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Keedajadi *(Ophiocordyceps sinensis)* Collection and Marketing: A Key Income Source of People in Goriganga Valley, Kumaun Himalaya, India

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ABSTRACT

Natural resources are very important for human life, and their sustainable use is possible only through proper technological development. Man is not only the creator of resources on earth but also utilizes them. There is immense availability of natural resources in the Goriganga Valley in Kumaun Himalaya, where insecticide has emerged as a significant natural resource. Keedajadi (Ophiocordyceps Sinensis) is a natural insect fungus mainly found in the Bugyals (Alpine meadows) of high Himalayan regions at an altitude of 3000 m to 5000 meters above mean sea level. There are a total of 170 villages located in the Goriganga valley. There has been a positive change of 2.41% in the total population growth between the years 2001 and 2011. The average income is recorded at 56252 INR per person in 2022, and around 3425 people from 70 villages are engaged in the collection. Income has been utilized in various sectors, 53.06% in the higher education sector and 38.91% in house construction.

Keywords: *Keedajadi (Ophiocordyceps sinensis), Population, Income use, Goriganga valley.*

INTRODUCTION

Natural resources have played a major role in the livelihood of mountain communities in the Himalayan regions (Olsen & Larsen, 2003). The importance of these products in rural livelihoods is contributing to the country's development at the global level. 1.6 billion people worldwide depend on forest products for their livelihood (Serstha et al.,2014). *Ophiocordyceps sinensis* (Berk.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora (earlier known as *Cordyceps sinensis*) The entomogenous fungus, Patsdoyozes the larvae of ghost moth and converts it into sclerotium from which the fungus fruiting body grows (Sung et al.,2007; Negi et al.,2020; Dai et al., 2020) The common name of species varies from place to place. For instance, it is popularly known as 'Dong Chong Xia Cao' in China, Yartsa Gunbu in Tibet, Yarsagumba in Nepal, and Keedajadi in India (Belwal et al., 2019).

Ophicordyceps sinensis is known by the name *Keedajadi* in Goriganga Valley of the Kumaun Himalayan region (Figure 1). Which has been placed under the *Ophiocordicipitaceae* family. The process of revising the overall *Cordycipita-ceae*and *Clacicipitaecae* classification resulted in the creation of the *Ophiocordycipitaceae*family or the transfer of the *Cordyceps*species to *Ophicordyceps*. The word Cordyceps originates from the Greek term "*kordyle*", which means "club", and the Latin etymon "*ceps*", which means "*head*" (Das et al.,2021). After 2007, Cordyceps is known as *Ophiocordyceps sinensis* (sen et al.,

2023). *Keedajadi (Ophiocordyceps Sinensis)* fungus grows on the larva of host insects, an entire stage which remains for 3 years to 4 years longer underground (Wei et al.,2021; Negi et al.,2020). They all die in winter after being infected by the fungus, and the fungal stroma comes in earlier, April last to May first (Winkler, 2008; Li et al.,2011; Wei et al.,2021). Keedajadi is a dormant stage in the life cycle which can resist unfavourable snow-cold conditions. Hyphae of Keedajadi can grow at about two °C with the optimum temperature between 15-18°C (Negi et al.,2020; Wei et al.,2021). High rainfall, low temperature, and high altitudinal zones are suitable for the growth of *keedajadi* (Wei et al.,2021).

Keedajadi is mainly found in the alpine meadows of Tibetan Plateau, China, Nepal, India, and Bhutan at a height of 3000-5000 m (Winkler, 2009; Belwal et al.,2019; Karki et al., 2020; Byers et al., 2020). At the global level, 95-96% of the contribution of Keedajadi collection is in China, 1.2-1.8% in Nepal, 1.5-2.0% in India and 0.6-0.8% in Bhutan (Kuniyal & Sundriyal, 2013; Caplines & Haverson, 2017; Negi et al.,2020).

Ophiocordyceps sinensis was recently listed as vulnerable on the IUCN Red List due to "its strict host–speciality on moth insects, and confined geographical distribution, and over-exploitation by humans in recent decades" (Yang, 2020; He et al., 2022).

A. **B.**

C.

D.

Figure 1. (A) Larva and foungus part of *keedajadi* (B) *Keedajadi* ready to sell in the local Market after cleaning the soil (C) keedajadi collection at Selapani bugyal. (D) keedajadi collectors' temporary tents in Charthi bugyal. (*Source: Primary data collected during field visit*)

Study area

The study area is located in the eastern region of Kumaun in the state of Uttarakhand, India, which is bounded by the international border with the Tibetan region of China in the north and Nepal in the East, near the confluence of Goriganga and Kali. River Gori-Ganga originates from Milam glacier (~ 3600m) and makes confluence at Jauljibi locality with Kali River at an altitude of ~ 630m which is later known as Sarda in Uttar Pradesh (neighbouring state of India).

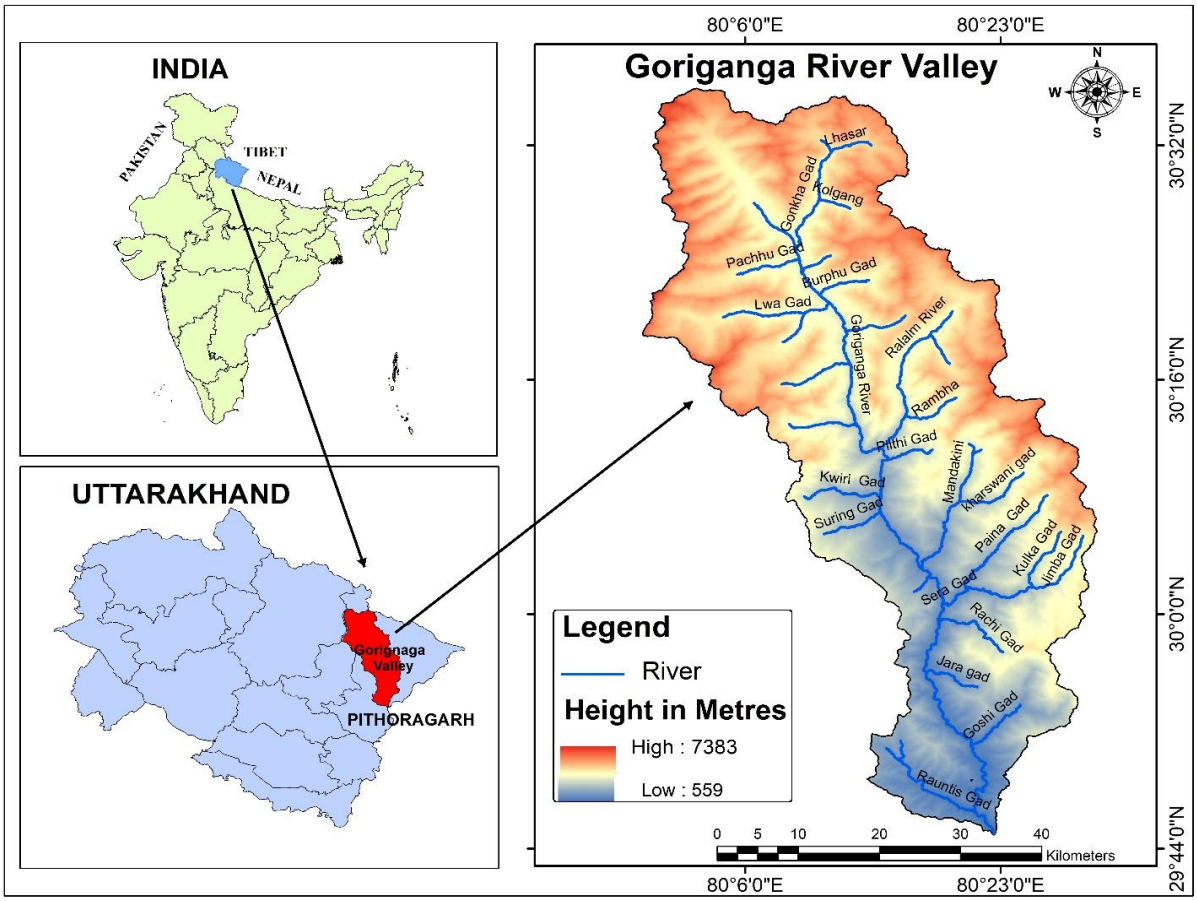

Figure 2. Location map of study area.

The Goriganga basin, a vast expanse, stretches between longitudes 79° 59' 11 to 80° 29' 25.95" and latitude 29° 44' 58.6 to 30° 35' 52.74". It covers a geographical area of 2244 Km2, about 4% of the total area of the State of Uttarakhand. The altitude ranges from about 559m at the confluence of river Gori with the Kali to 7383 m at the summit of Nanda devi East, one of three 7000 m high mountains that dominate the landscape (Figure 2.). The study region is home to 29 large and medium-sized glaciers, and the upper Trans-Himalaya reaches of these valleys form an arid, cold desert area with minimal annual rainfall and absence of vegetation.

MATERIALS & METHODS

The growth rate of the total family and total population of 170 villages in Gori Ganga Valley has been calculated on the basis of census years 2001 and 2011. In the year 2022, the altitudinal zone-wise total village and population engaged in Keedajadi collection has been estimated, and the per-person average income has been shown. The area of utilization of income derived from Keedajadi collection and marketing in the entire Goriganga Valley is shown in the table. In 2022, a questionnaire survey of 1881 families in 70 villages of Goriganga Valley was conducted. In the field survey, the questionnaire form was filled through the Keedajadi collector and the village head of the Van panchayat sarpanch. Village altitude is assessed using GPS, a Google Earth map, and a topographical map. ArcGIS is used to prepare the final maps.

RESULT AND ANALYSIS

Altitudinal Zone wise Population

In 2001, in Goriganga Valley, there was a total population of 43321 in 170 revenue villages, and in 2011, there was a total population of 43321 in 170 villages (Table 1). A total nominal growth of 19 (2.41 %) has been observed in the yearly interval of the census years 2001 and 2011. The villages situated in the Goriganga Valley have been divided into six zones. There are 02 forest villages in the altitudinal zone 2400m-3000m. Based on population change, the most positive change occurred in the altitudinal zone 3000m -3600m, which is 137.69%. 14 Shoka villages of Goriganga Valley are situated in this altitudinal zone. The provinces that became extinct after the India-China War of 1962 are currently repopulating these villages to increase tourism, traditional agriculture, and herb collection. Below 1200m, there is a negative change of -242(-2.30%), the zone with the lowest growth rate in the valley

Table .1 Altitudinal zone wise population in Goriganga Valley, 2001 and 2011

Sl. N	Altitudinal Zone	Total Village	Population 2001	Population 2011	Growth rate 2001-2011	Growth rate in %
1	Below-1200	20	10486	10244	-242	-2.30
2	1201-1800	81	14942	14792	-150	-1.00
3	1801-2400	52	16518	17525	1007	6.09
4	2401-3000	02	02	03	1	50
5	3001-3600	14	252	599	347	137.69
6	Above-3600	01	102	158	56	54.90
	Total	170	42302	43321	1019	2.41

Source: Census of India 2001,2011.

Table .2 Altitudinal zone wise family and population of villages engaged in keedajadi collection (2001 and 2011)

Sl. N.	Altitudinal zone	Total village	2001		2011		Growth rate 2001-2011	
			Total family	Total population	Total family	Total population	Total No. Of family	Total population

01	Below -1200	06	859	4147	922	4133	63 (7.33)	-14 (-0.34)
02	1201-1800	26	1442	7016	1685	7544	243 (16.85)	528 (7.53)
03	1801-2400	26	1403	7011	1482	6638	79 (5.63)	-373 (-5.32)
04	2401-3000	00	00	00	00	00	00 (0.00)	00 (0.00)
05	3001-3600	14	126	252	341	599	215 (170.63)	347 (137.69)
06	Above -3600	01	27	102	28	158	1 (3.70)	536 (54.90)
	Total	70	3857	18528	4458	19072	601 (15.58)	544 (29.36)

Source: census of India 2001,2011.

**** The Numbers Inside the brackets are showing the percentage***

In Goriganga valley, 70 villages are involved in the rural Keedajadi collection (Figure 3.). In 2001, 18528 people lived in 3857 families, and 2011, 19072 people lived in 4458 families. During the years 2001-2011, there was a positive change of 15.58% in family growth rate and 29.36% in population (Table 2). In the altitude zone 1800-2400m there has been a negative change of -373 (5.32%). Due to a lack of modern and English medium education facilities, people live in local markets, such as the tehsil headquarters and district headquarters.

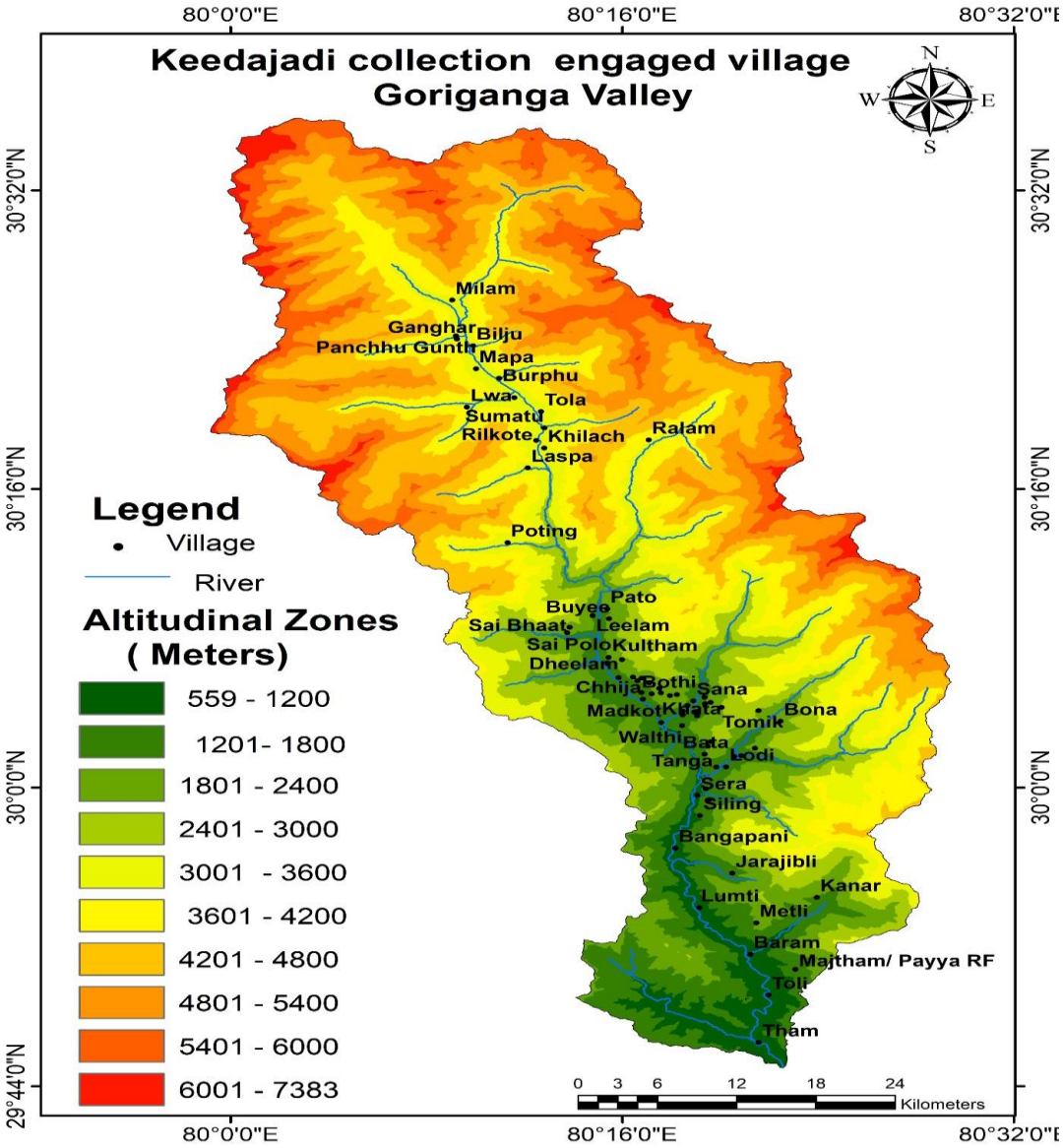

Figure 3. Altitudinal Zone Wise Village Location

Keedajadi collection and Income

In 2022, 3425 people from 1881 families are engaged in *Keedajadi* collection in Goriganga Valley (Table 3). 175.15 kg of *Keedajadi* is collected all over Goriganga Valley. The average per person income from *Keedajadi* collecting and marketing is Rs 56252. At the base of the altitudinal zone, 28 families from 06 villages with altitudes below 1200m have collected 2.9 kg of *keedajadi*by, 44 people, which is the lowest. The distance of Bugyala from the village located at 1200 meters below is more due to which people are less engaged in Keedajadi collection, and the collection is also the lowest. One thousand six hundred sixty people have collected 93.8 kg of pesticides from 1066 families in villages situated in the altitude zone of 1800 -2400 metres, which is the maximum. The

Table .3 Altitudinal zone-wise village and engaged keedajadi collection population

Sl. N.	Altitudinal Zone	Village	Total Family (2022)	No. of family engaged in Keedajadi Collection	Total Population engaged in collection 2022	Total collection in kg	Average Income /Person In INR (11 lakhs kg) 2022
1	Below-1200	06	1664	28	44	2.9	72500
2	1201-1800	26	2037	506	745	39.65	58543
3	1801-2400	23	2023	1066	1660	93.8	62156
4	2401-3000	00	00	00	00	00	00
5	3001-3600	14	253	201	416	18.8	49711
6	Above-3600	01	80	80	260	20	84615
	Total	70	5557	1881	3425	175.15	56252

***Source: Primary data collected during field visit* 2022**

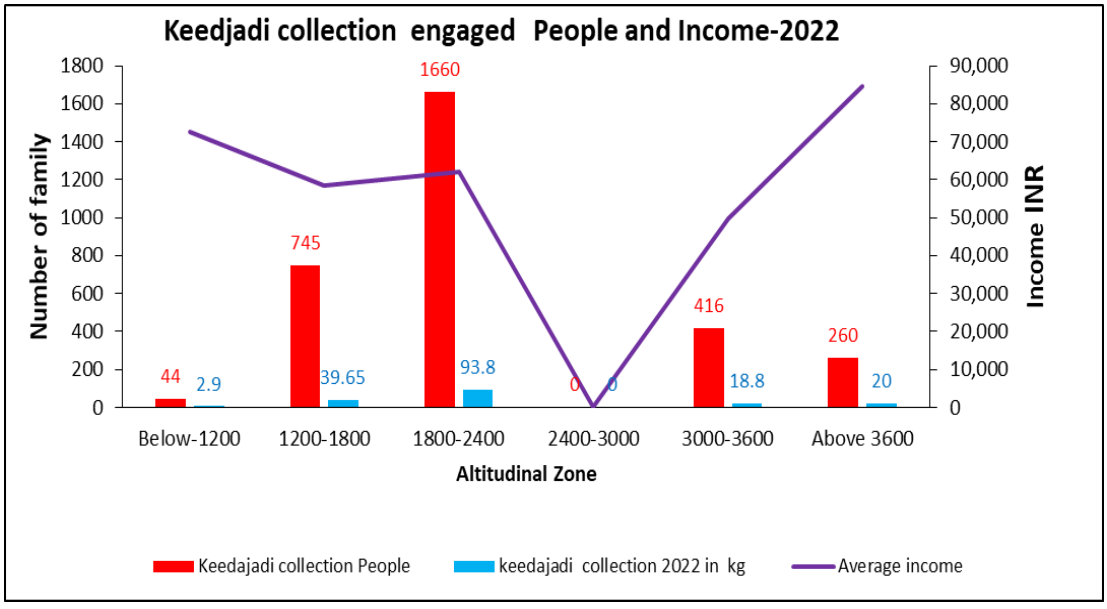

Figure 4. Average Income Per/ Person

maximum number of people in this altitudinal zone are engaged in *keedajadi* collection because the distance between the Bugyal and the village is less. There are 14 summer villages located between elevations 3000 -3600m. The village is situated at an elevation of more than 3600 meters. Ralam is also a summer village which is situated at the highest elevation in Goriganga Valley. The income per person from keedajadi

collection here is INR 84615, the highest (Figure.4).

Income use

The utilization of income generated from keedajadi collection and marketing by people of 70 villages in Goriganga Valley from the year 2001 to 2022 has been shown in Table .4. The income received from Keedajadi has been used to fulfill the needs of his daily life and for his employment business. In the higher education sector, 998(53.06%) families used the highest income. Due to the poor financial condition of students from low-income families, they could not be admitted to higher education. However, with the income from *Keedajai* collection, they easily go out of the village and get higher education.

Table.4 Distribution of earned income for keedajadi (Total family 1881)

Sl. No	Utilization of Money earned from Keedajadi	Total Family	Total No	Total Family In %
1	Taxi	21	21	1.17
2	Personal vehicle	61	61	3.24
3	Shop	57	57	3.03
4	Restaurant	32	32	1.70
5	Higher education	998	1530	53.06
6	Animal Husbandry	139	3118	7.38
7	Home construction in the village	732	742	38.91
8	Home construction out of Village	142	142	7.55

***Source: Primary data collected during field visit* 2022**

742 (38.91%) families are in home construction and home improvement in the village area (Figure 5.), home construction in the market outside of the village 142 (7.55%) families, animal husbandry 139 (7.38%), personal vehicle 61(3.24%) families, shop, and income has been utilized in etc. sector.

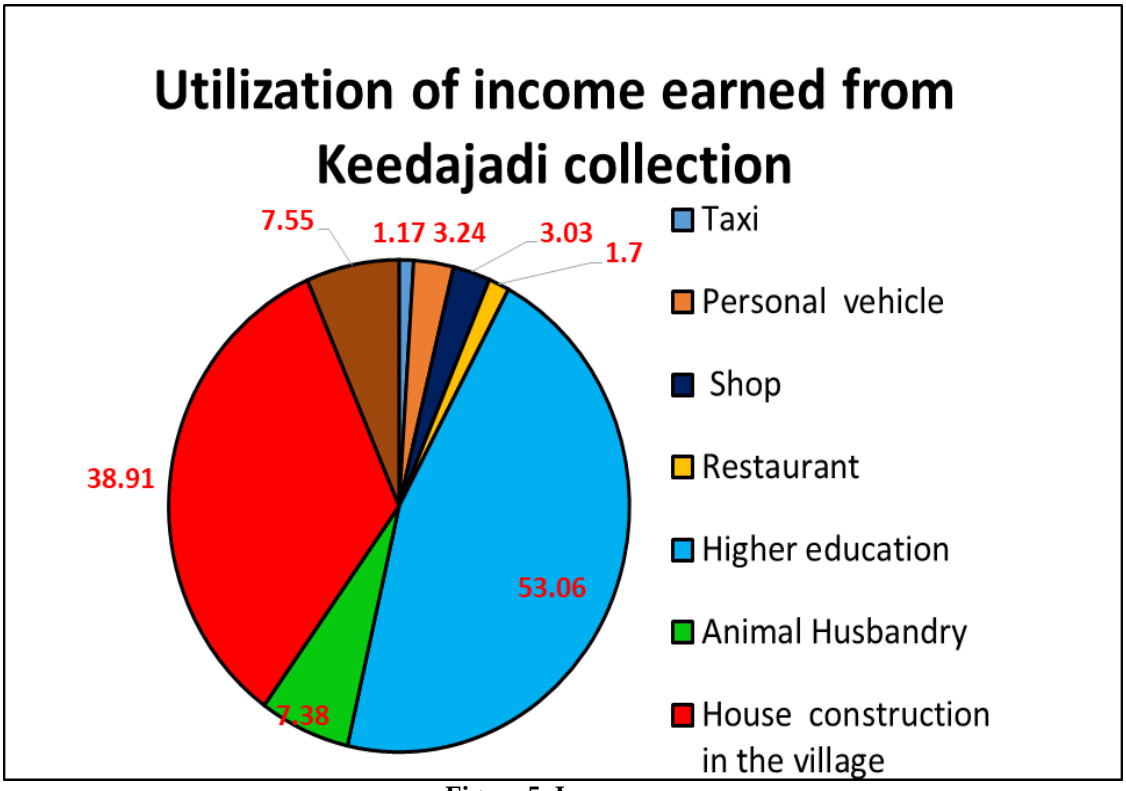

Figure 5. Income use

CONCLUSION

Keedajadi is collected in the alpine meadow areas of 4 countries of world. It plays a vital role in rural livelihood. Keedajadi collection started on a large scale in Goriganga Valley after 2001. After this, Keedajadi emerged as an employment-oriented resource. The people of 70 villages in this valley collect keedajadi in bugyal. After the collection of *keedajadi*, the income received from its marketing is used by most of the families for the education of children, building construction, employment-oriented businesses, and meeting their day-to-day needs.

Declaration by Authors

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REFERENCE

1. Belwal T, Bhatt I D, Kashyap D, Sak K, Tuli HS, Pathak R, Ghatnur S M. *Ophiocordyceps sinensis. Nonvitamin and Nonmineral Nutritional Supplements.2019; 527–537.* doi:10.1016/b978-0-12-812491-8.00069-2 .
2. Byers A C, Byers E, Shrestha M, Thapa Dambar and Sharma Bidhya. Impacts of Yartsa Gunbu Harvesting on Alpine Ecosystems in the Barun Valley, Makalu-Barun National Park, Nepal. HIMALAYA .2020;39(2). Available at: https://digitalcommons.macalester.edu/himalaya/vol39/iss2/8
3. Census of India (2001,2011) census Date2001,2011 office of the Registrar General & Census Commissioner India; Ministry of Home Affairs Government of India http://censusindia.gov.in
4. Caplins L, Halvorson SJ. Collecting Ophicordyceps sinensis:an emerging livelihood strategy in the Garhwal, Indian Himalaya. Journal of Mountain Science.2017;14(2) pp,390-402, DOI:10.10007/s11629-016-3892-8. https://www.researchgate.net/publication/313321558
5. Dai Y, Wu C, Yuan F, Wang Y, Huang L, Chen Z, Zeng W, Wang YZ, Zeng P, Lemetti P, Mo, X Yu,H .Evolutionary biogeography on Ophiocordyceps Sinensis: An indicator of molecular Phylogeny to geochronolo820gical and ecological exchanges. Geoscience Frontiers. 2020;11 :807-820. https://doi.org/10.1016/j.gsf.2019.09.001
6. Das G, Shin H-S., Leyva-Gómez G, Prado-Audelo MLD, Cortes H, Singh YD, Panda MK, Mishra AP, Nigam M, Saklani S, Chaturi PK, Martorell M, Cruz-Martins N, Sharma V, Garg N, Sharma, R and Patra, JK. Cordyceps spp.: A Review on Its Immune-Stimulatory and Other Biological Potentials. Front. Pharmacol. 2021; 11:602364 doi: 10.3389/fphar.2020.602364
7. He J, Smith-Hall C, Zhou W, Zhou W, Wang Y & Fan B. Uncovering caterpillar fungus (ophicordyceps sinensis) consumption pattern and linking them to conservation Intervention. *Conservation science and practise*.2022; 4(8), e12759. https://doi.org/10.1111/ csp2.1275.
8. Karki R, Kandel K, Kunwar A, Bhatta J, Thapa P, Panthi S & Pant P K. Yarsagumba collection and marketing: A key income source of people in Api Nampa conservation area, Darchula, Nepal. *Journal of Agriculture and Natural Resources*. 2020;*3*(1), 219-232. DOI: https://doi.org/10.3126/janr.v3i1.27175.
9. Kuniyal CP, and Sundriyal RC. Conservation salvage of Cordyceps sinensis collection in the Himalayan Mountain is neglected. Ecosystem Services. 2013;3: E40-E43.
10. Li Y, wang X, Jiao L, et al. A survey of the Geographic distribution of Ophiocordyceps sinensis. The Journal of Microbiology.2011;

49(6): pp,913-919. DOI:10.1007/s12275-011-1193-z
11. Negi SV, Rana SK, Giri L, Rawal RS. Caterpillar fungus in the Himalayas, current u standing and future possibilities. G. B. Pant National institute of Himalayan Environment, Kosi- Katarmal, Almora Uttarakhand, India.2020;
12. Olsen CS, Larsen HO. Alpine medicinal plant trade and Himalayan Mountain livelihood strategies. The Geographical Journal .2003;169: 243-254. DOI: 10.1111/1475-4959.00088.
13. Sen Sanjukta, Karati Dipanjan, Priyadarshini Rosy, Dua T K, Paul Paramita, Sahu Ranabir, Nandi, Gouranga. Cordyceps Sinensis (Yarsagumba): Pharmacological properties of a mushroom, Pharmacological Research - Modern Chinese Medicine. 2023;8: 100294 https://doi.org/10.1016/j.prmcm.2023.100294
14. Shrestha UB and Bawa KS. Economic Contribution of Chinese Caterpillar Fungus to the Livelihoods of Mountain Communities in Nepal. *Biological Conservation, 2014; 177*, 194–202. doi: 10.1016/j.biocon.2014.06.019.
15. Sung GH, Nigel LHJ, Sung, JM, Luangsa-ard J, Shrestha B, Spatafora JW.
16. Phylogenetic classification of Cordyceps and the clavicipitaceous fungi. Stud. Mycol.2007;57, 5–59. https://doi.org/10.3114/sim.2007.57.01.
17. Wei Y, Zhang L, Wang J, Wang W, Niyati N, Gou, Y &Wang X. Chinese caterpillar fungus (Ophiocordyceps sinensis) in China: Current distribution, trading, and futures under climate change and overexploitation. Science of the total Environment, 2021; 755,142548.
18. Winkler D., Yartsa gunbu (Cordyceps Sinensis) and the fungal commodification of Tibet rural economy. Econ. Bot. 2008;62(3),291-305. https://doi.org/10.1007/s12231-008-9038-3.
19. Winkler D, Caterpillar Fungus *(Ophicordyceps Sinensis)* Production and sustainability on the Tibetan Plateau and in the Himalayas. Asian Medicine.2009; 5(2): pp.291-316. https://doi.org/10.1163/157342109X56.8829.
20. Yang Z-L,Ophiocordyceps sinensis (amended version of 2020asse2020 assessment IUCN red list of Threatened species2020:e.T58514773A179197748.

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