinal' and 'importance of medicinal /herbal plants' were used to gather the relevant literatures. This study explored the ethnobotany and use of medicinal plants in Nepal, India, and Bhutan (Figure 2) along with the production, benefits, and usage of Yarsagumba in the three countries.

3. Results and Discussion

Ethnobotany is the interrelationship between plants and people (Heinrich, 2002). Humans have shown dependency on plants since a long time ago. After years of searching for healing factors in plant's parts like bark, seed, root, and flowering parts, they develop a way of treating illness with medicinal plants (Petrovska, 2012). More than 80,000 species of plant in the world are used for the medicinal and herbal industries as well as contributing to livelihood generation and health security (Sareea Al-Rekaby, 2017).

3.1. Ethnobotany and Use of Medicinal Plants in Nepal, India, and Bhutan

Ethnobotany was coined by Harshberger in 1895 in the Philadelphia Evening Telegraph (Jain 2007). It is defined as multi-diciplinary subject which studies about the people's interaction with plants (Eldeen et al., 2016). It also refers as folk botany which gives the information about the methods that local people use to utilize plants. It gives the traces of the cultural status of ethnic group which are linked with plants via any medium (Rahman et al., 2019). From many Veds, books, it is known that our ancestors used plants as therapeutic herbs started from 60,000 years ago globally (Rudra et al, 2020). For e.g., in Badalchori Vadi Sora village of Bangladesh, local people used formulation derived from roots, leaves etc. of medicinal plants to cure around 379 illness which they learned from their ancestors (Rudra et al., 2020). In Nepal also due to lack of proper health facilities, about 70% to 80% people rely on medicinal plants for their treatment from the ancient times (Rokaya et al., 2017). In India there is a trace of ethnobotany linked with medicinal plants because the initial knowledge obtained about medical properties of plant is due to observations of early humans which is passed down to till this generation via teachers to students or in written form (Jain 2007). Ethnobotany provides many vital information which play great role in medical field but still there are lack of researches on it (Rahman et al., 2019). From global perspective also, field ethnobotanist does not receive necessary funds which stops them to explore new drugs (Rahman et al., 2019).

Plants with medicinal property are termed as medicinal plants (Figure 3). The medicinal plants are the backbone of traditional knowledge from the ancestral times (Lagoudakis et al., 2014). Today, more than 80% people in developing countries and above half of world's population depend on the traditional medicine. The demand for pharmaceutical products has been decreased and people's interest is more focused on herbal plants to treat diseases, nutritional disorder etc. (Chakraborty et al., 2014). In Nepal, people are dependent on plants for source of food and medicine from very ancient times (Kunwar and Bussmann, 2008). The *Saushrut Nighantu* which was written in 878 A.D. (935 B.S.) where the use of 278 Nepalese medicinal plants was recorded (Kunwar and Bussmann, 2008). When the plants began to harvest from Himalayas to use as medicine, its earliest written record can be found in 6,500-year-old texts of Rigveda, followed by Atharveveda and Ayurveda (Kunwar and Bussmann, 2008). Later information regarding 750 plant species' traditional knowledge was published by Royal Nepal Academy in 1969 in *Nepali Nighantu*. Around 554 plant species are believed to have ethnomedicinal in properties from the total of 1,012 plants which was recorded as useful species. During the period of human civilization, nearly 3,000 flora species

Figure 2. Map of the study area (National Geographic Maps).

came in use for food purpose but there is cultivation of only 150 species out of which less than 10 species meet the demand of world food. But nowadays due to the evolving people's interests and importance, many institutions are conducting research on the medicinal plants (Pandey and Shrestha, 2018). Though medicinal plant is being used from ancient times but due to Covid-19 pandemic it is assumed that there is slight increase in its use (Khadka et al., 2021). Many pharmaceutical products consumptions are indirectly affecting human's health and through social media also people's interest on traditional system of medicine, folk medicine goes on increasing (Khadka et al., 2021). Despite of this, it is necessary to wisely use the available resources which has been contributing to the sustainable livelihood and economic development of the people (Aliero et al., 2022; Giri et.al., 2022).

Indigenous knowledge of plants has gained popularity in recent years in developing countries like Nepal not only because of their intrinsic value, but also due to their potential to be globalized (Pandey and Pokhrel, 2020). In various regions of Nepal plant species, diversity and cultural diversity bring diversity to the ethnomedicinal value of plants. In the far western region of Nepal medically valuable plants are available in the form of wild and weeds, and 108 weed species are recorded to be valued medically (Bhatt et al., 2021). Research and survey have shown that the Tamang community in Makwanpur district use 161 plant species for the treatment of disease related to gastrointestinal, wounds, cuts, fever, etc. (Luitel et al., 2014), a local community in Dolakha possess knowledge of 113 medical remedies for the treatment of headache, skin infection, cough, and cold by the medicine derived in the form of juice from roots, leaves, and stem from 58 species of plants (Shrestha and Dhillion, 2003), similarly in Rasuwa district 60 medicinal remedies were derived from 56 medicinal plants (Uprety et al., 2010).

Likewise, India being the land of varied cultures, ethnicity, geographical area, climate, and biodiversity is developed as the origin place of different medication systems like Ayurveda and highly recognized for use of more than 8,000 plant species in the herbal Industry (Jain and Borthakur, 1980). Records show that India utilizes 20% of its plant flora as medicinal plants (Wangchuk and Tobgay, 2015). In Uttar Pradesh India 125 plant species were found to be used by local tribes for the medicinal purpose (Singh et al., 2002). Similarly, Mikirs tribes in the Karbis Anglong district of southeastern India are highly dependent on forest resources for their livelihood generation and medicinal needs (Jain and Borthakur, 1980). Research conducted at the Monpa ethnic group in Arunachal Pradesh shows that people living there use mostly leaves herbs, shrubs, and trees to treat 22 humans as well as 4 veterinary ailments (Namsa et al., 2011).

In Bhutanese, traditional medicine more than 1,000 plant species are recorded of which at present only 300 species are collected (Wangchuk and Tobgay, 2015). 113 species of lower-elevation medicinal plants were identified among them 21 species were not used currently in Bhutan (Wangchuk et al., 2011). In 2007, farmers of Lauri Gewog village collected 94,000 kg chiretta (*Swertia chirata*), 24,000 Common madder (*Rubia cordifolia*), 5,024 kg star anise (*Illicium griffithii*) (Jamba and Kumar, 2018). The seed was the most collected part followed by fruits and then leaves (Wangchuk et al., 2011).

Every year Nepal collect and export 15,000 to 20,000 tons of wild medicinal plants to foreign countries valued at 15 million to US$ 20 million (M.K. et al., 2013). A study has shown that the Indian herbal medicinal industry makes an annual turnover of Rs. 2300 crore (Sharma et al., 2008). In 2012, Pakistan have generated more than US$ 10.5 million through medicinal and aromatics plants (MAPs) export (Sher et al., 2014). Similarly, study conducted in Kalat city, Pakistan shows that MAPs cultivation generates US$ 523.6 more revenue than crop plantation (Khesht et al., 2021). According to the economic survey report of the ministry of finance of Nepal, the Herbal Processing and Production Company Limited manufactured total of

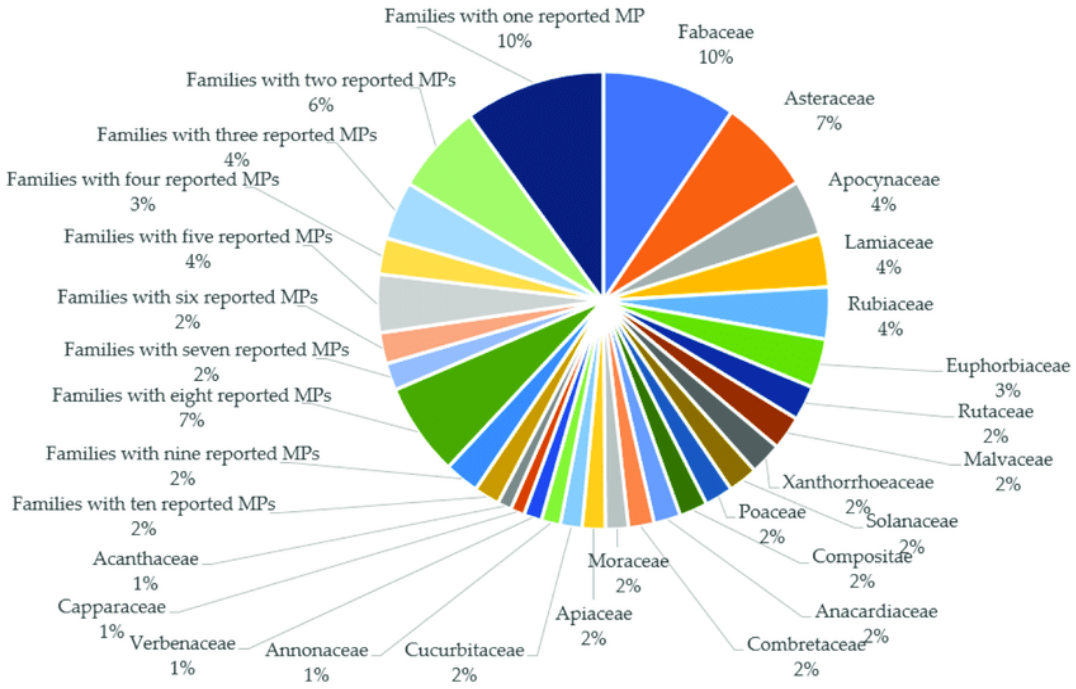

Figure 3. Percentage distribution of families of medicinal plants used for cardiovascular diseases treatment (Rana et al., 2022).

44.8 tons of aromatics oil and 4.96 million units of herbal care in the fiscal year 2019 ~ 2020 (Sher et al., 2014).

Villagers in India received 12 ~ 13 % of their total revenue in 1992 from medicinal and aromatic plants collection (Rathore and Mathur, 2019). Before 1998, annual turnover of the Indian herbal Industry was estimated at around US$ 300 million and in the years 1998 ~ 1999 and 1999 ~ 2000, the annual turnover of the Indian herbal industry rises to US$ 31.4 million and US$ 48.9 million, respectively (Sharma et al., 2008). In Bihar, during 2007 ~ 2008, 252 tons of Mentha and 25.9 tons of lemon grass were produced in 2,100 and 185 ha, respectively. In the production of Mentha and Lemongrass net income derived was 15,500 and 19,500 Rs/ha, respectively (Charan, 2013). In the years 2004 ~ 2005, 2016 ~ 2017 and 2017 ~ 2018, the productivity of Aromatic and medicinal plants in India was 1.2, 2.2, and 2.2, respectively (Rathore and Mathur, 2019).

Over a past 10 years of its financial value has increased dramatically, with collector paid as much as US$ 12,500 per kg for top quality material in Bhutan (Cannon et al., 2009). More than 60% of the world's population depends upon traditional medicinal plants for curing various types of diseases which are being harvested and used since the beginning of human civilization (Shrestha and Dhillion, 2003). Till now more than 7000 kinds of medicinal plants have been found all over the world out of which more than 900 varieties of medicinal plants are available in Nepal (Chhetri et al., 1970). There are different medicinal plants used for treating different diseases as shown in Table 1.

The Sustainable Development Goals (SDGs) or the global goals can be defined as goals which consists of list of objectives made from the universal agreement and adopted by all member states of United Nations formally in 2015 (Morton et al., 2017). Its objectives are to ensure development programs are sustainable, end poverty, make the planet suitable to live and enable people to live in peace and prosperity (Rekha et al., 2011). In developing countries, micro-organisms are the root cause if infectious disease which gets transmitted by coming into contact with one another. But the consumption of antibiotics nowadays commonly shows side effects like diarrhea, vomiting etc. Apart from pharmaceutical products, it has been found that within the last few decades the use of herbal plants against common infectious diseases shows no harmful side effects. Therefore, medicinal plants can be replaced against antibiotics in case of bacterial related infections and synergistic studies can be extended to other plant species. Some medicinal plants like Yarsagumba also become a source of income for many collectors or people (Damodar, 2019). Due to its known benefit, its conservation status and sustainable use came into consideration of today's generation (Chen et al, 2016). Various sets of strategies are recommended regarding conservation like in situ and ex situ programs and systems like inventorying and monitoring the status etc. Cultivation practices can also be applied to improve the status of endangered plant species. Although the medicinal plants important role is known in both developing and developed countries but its degradation rate is more than conservation strategies. Due to the increased trade the herbal plants are in verge of endangered (Padulosi et al., 2002). For example, *Prunus Africana*, which is used to treat benignant prostate cancer, is being stripped of its bark to extent that species gradually search, expertise, collaboration on inter-regional, inter-sectoral for training people and implementation of good practices (Pelkonen et al., 2014).

Table 1. Usage of Different Medicinal Plants

Plants	Usage	References
Ficus feligiosa L. (Pipal)	The leaf juice of Ficus religiosa is used for curing asthma, diarrhea, migraine, earache, and toothache	Lyonia (2006)
Lannea coromandelica	It is commonly known as an Indian ash tree. The bark of the Lannea coromandelica is used for curing ulcers and skin infections. Similarly, the boiled leaves are placed in the swelling part of the body to cure pain	Singh et al. (2002)
Cinnamomum tamala	It is commonly known as Tejpat in Nepal. It is generally used as a spice but nowadays it is also widely used to cure diabetes, colds, and cough	Kuniyal et al. (2013)
Terminalia chebula	It is commonly known as Harro in Nepal. Its fruit is used in treating heart diseases, constipation, hepatitis, and urinary problem	Khana et al. (2009)
Pinus wallichiana	It is commonly known as Himalayan White Pine. Its Resin, bark, seed, and leaves are used to cure asthma, fever, scorpion, and Snakebite	Kayani et al. (2015)
Tribulis terrestris	It is commonly known as puncture vine. The powder collected from the seed of Tribulis terrestris is used to treat kidney stones	Aziz et al. (2018)
Catharanthus roseus	It is commonly known as Madagaskar Periwinkle or annual vinca. It is used to cure diabetes and fever. It is also commonly used as Arrow poison	Gurib-Fakim (2006)
Mimosa pudica L.	It is commonly known as touch me not plant. Its whole plant is grinded and mixed with water and sugar is taken twice a day to cure piles and dysentery	Rana et al. (2010)
Betula alba	It is commonly known as downy birch or white birch. Its bark, flower, and leaves are used as Bile stimulants, oedema and also fight against cholesterol and urea	Neves et al. (2009)
Urtica dioica	It is commonly known as burn nettle or simply nettle. Its leaves are used to control hair fall	Vitalini et al. (2009)

Table 2. Annual Production of Yarsagumba in Selected Areas of the Studied Site

Annual Production (10^3 kg)	India[a]		Nepal[b]		Bhutan[c]
Estimate	Uttarakhand	Others	Dolpa	Others	--
Low	1.25	0.45	0.50	0.50	0.50
Medium	1.50	0.75	1.00	1.00	0.75
High	1.80	1.00	1.70	1.50	1.50

Note: The references include: [a] Negi et al. (2009); [b] Negi et al. (2009); [c] Cannon et al. (2009), and Winkler (2020).

3.2. *Ophiocordyceps sinensis* and Its Production, Benefits, and Usage

Ophicordyceps sinensis (Yarsagumba) is a rare fungus that is harvested and sold by millions of people living in the mountainous region of Nepal, India, Bhutan, and China (Table 2) where Yarsagumba harvesting is the main income generation source for the poor people (Shrestha et al., 2019). Yarsagumba is presently the most prized medicinal plant in Nepal (Figure 4) with prices varying from US$ 8,000 to 14,000 per kg in the market (Wallrapp et al., 2019). Its health benefits have been recognized from more than 1,500 years ago. The Yarsagumba is largely used for brain and body nourishment furthermore to improve the immune system (Ghanshyam and Manvitha, 2017). Research on Yarsagumba in the rat shows that it the minimize acute renal failure (ARF) and chronic renal failure (CRF) (Chakraborty et al., 2014). The Yarsagumba also helps to increase the capacity of an organism to adjust to the changing environment and also avoid damage from these changes (Shashidhar et al., 2020). To increase sexual excitement both males and females consume the Yarsagumba with milk and some tablespoons of ghee for a week (Devkota, 1970). Similarly, it is used as a reno-protective, anti-inflammatory, anti-metastatic, and neuroprotective agent (Das et al., 2021). As tumor diseases are considered a serious cause of human death all over the world, Yarsagumba is used as an antitumor agent to cure tumors (Zhou et al., 2009). The cordycepin extracted from the Yarsagumba lowers the expansion of the aortic smooth muscle cells by lowering the presence of cyclins and cyclin-dependent kinase (Luitel et al., 2020). In addition, research conducted in Sikkim, India shows that the Yarsagumba is also used to quicken corticosteroid production in different animals (Panda and Swain, 2011).

Yarsagumba is found in the Tibetan plateau of China and the alpine grassland of Nepal, India, and Bhutan (Shrestha, 2011). In Nepal, it is reported to be found in almost 27 northernmost districts but its distribution pattern is still unknown (Thapa et al., 2014). It is known to treat various abnormal hepatic conditions, cardiovascular system and different nephrotoxicity, asthma, chronic bronchitis (Chakraborty et al., 2014), combat sexual disfunction, reduction of tumor size, DNA repair, anti-aging (Cannon et al., 2009), improve liver function (Negi et al., 2010). It has been estimated that about 75 kg of Yaragumba is collected every year from Dhorpatan Hunting Reserve (Thapa et al., 2014). It has been found that the potential annual production of Yarsagumba in the Jumla district is 201 kg (Shrestha et al., 2019). In the Darchula district of Nepal, harvesting and selling Yarsagumba contribute to 68% of income generation (Karki et al., 2022). Yarsagumba contributes economic support to several families in Nubri and Tsum, Nepal (Childs and Choedup, 2014). India supplies 1.7 to 2.8 tons of Yarsagumba, and Bhutan has 0.5 to 1.5 tons of Yarsagumba per year (Gaire, 2022).

3.3. *Ophiocordyceps sinensis* Availability in Nepal, India, and Bhutan

Yarsagumba is known for its abundance in the Tibetan Plateau and the Himalayas (Winkler, 2013), including countries like Nepal and India (Adhikari, 2017). Jumla, Dolpa, and Darchula are the three major Yarsagumba producing areas in Nepal, contributing nearly 7% of the total supply (Shrestha et al., 2019). In 2009, 1,560 kg of Yarsagumba were collected in the Dolpa district of Nepal costing NRs. 250,000 per kg, which contributes to NRs. 1,794 in the county economy (Chhetri and Gotama, 2010). In 2012, harvesters in the Mugu district of Nepal sold 400 million Nepalese rupees (Karki et al., 2022). According to data collected from a survey in Garjyangkot village of Jumla district, the mean annual harvest per person was 347/251 pieces in 2010 with earnings of US$ 604.12/505.8, which in 2014 found to decrease by 25 pieces per person with earnings increased by US$ 194.1 per person per year (Shrestha et al., 2019). For last few years, the trade of Yarsagumba is increasing in Nepal (Ghimire, 2021). People in Makalu Barun National Park receive US$ 10 per piece. Local collectors in Sankhuwasava earn an average of NRs. 12,000 in the peak season (Gaire, 2022). Bhutanese collectors relatively receive less value for their collection nearly 30 to 60% of the Tibetan Yarsagumba (Pradhan et al., 2020). In Bumdeling, Bhutan in 2008 set of 40 individual collectors earn US$ 30,000 for their collection; similarly, in Paro, Bhutan 14 kg Yarsagumba collected contributing US$ 40,000 (Cannon et al., 2009). In 2004, a total collection of 176 kg was made worth US$ 315,138 which increases to 673 kg worth US$ 2,418,168 (Cannon et al., 2009). Study shows that in 2007, per kg Yarsagumba cost Rs. 24,000 in China, Rs. 2,000 to 8,000 in Lasa, and one lakh in India (Cannon et al., 2009).

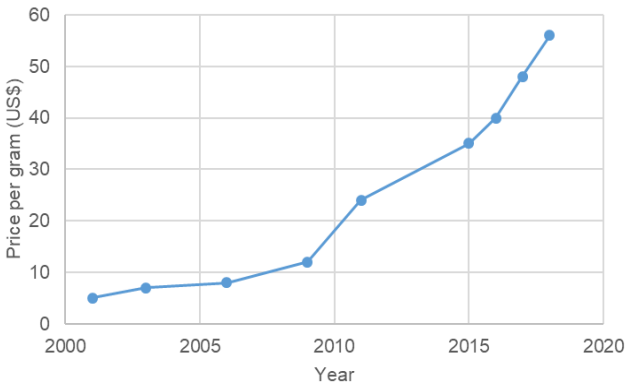

Figure 4. Prices of Yarsagumba (Gaire, 2019).

The local population in the border region of Kailash Landscape in Nepal and India is highly dependent on Yarsagumba collection for livelihood generation. About 3,500 people are involved in the Yarsagumba collection in the Kailash Landscape region in the year 2074/75 (Pandey and Pokhrel, 2020). In Nepal, exact cultivation of Yarsagumba is still unknown but some individuals and business organizations are working on it (Ghanshyam and Manvitha, 2017). After the legislation of trade in 2001, trade volume increased continuously reaching 2,442.4 kg in 2009, and in 2011 decreases to 1,170.8 kg (Shrestha and Bawa, 2013). Wild collected Yarsagumba costs range between Rs. 30,000 to 60,000 in Nepal and Rs. 1 Lakh in India (Sharma, 2004). Nepal contributes to 1.4% of the total annual production of Yarsagumba, India and Bhutan contribute 1.6 and 0.5%, respectively (Thapa et al., 2014). Research conducted in Munsyari block Uttarakhand, India shows that between 2004 and 2009 annual income contributions were US$ 972 to 1,485 per collector (G.C and Tiwari, 2014), and total yield in 2012 was nearly 77 kg contributing 97 INR million (Negi et al., 2015).

4. Conclusions

Ophiocordyceps sinensis is an entomopathogenic rare fungus found in the Himalayan regions of Nepal, India and Bhutan. It has long history of being used as the traditional medicine in the Asian region. *Ophicordyceps sinensis* is harvested and sold by millions of people living in the mountainous region of Nepal, India and Bhutan. Till now more than 7,000 kinds of medicinal plants have been found all over the world out of which more than 900 varieties of medicinal plants are available in Nepal. More than 60% of the global population depends upon traditional medicinal plants for curing various types of diseases, which are being harvested and used since the beginning of human civilization.

Following the ethnobotany concept, people have been searching for healing factors in plant's parts like bark, seed, root, and flowering parts and have developed a way of treating illness with medicinal plants. *Ophiocordyceps sinensis* has numerous health benefits and have been used by the people of Himalayan from centuries for reduction of fatigue. It has good impact on reproductive system, blood production, sperm production etc. Nowadays it is also being used for increasing physical stamina, improving heart diseases, regulating proper function of liver and kidney. Though medicinal plant is being used from ancient times, it is assumed that there is slight increase in its use due to Covid-19 pandemic. Many pharmaceutical products consumptions are indirectly affecting human's health and through social media also people's interest on traditional system of medicine, folk medicine goes on increasing.

Out of three studied countries, the production of *Ophiocordyceps sinensis* was higher in India compared to Nepal and Bhutan. Though the harvest of *Ophiocordyceps sinensis* was illegal in the studied countries in the past, looking its high monetary value and medicinal benefits, the government has opened for its harvesting. It has been become one of the major sources of income for the local people in the Himalayan region of Nepal, Bhutan, and India.

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