

CONTRIBUTION OF *OPHIOCORDYCEPS SINENSIS* (BERK.) SUNG ET AL. (YARSA GUMBA) IN THE LIVELIHOOD OF RURAL COMMUNITIES IN KUMAUN HIMALAYA: MANAGEMENT AND CONSERVATION ISSUES

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ABSTRACT

During summer collection of yarsa gumba, a highly priced natural product, is the main occupation of around 81% people of Munsyari Tehsil in Pithoragarh district of Uttarakhand resulting into collection of approximately 88.96 kg material worth ₹ 2.05 crore annually. It has completely changed the socio-economic set up of the region affecting the long-established agricultural and animal husbandry system too. The various issues pertaining to its collection have been discussed in details to suggest measures for the conservation and sustainable management of this valuable resource in the remotest part of the country.

Key words: *Ophiocordyceps sinensis*, Yarsa Gumba, *Cordyceps sinensis*, Conservation, Sustainable management.

Introduction

Yarsa Gumba (*Ophiocordyceps sinensis*) has very high demand and economic value in the international markets. The British mycologist, Berkely, first described it in 1843 as *Sphaeria sinensis* Berk. Later in 1878, Saccardo renamed it as *Cordyceps sinensis*, which was again transferred to the newly recognized family Ophiocordycipitaceae (Ascomycota), and new genus *Ophiocordyceps* as *Ophiocordyceps sinensis* (Berk.) (Sung et al., 2007). Initial records of *Cordyceps* as medicine dates back to Qing Dynasty in China in 1757 (Sharma, 2004). Recent studies have discovered that *Cordyceps* usage increases cellular ATP level and oxygen utilization (Namgyel and Tshitila, 2003; Zhu and James, 2004). Internationally, the health efficacies of *O. sinensis* are observed and tested in asthma, allergic rhinitis, poor renal function, renal injuries by chemicals, chronic bronchitis, cough, poor resistance of respiratory tract, regulating blood pressure, anti-aging, weakness, declining of sex drive, lowering of raised blood lipid levels, strengthening body immunity, poor function of lungs and kidneys and in irregular menstruation (Zhu et al., 1998; Mizuno, 1999; Francia et al., 1999). In India, it is collected from Uttarakhand, Sikkim and Himachal Pradesh. In Kumaun Himalayas, *O. sinensis* is distributed in the alpine meadows of Chiplakedar, Darma Vyas and Ralam Dhura at 3,200-4,000 m. Studies demonstrate that the income generated from its collection and trade has completely changed the socio-economic pattern and traditional practices impacting local ecology and

economy (Sharma, 2004; Negi et al., 2006). Although it is being collected since long time, yet little information is available on the sustainable management and conservation of this species. The present study was therefore undertaken in alpine and subalpine zones in Munsyari Tehsil of Pithoragarh district to assess its collection and marketing as well as social impacts on local communities so as to suggest measures for the *conservation and* sustainable management of this valuable resource.

Material and Methods

The study area is located between 29°21' to 30° 49'N latitude and 79°48' to 81°5'E longitude at an altitudinal range of 3,210 to 4,000 m amsl in Munsyari Tehsil of Pithoragarh district. Eight villages in three collection zones were selected for the detailed study. The distance of these villages from road heads varies from 1 to 70 km. The population details of these villages are mentioned in Table 1. Seventy families (20% households or primary collectors) were selected for detailed study, and divided into three wealth- ranking classes based on size of land holdings (Table 2). Information was collected on the quantity of 'Yarsa Gumba' collected and the money earned by them during 2008 and 2009. In addition to this, small and big traders and commission agents from Munsyari, Madkot and Tanakpur were also interviewed to estimate the quantum of trade and price spread. Rapid Vulnerability Assessment (RVA) was done based on Wild and Mutebi (1996) to make a rapid and extensive estimation. The scoring was done by following

Main occupation of 81% people of Munsyari tehsil in Pithoragarh district is to collect *Ophiocordyceps sinensis* resulting into collection of appr. 88.96 kg material worth Rs. 2.05 crore.

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Table 1: Zone wise details of the villages covered during the study

Collection zone	Collection areas (Villages)	Distance from road (km)	No. of House-holds	Total population	Population and literacy status			
					Male	Literacy %	Female	Literacy %
Chipla kedar	Golfa	43	83	387	189	66	198	53
	Lodi	1	26	129	65	91	64	56
	Sera	35	26	135	68	81	67	52
Panchachuli	Bui	32	56	279	151	85	128	51
	Dheelam	35	30	164	84	82	88	34
	Kultham	33	34	160	82	77	78	34
Ralam	Pato	25	61	245	117	71	128	39
	Ralam	70	27	102	50	88	52	63
Total / Average			343	1609	806	80	803	48

(Source: Agricultural Census, 2005)

Table 2: Wealth ranking class wise details of respondents in the study area

Criteria	Wealth Ranking Classes		
	Poor	Medium	Rich
Size of land holding	Less than 0.5 ha and below poverty line	0.5 to 1 ha.	More than 1 ha
Number and percentage of collectors	45 (64%)	19 (27%)	6 (9%)

Namgyel (2003) methodology. Secondary data were collected from existing records for study sites depending on availability and the review of literature i.e. journal, articles, books and government documents.

Results and Discussion

The details about the quantity of *O. sinensis* collected from 2003-04 to 2008-09 are mentioned in Table 3. It indicated around seven time increase in the quantity of *O. sinensis* collected from 2003-04 to 2007-08, after this, a sharp decline was reported in the quantity of total collection in 2008-09. In 2003-04, Ralam was the only Van Panchayat involved in the collection of Yarsa Gumba, while due to its high economic value, 13 Van Panchayts were involved in its collection in 2008-09 (Uttarakhand Govt., 2008). The analysis of socio-economic status of the collectors indicated that the main collectors were men, women, boys and girls in the age group of 15 to 60 years. The highest participation was from age group of 15 to 40 years and percentage of male was higher than the female. Majority of households belonged to the poor class category. The number of female participants was maximum from the poor class category, while maximum number of male involved in the collection were from the medium land holding class category.

The fungus is usually classified into two grades before sale:

Grade - A: dried and cleaned specimens having golden colour with short aerial part consisted of 2,600 to 3,000 pieces per kg, and

Grade - B: medium quality matured pieces with long aerial part; about 3,000 to 3,500 pieces per kg. The weight of the individual dry specimen generally varied from 0.29 to 0.57 g.

The per kilogram price of 'yarsa gumba' showed a positive trend from 1999 to 2007 (Table 4). After that, it declined a bit in 2008 and again a positive trend was observed in 2009 (Uttarakhand Govt., 2008). Majority of the respondents did not disclose about the actual quantity of produce collected by them probably due to better gains from its illegal trade across Nepal border.

Share of *O. sinensis* collection in household income

The results indicated that the share of *O. sinensis* collection in household income was around 21%. It was slightly lower than what these people earn from government jobs and wool-cottage industry, which had a share of 24% and 37%, respectively in the total income of the households in the region (Table 5). Due to high economic return in a short period, collection of 'yarsa gumba' was the main occupation of around 81% villagers during the summer season. Most of the collectors informed that Munsyari and Madkot were the important local markets and collection points for *trading* of this species. On the basis of interviews with respondents, it was estimated that about 3-5 quintals of *C. sinensis* is illegally traded annually from Dharchula to Nepal and finally to international markets.

The results indicated that a primary collector collects about 45 to 55 specimens in a season. i.e. on an average, approximately 2.24 kg material is collected by a

Table 3: Details of the quantity of *O. sinensis* collected from Munsiyari region from 2003 to 2009

Year	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Quantity (Kg.)	10.00	24.00	62.39	68.60	71.30	8.30
Number of Van	1	4	5	6	13	13
Panchayats involved						

(Source: Uttarakhand Forest Department)

Table 4: Year wise increase in the price of *O. sinensis* from 1999 to 2009

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Rate (R. Lakh/Kg.)	0.01	0.03	0.07	0.24	0.66	1.27	1.75	2.20	2.50	1.82	2.30

family. The maximum quantity of material was collected by the people belonging to the poor class, followed by middle and rich class category, respectively having an average family collection of 12.3kg, 7.6kg and 2.5kg, which respectively had a share of 55%, 34% and 11% in the total collection of 'yarsa gumba' in the region. However, the average per capita collection was the lowest in the poor class category, followed by middle and rich classes, respectively having an average annual collection of 0.27 kg, 0.40 kg and 0.41kg material per collector. The total earnings in a season of 32 days from the collected materials based on the sale rate of 2009 was the lowest for the poor class category, followed by middle class and rich class, respectively earning ` 62,790/collector (` 1,962.20/day), ` 92,000.00 (` 2,875/day) and ` 95,910.00 (` 2,997.20/day). Though the quantity collected by the respondents of poor class category was much higher than the medium and rich class respondents but due to higher number of family members involved in the collection, the average per person quantity was quite low in comparison to other categories, resulting in poor class being least benefited. It was estimated that annually about 88.96 kg materials worth ` 2.05 crore is being collected from the area. The annual collection of 'Keera jari' in the State is around 1,000 Kg worth ` 10 crore. It is mainly from Chamoli, Pithoragarh and Uttarkashi regions of the State (Uttarakhand Govt., 2008). Garbyal (2004) estimated the volume of trade in Dharchula over 500kg annually, of which, half came from Nepal and half from Indian Himalaya. Thus the government is losing a large sum of money as royalty due to its illicit collection.

It was also observed that during the collection season about 47,651 man days were generated by the tea shops, way side restaurants and from the transportation of food materials to the collection sites. Several negative impacts of collection of *O. sinensis* were also noticed in the area such as the long-established agricultural system as well as animal husbandry is declining apart from spoiling social relations amongst the

villages and the villagers because of its prohibited trade and collection.

This species differs from others in that the individual organism produces only a single fruiting body, after that it dies. It propagates through the spores which are spread in a localized manner. The spores are short-lived and must infect the hosts in order to survive. In ecological terms, the concept of sustainable use is normally related when the species collection does not have long term negative effect on the reproduction and regeneration of populations being collected in comparison to equivalent non-collected population (Namgyel, 2003). The young or immature fruiting bodies (thick and golden larvae with short and light brown aerial fungal part) are good in taste; therefore fetch higher prices than the matured ones with long and dark brown fungal part. As the insect is the sole source of food for the fungus, the size of its stroma is dependent on the size of the host caterpillar. This ratio is normally dependant on the timing of the collection in the lifecycle of the fungus. The most important move to secure optimal larva vs. stroma ratio is to collect fungus early in the season or before sporulation and thus the fungus has no chance to disperse spores for future larvae infection. Thus grading of fungus on the basis of aerial part is not appropriate for sustainable management.

Policy initiatives taken by Uttarakhand Government

There are no defined legal protection provisions for 'yarsa gumba' in Wildlife (Protection) Act, 1972, EXIM policy, and in the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Therefore, there is hardly any regulation for collection or trade of *O. sinensis*. Since this species is normally found on the government lands, the State government has issued guidelines for its sustainable collection. According to these guidelines, forest department will allot the area for collection to the van panchayats and nominate the agencies for purchasing of the collected materials. The van panchayats will allow only the local villagers for collection after depositing a fee of Rs. 1,000.00 per

Table 5: Contribution of different sources in total annual income of the households in the study area

Sources of annual income	Contribution in %
Sheep rearing/livestock	4
Agriculture/Herb production	8
Petty business	4
Wool-Cottage industry	37
Government and other jobs	24
Cordiceps collection	21
Tourism	2
TOTAL	100

collector, and after collection they will deposit all the materials with the Head of van panchayat, who shall verify the collected quantity and then inform the buying agencies and the Forest department. The buying agencies after making advance payment @ ` 50,000.00 and ` 40,000.00 per kg, respectively for A - grade and B - grade materials will sell it through open auction. The buying agencies will return the balance amount to Van Panchayats after deducting 10% of sale price, which includes 1% Mandi tax, 4% royalty charges, and 5% as handling charges and profit of buying agencies. The forest department is over all responsible for collection work and issuing transit pass and Export Ravanna to purchasers from auction site to the final destination. However, uncertainty about the agencies of operation, time of auction and sale price to be received have resulted into sharp decline in the quantity of the materials received by the agencies authorized by the government, and encouraging the illegal trade of this

valuable resource.

With the gradual increase in the market value of *O. sinensis*, the dependency of local communities is becoming more prominent on the income generated through its collection, whose livelihoods were earlier based on pastoral and agricultural activities. Collection by womenfolk is playing a significant role in economic empowerment of women. However, a sharp difference in sale rate of government agencies and outside trading agencies along with delay in sale process is encouraging the illegal trade of this valuable resource. The overall vulnerability of *O. sinensis* utilization in Kumaun Himalayas, especially in Munsyari, had a score of 25, indicating the moderate vulnerability. The degree of vulnerability can be lowered if new areas for collection are opened, and grazing and harvesting pressures are reduced. Steward (2009), suggested that community-based natural resource management (CBNRM) would be the most promising strategy to protect the resource. Local communities should also be educated about negative effects of harvesting of immature fruiting bodies. Another reason for its declining population is the lack of sustainable harvesting practices and management of natural propagation. Starting rotational collection practice, opening of new areas for collection, regulation on number of members per household for collection and limiting collection season up to the month of June to facilitate spore dispersal in July can help in increasing the productivity.

कुमाऊँ हिमालय के ग्रामीण समुदायों के जीविकोपार्जन में ओफियोकार्डीसेप्स साइनसिस $\frac{1}{2}$ बर्की $\frac{1}{2}$ सुंग एट अल $\frac{1}{2}$ यार्सा गुम्बा $\frac{1}{2}$ का योगदान तथा संरक्षण समस्याएँ

गिरीश चंद्र पंत तथा आशीष तिवारी

सारांश

उत्तराखण्ड के पिथौरागढ़ जिले की मुक्तिचरी तहसील में करीब 80% लोग गर्मियों में यार्सा गुम्बा, एक मूल्यवान उत्पाद का संग्रह करते हैं और लगभग 88-96 कि०ग्रा० सामग्री एकत्र करते हैं जिससे रू. 2.05 करोड़ की वार्षिक आय होती है। इससे क्षेत्र की सामाजिक आर्थिक व्यवस्था बदल गई है और कृषि तथा पशुपालन के स्थापित मापदण्ड भी बदल रहे हैं। देश के अत्यंत दुर्गम स्थल में इस मूल्यवान संसाधन के सतत् प्रबंधन और संरक्षण के उपायों पर व्यापक सुझाव दिये गये हैं और इसके संग्रह की समस्याओं पर विचार किया गया है।

References

- Francia, C., Rapior, Courtececuise, R. and Siroux, Y. (1999). Current research findings on the effects of selected shrooms on cardiovascular diseases. *International Journal of Medicinal Mushrooms*, 1: 169-172.
- Garbyal, S.S., Aggarwal, K.K. and Babu, C.R. (2004). Impact of *Cordyceps sinensis* in the rural economy of interior villages of Dharchula sub-division of Kumaon Himalayas and its implications in the society. *Indian J. Traditional Knowledge*, 3:182-186.
- Mizuno, T. (1999). Medicinal effects and utilization of Cordyceps (fr.) Link (Ascomycetes) and Isaria Fu. (Mitosporic fungi) Chinese caterpillar fungi, "Tochukaso". *International Journal of Medicinal Mushrooms*, 1(3): 251-261.
- Namgyel, P. and Tshitila (2003). Rare, Endangered, Over-Exploitation and Extinction of Plant Species? Putting Cordyceps – a high value medicinal plant – to Test. CORE – BTFEC Report. Thimphu, Bhutan on the sustainable collection and utilization. RNR-RC Yusipang, Thimphu, Bhutan.
- Namgyel, P. (2003). Household Income, Property Rights and Sustainable Use of NTFP in Subsistence Mountain Economy: The Case of *Cordyceps* and Matsutake in Bhutan Himalayas'. Paper Presented at the Regional CBNRM Workshop, Nov. 2003, 1-23 *unpubl.*

- Negi, C.S., Koranga, P.R. and Ghinga, H.S. (2006). 'Yartsa Gumba (*Cordyceps sinensis*): A call for its sustainable exploitation', *International Journal of Sustainable Development and World Ecology*, 13 (3): 1–8.
- Sharma, S. (2004). Trade of *Cordyceps sinensis* from high altitudes of the Indian Himalaya: Conservation and biotechnological priorities', *Current Science*, 86(12): 1614–19.
- Stewart, M.O. (2009). "The "Himalayan Gold" Rush: Prospectors' Practices and Implications for Management", In: Contemporary Visions in Tibetan Studies [T.B. Dotson *et al.* (eds)]. Proceedings of the First International Seminar of Young Tibetologists, Chicago and Bangkok: Serindia Publications, 1–26.
- Sung, G. H., Hywel-Jones, N.L., Sung, J.M., Luangsa-ard, J.J., Shrestha, B. and Spatafora, J.W. (2007). 'Phylogenetic Classification of *Cordyceps* and the *Clavicipitaceous Fungi*', *Studies in Mycology*, 57: 5–59.
- Uttarakhand Government (2008). Letter No. k 2448/16-45 dated 28.03.2008. 2pp.
- Zhu, J.S., Halpern, G.M. and Jones, K. (1998). The Scientific Rediscovery of an Ancient Chinese herb Medicine: *Cordyceps sinensis*. Part1. *J. Alternative Complementary Medicine*, 4(3): 289-303.
- Zhu, J.S. and James, R. (2004). Presented at the American Physiological Society's (APS) Annual Scientific Conference, Experimental Biology 2003, held April 17-21, 2004, in Washington, D.C.
- Wild, R.G. and Mutebi, J. (1996). Conservation through Community Use of Plant Resources: Establishing Collaborative Management at Bwindi Impenetrable and Mgahinga Gorilla National Parks, Uganda. People and Plants. Working Paper 5. Paris, France. UNESCO. pp 1–45.
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