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Research Article

Yarsagumba collection and marketing: A key income source of people in Api Nampa conservation area, Darchula, Nepal

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ABSTRACT

Yarsagumba the Himalayan gold rush is the major part of the economy of the himalayan people in the Darchula distict. Our study was conducted in Khandeshwori region of the the Darchula district to quantify the contribution of Yarsagumba on the total household income of the harvester and to reveal the problems releated to its harvesting and selling. Income from Yarshagumba accounted upto 68% in this region. Geo-physical problems were observed most during collection along with significant conflicts and lower productivity. Price variation is the major market problem of those Yarshagumba harvesting peoples. Social factors like family size, adult members and educational factors have significant impact in total collection and income. The highest price obtained was Rs.18408.33, average price was Rs.15308.33 and the lowest price was Rs. 10205. Benefit to cost or expenses (BC) ratio found in research area was 5.13. Having sharp eye vision school children were taken for the collection and have to leave school for time. Although the data is emerging on medicinal use and market of Yarshagumba little systematic research has explored village level harvesting practice and socioeconomic impacts, especially in this region of Nepal.

Keywords: Yarshagumba, *Cordyceps sinensis,* fungus, revenue, collection

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INTRODUCTION

Yarshagumba; *Ophiocordyceps sinensis* (syn. *Cordyceps sinensis*) is an entomopathogenic fungi (Hajek & Leger, 1994; Kim et al., 2003) a caterpillar fungus (Winkler, 2008) belonging to the order Hypocreales of the family Clavicipitaceae (Sung et al., 2001). The fungus infects and eventually kills the mummified Lepidopteran larvae (Hajek & Leger, 1994) usually that of the Himalayan Bat Moth, Hepialusarmonicanus (Holliday et al., 2005). In Nepal it is known as Yarshagumba or yarchagumba. It is also known as kirajhar, keedajadi, and keedaghas in Nepali. Its Chinese name is Dongchongxiacao meaning "winter worm summer grass". The caterpillar prone to infection by O. sinensis generally live 15 cm below the surface in the alpine grass and shrub-land on the Tibetan plateau and the Himalayas. Yarshagumba from the northern range of Nepal, Bhutan and also from the northern state of India, apart from northern Yunnan eastern Qinghai, eastern Tibet, western Sichuan, southwestern Gansu provinces (Miller, 2002). It is endemic to Tibetan Plateau and alpine grasslands of China, Nepal, Bhutan and India ranging from 3000 to 5000 m above sea level (Shrestha et al., 2010).

The high value low volume Yarshagumba (*Ophiocordyceps sinensis*) is one of the important medicinal fungi harvested by local communities in mountainous part of Nepal as a treatment for a variety of ailment; as a reputed curative for many diseases, anti-ageing, hypoglycemic, aphrodisiac and also treatment against cancer (Harsahay et al., 2010; Wei et al., 2010). A highly valued medicine used in Traditional Chinese Medicine (TCM) for at least 2,000 years (Shrestha et al., 2010) documented in Tibetan medicine for more than 500 years (Winkler, 2009). Therapeuticall, it is used to strengthen lung and kidneys, increase energy and vitality, stop hemorrhage, and decrease phlegm (Holliday and Cleaver 2008). Nevertheless, the major trade of Yarshagumba occurs with the popular name ''Himalayan Viagra'' for use as an aphrodisiac and tonic (Holliday & Cleaver, 2008; Winkler, 2009).

Yarshagumba is one of the most expensive natural medical resources in the world (Stone, 2008; Shrestha, 2012). In September 2012, the highest price of Yarshagumba in China, the major trade destination was $140,000 per kg, three times more expensive than gold (Xuan, 2012). Although the market price is remarkably high, the Yarshagumba is harvested by the most impoverished communities of the Himalayas and Tibetan plateau. In Nepal, Yarshagumba harvesting became a major source of cash income for indigenous communities after the ban was lifted on harvesting and trade in 2001. Yarshagumba is reported to be collected from at least 25 northern mountainous districts of Nepal (Devkota, 2010). Local media reported that harvesters of Mugu district in Nepal alone sold 400 million Nepalese rupees ($4,700,000) of Yarshagumba in 2012 (Shahi, 2012). In 2014 collector of Darchula sold each piece for an average price of NRs. 332 (Pant et al., 2014). Yarshagumba has generated the highest amount of revenue among 62 species traded in Nepal as non-timber forest products (NTFPs), which shared 41% of the total revenue from NTFPs in 2011 (GoN, 2011). Collection is done from late spring to early summer when snow starts thawing in the alpine and sub-alpine pastures of the mountains (Thapa, 2014). The collection season of Yarshagumba in Nepal generally starts from the second week of May and lasts up to the end of July depending on the local weather, condition of snow in the pasture and elevation of the collection locality (Thapa, 2014). Because of the high market price, the income from Yarshagumba harvesting has improved local food security, provided a much-needed safety net, and generated employment opportunity for the people in this region. In Nepal, the market

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of Yarshagumba is attractive and the economic return is very high due to its price and demand. This motivates local harvester to extract the species as much as possible which has also contributed to over exploitation and population decline of Yarshagumba (Shrestha & Bawa, 2013). Government interventions like, rules and regulation, royalties and taxes increase the expenditure of each Yarshagumba collector. In 2014 Api Nampa Conservation Area (ANCA) collected 8,630,000 NRs. as royalty from 863 kg Yarshagumba (ANCA, 2014).

Exploding market demand and the dramatic price increases are leading to rapid increases in the number of harvesters. In season (June-July) nearby 35000 peoples gathered in the highland pastures of Darchula to collect and earn fungal money each year and there is a widespread concern about the sustainability of the current harvest rates (Cannon et al., 2009; Zhang et al., 2012; Shrestha & Bawa, 2013; Shrestha et al., 2014). The competition for picking Yarshagumba is not surprising. Its possible share in the annual household income from Yarshagumba collection exceeds other traditional income sources, including agriculture and livestock. With only two months of engagement in this activity, they can support a family for an entire year. This suggests that the opportunity costs of participating in Yarshagumba collection is low for harvester, which prompts them to even risk their lives (Winkler, 2009). The research about the contribution of Yarshagumba on harvester household are very done very less with lack of recent data. So, our study was focused on this issue along with the study of various problems faced by harvester in Yarsha harvesting and selling.

The Yarshagumba harvesting contributes to new cultural developments in the mountain regions of Nepal. Because of this, other activities such as farming have become secondary, although most of the Yarshagumba collectors are traditionally farmers (Negi, 2007). During the harvesting season, virtually all socioeconomic activities come to a halt: schools are closed, government offices of these mountainous districts become less functional, and social life is severely affected (Shrestha & Bawa, 2014).

Currently, China is the largest producer of Yarshagumba which meets 95 per cent of the world demand and Nepal is the second largest supplier of this fungus, with official annual production standing at three tonnes out of which Darchula contributes more of this amount after Dolpa which is the largest contributor district (NRB, 2016).

These days thousands of people in mountainous areas of the country rush to pick up Yarshagumba during peak season. In 2014-15, 40,000 people officially joined the caravan to collect Yarshagumba in Darchula alone (ANCA report, 2016). Most natural resources are managed by nearby local communities that create their own rules and regulations (Winkler 2010; Shrestha & Bawa 2014). But there is not enough technical assistance for sustainable use of these non-timber forest products (Wynberg et al., 2015).

METHODOLOGY

Site Selection

This study was carried out in the Darchula district of Mahakali zone of Far western development region of Nepal covering 2322 sq. m. with elevation ranging from 357 to 7123 masl. There are 7 rural municipalities and 2 municipalities. The study of Darchula was

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purposively taken as Darchula is the second largest producer of Yarshagumba after Dolpa ditrict (NRB, 2016). The Khandeshwori area of Api Himal Rural Municipality was taken for study as it lies in Api Nampa Conservation area and most of the locality used to collect yarshagumba (Pant et al., 2017). Yarshagumba harvesting is one of the key income sources for poor mountain communities in Nepal, where the availability of other livelihood opportunities is comparatively low (Shrestha & Bawa, 2014). The Api Nampa Conservation area has an area of 1903 km^2 and lies between Mahakali and Chameliya river where Yarshagumba collection can be done in 4 rural municipalities and our site of survey was Khandeshwori village.

Respondent Selection

The main governing body for the promotion and conservation of Yarshagumba is ANCA. In Darchula district about 4500 households involved in the collection of the Yarshagumba and around 50000 individuals are involved in the harvesting of the Yarshagumba. Sampling frame size was 6.75 and sampling framework was prepared based on the information obtained from key informants, local leaders, secondary sources, information obtained from ANCA and another stakeholder. Individual with an experience of at least 2 yr. in harvesting to trading of Yarshagumba were identified based on ANCA information and were selected. Involvement of contractors in the Yarshagumba transactions were identified by using various sources of information like local inhabitants, local leader and other sources like ANCA.

Sampling Unit

Household surveys were conducted during 17th June – 22th June 2018. The total households of the Khandeshwori were 405 (Source: Api Himal Rural Municipality). Sample size of 60 HH were selected from Khandeshwori VDC on simple random basis as total population and sampling frame size were determined (405/6.75). The sample size was 14.8% of the total households. Generally, a typical sample size of 10 % (Ajayi et al., 2005) is used everywhere, but we used 14.8% sample size to get more-wise, and diversified information. The sample represented the people from entire age category, economic status, education level, ethnicity, gender and other parameters too.

Nature and sources of data

The study was focused on the primary and secondary data which were collected from two sources of data collection i.e. Primary source and Secondary source. The study mainly focused on the primary data collected. And, secondary data from which huge information was obtained opened windows to meet our set objectives.

a. Primary Data

The primary data were collected through face to face interview of HHs. The primary data were the main source of data whereas other methods were applied for value addition. These data obtained were verified and validated by using focus group discussion and key informants survey. Three focus group discussion were carried out with 18-22 participants including all genders, ages and social status. The discussion was of 40 minutes in an average.

b. Secondary Data

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The secondary data were extracted from various publications and reports prepared by different researches, legal documents, organizations like DFO, ANCA, Api himal Village Council etc.

Data collection methods

a. Interview

Primary data were collected through interview with the HH head or member involved in the Yarshagumba harvesting and selling. Information regarding current environment of the Yarsha trade, production and other factors affecting the harvesting, marketing and the pricing of the Yarshagumba were collected through personal interview with the harvesters.

b. Focus Group Discussion

The focus group discussion was carried out on June 23 to validate and verify the data obtained. In FGD participants were the harvesters, inhabitants, businessmen, and representatives of the Api Himal Rural Municipality.

Survey and Survey Design

a. Interview Schedule Design

Interview schedule was prepared to collect the primary information from the selected respondents. Consistency in interview schedule was maintained with the objective of the research. Question sequencing was of the topmost importance in the interview schedule and they were ordered in such a way that the preliminary question will generate the information required to fulfill the preliminary objective and Vice versa.

b. Pre-testing of interview schedule

Once prepared interview schedule was pretested to the 20 individuals living in the adjoining VDC to determine its effectiveness in gathering reliable and valid information and final amelioration in the interview schedule.

Methods and Techniques of Data Analysis

Descriptive analysis was done using MS Excel 2016. As there were more than one outcome variables like BC ratio, contribution in household income, etc. we used multi variate regression analysis was done with R-STAT as regression analysis can be done with sample size more than 30. Pie charts, Likert matrix, frequencies and tables were used to represent the data.

Expenses during harvesting

Mainly the expenses during harvesting of Yarshagumba were done by the harvester on provisional supply to support the number of harvesting member while camping during the entire period of harvesting, the expenses on warm clothes and transportation cost if mules were used, cost of tents, cost of food, postharvest expenses, selling expenses, etc. These factors were focused on determining the total expenses in harvesting.

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Benefit cost ratio

For benefit cost analysis, total expenses while harvesting and total gross return from Yarsha selling were used. So, the B/C ratio was calculated using the following formula:

B/C ratio = Gross Return/Harvesting Expenses

Index Valuing

For index valuing different causes, problems or reasons were ranked from 1 to 5 for each respondents and average for each reason was calculated to analyze.

RESULTS AND DISCUSSION

Api Himal rural municipality is one of the nine local level of Darchula district where Api mountain and most of ANCA has. It takes almost 2 hr. by bus and 7-8 hr. by foot to reach Khandeshwori region which is the entrance for Api Nampa conservation area from southern part. Southern part of rural municipality is Naugadh and Marma rural municipality, eastern is Bajhang district and Marma rural municipality, Northern part is China and Western part is Vyas rural municipality. Majority of the people of this region have few animals and collect Non-Timber Forest Products (NTFPs) for their own consumption and sale. Over the years, more and more men have left the villages to work as wage laborers either in the urban centers of Nepal or abroad. Women are solely responsible for the cultivation of crops, the management of household activities, and the care of family members including children. Given this situation, it is not surprising that the discovery of Yarsagumba in high alpine areas is considered a lucrative income source by these people. Consequently, over the last few years, most of the men who migrate for employment opportunities return home during the Yarsagumba collection season while the whole family often accompanies them to the Yarsagumba collection sites during that time. Due to the overall deprivation and limited sources of income, these households are ready to take any risks to collect Yarsagumba.

Socio-economic characteristics of respondents

The table shows the total number of respondents were 60. The majority (61.7%) of respondents were male (although the number of females harvesting has increased in recent years). The mean age of the respondent was 33 years and the mean family size of the respondent was 6.7. Majority of the respondents were going to school or graduated from college and universities (71.7), while illiterate (11.7%) and literate (16.7) were found less. The mean harvesting experience of the respondent was 10 years and the mean time spent by the respondent for harvesting Yarshagumba during the season was 29 days. Average Yarshagumba collected per family was found 163 pieces which is comparable with previous study; average collection of yarshagumba is dropping from 475 pieces in 2010 to 186 pieces in 2014 (Pant et al., 2014). This could be due to degradation of Yarshagumba sites, over exploitation of NTFPs, increasing numbers of harvesters, etc.

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Table 2: Demographic characteristics of respondent

Demographic characteristics	Number
Total respondent	60
Male	37 (61.7%)
Female	23 (38.3%)
Age (years)	33.35 (±13.167)
Mean Family size	6.73
Academic Qualification	
Illiterate	7
Literate	10
Numbers of School/University going respondents	43
Mean Harvesting experience (years)	10.15
Mean time spent during harvesting (days)	29.45
Average Yarsha collected per family	163

Financial analysis of Yarshagumba harvester

In general B/C ratio for Yarshagumba harvesting found 5.13. The average expenses for an individual in harvesting Yarshagumba for 29 days was found to be Rs.5026.73. Per kg transport cost by mule was NRs. 5 and average total transportation cost was NRs. 2125. Average total expenses in food and others like tent was NRs. 10986.54 and NRs. 2555.13 respectively. NRs. 20000 per kg was mandatory royalty amount which was collected by Api Nampa Conservation Area (ANCA).

Table 3: Financial analysis of Yarshagumba harvester

Particulars	Amount (NRs.)	B/C ratio
Average total expenses in Yarshagumba harvesting	35666.67	5.13
Royalty	20000	
Expenses in transportation by mule	2125	
Average expenses in food	10186.54	
Average expenses in other items (tent, spade, etc.)	2255.13	
Postharvest expenses	434.37	
Selling expenses	665.63	
Average income by Yarshagumba	182975	
Average expense per person	5026.73	

Price fluctuation

The fluctuation is present in the price of Yarshagumba fetched by the harvester. The highest price obtained was Rs.18408.33 per 50g, average price was Rs.15308.33 per 50g and the lowest price was Rs. 10205 per 50g which is equivalent to NRs. 200,000 to 400,000 per kg which is similar to the price received by the harvester in Myagdi district who receives NRs 50 to 80 per piece which is equivalent to NRs 300,000 to 500,000 and quite lower as compared

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to the price received by the people of Rukum district who receives NRs 100 to 180 per piece which is equivalent to NRs 500,000 to 800,000 (Thapa et al., 2014).

Table 4: The mean highest, average and lowest price of Yarshagumba fetched by harvester

Highest price (Rs. Per 50g)	Average price (Rs. Per 50g)	Lowest price (Rs. Per 50g)
18408.33333	15308.33333	10205

Contribution of Yarshagumba in total household income

Using descriptive statistics, the result revealed that 68% of annual household income was shared by Yarsha income which is similar statistically to 65% found in western Nepal (Shrestha et al., 2017) and the remaining 32% of it was shared by other sources. This is comparable with the findings of other studies; Yarshagumba was found to contribute 53.3% of total household income in rural households of Dolpa district, Nepal (Shrestha & Bawa, 2014a) up to 72.2% in China (Woodhouse et al., 2014), up to 98% in India (Kuniyal & Sundriyal, 2013), and up to 100% in Bhutan (Wangchuk et al., 2012). Major reasons of differences in reported values may be attributable due to several factors, such as market price, methods used in monetization of the household income, sources of income of the local harvesters, and number of yarsagumba pieces collected by harvesters. Share of Non-agricultural income like services, business and trade was found similar to the overall share of 13% in the district (Population Census, 2001). The agricultural activities like yarshagumba collection, vegetable farming and animal production contributes around 87% of the income and ratio of non-agricultural to agricultural economy is around 0.15 which is similar to governmental records (National Population Census, 2001).

Among the surveyed households it was the highest contributor (64.5%) to the total household cash income, and has become an integral part of local livelihoods for savings for future use which is followed by food and clothes, and children's education, thus entirely helping to reduce poverty (Belcher, 2015).

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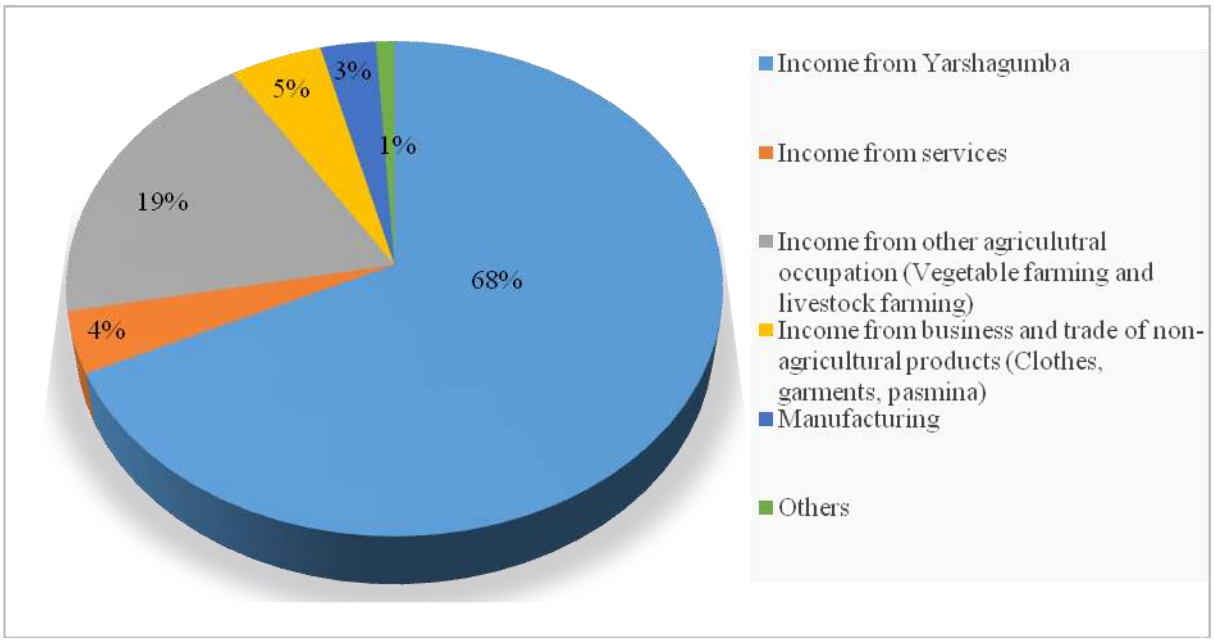

Fig 2: Share of Yarshagumba in total household income

Problems faced during harvesting

The findings reveal that major 5 problems faced by harvesters during the harvesting of Yarshagumba were geo-physical, insufficient labour, low productivity, conflict and insect pests. Insufficient labour becomes one of the major problems during harvesting because most of the labour are family labour and those families with few family members are not getting much Yarshagumba from collection. Reasons for the low productivity of Yarshagumba might be unfavourable environment for caterpillar growth, climate change, etc. The highest ranked problem was geophysical problems with index value 1.967, followed by insufficient labour with index value 1.767. The least ranked problem was insect pests with index value 1.158. The other problems faced by the harvesters during harvesting were open defecation and unavailability of medical facilities.

Table 5: Likert's matrix for the ranking of the problems faced by harvesters during harvesting

S.N.	Problems	Index	Ranking
1	Geophysical	1.967	I
2	Insufficient labour	1.767	II
3	Low productivity	1.683	III
4	Conflict	1.167	IV
5	Insect-pest	1.158	V

Problems faced during marketing

The findings reveal that major 5 problems faced by the harvester during the selling of the Yarshagumba were price variation, low price, less awareness to consumers, problems created by middlemen and insufficient storage. Most of the harvesters of the ANCA region are poor and pro-poor. This is the reason why low price of Yarshagumba is still contributing 68% to the family income. The problem with utmost importance was price variation with index value

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1.90 followed by low price with index value 1.78, the problem gaining least problem among them was insufficient storage with index value 1.45.

Table 6: Likert's matrix for ranking the problems faced during selling of Yarshagumba

S.N.	Problems faced during selling	Index	Ranking
1	Price variation	1.90	I
2	Low price	1.78	II
3	Less awareness of market price	1.75	III
4	Problems created by middlemen	1.63	IV
5	Insufficient storage	1.45	V

Factors determining total Household income

Table above provides the results of multi linear regression model to determine the most critical factors that affect the annual household income of the YARSHA harvesting household. Regression analysis of dependent variable annual household income was carried out on 20 independent variables. Family size, expenditure during harvesting, income from yarsha, method of curing (flame/fire), etc. contributed positively to the total income of the household while profit decline, female headed household lower price fire and sun curing methods, etc. contributed positively to the total expenditure of the household (Shrestha et al, 2017).

Table 7. Factors determining total HH income of Yarsha harvesters

Total HH	Coefficient
Family size	13498.67*
Total expenses during harvesting	3.8
Income from YARSHA	0.93***
Average price of YARSHA	6.88
Method of curing (Flame/Fire curing)	110925.25
Method of curing (Fire and sun curing)	-7324.19
Harvester satisfaction	-215056.4
Dissatisfied harvester	-108545.68**
Lower price	-15241.16
Lower productivity	43708.72
Weak coordination	-125024.18**
Easy and quick selling	3999.6
Profit decline	-4773.83
Geophysical problems	-321539.37**
Price variation	42976.6
Female headed HH	-61697.4
Harvester age	-1176.70*
Education level	268727.13***
Years of experience on harvesting	10973.35**
Time of collection	-3040.47
Constant	19910.99

****sig@1%;**sig@5%;sig@10%* *(Field survey, 2018)*

Social factors

Different social factors like family size, average income and price, coordination, productivity and price, etc., are taken as the determinants of household income from Yarshagumba.

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Higher the number of members in a family; higher is the annual income for the household. If the harvester is a year aged, family income decreases by Rs 1176.50. Young harvesters are thought to pick more YARSHA than the aged one. This was also supported by the research done by Winkler in 2008 A.D which state that children are astute gatherers of *Cordyceps* because of their sharp eyes and proximity to the ground (Winkler, 2008). If the level of education increases by a level, the annual household income increases by Rs 268727.13.

Economic factor

The result of regression analysis revealed that income from Yarsha is highly significant with positive effect at 1% level. Other business factors like average price of Yarsha, lowest price and price variation do not have significant effect on the total household income.

Behavior factor

The factors like Years of experience of harvesting Yarsha, weak co-ordination with the market actors, dissatisfaction level of the harvesters was significant at 5% level. Whereas satisfaction of the harvester was found non-significant. If the year of experience in harvesting of Yarsha increases by a unit, annual income of the household increases by Rs.10973.35. Similarly, weaker the co-ordination between the harvester and market actors lower will be the total household income. Those harvesters who are dissatisfied from the Yarsha picking have do have Rs. 108545.68 less annual household income as compared to the satisfied one.

Physical factors

Among physical factor only the geophysical problem while harvesting do have significant effect on the total household income while the easy and quick selling of Yarsha was found to be non-significant on the total household income of the harvester. In the year of difficult geophysical situation, the average annual income of the household decreases by Rs.321539.37.

CONCLUSION

It can be concluded that the Yarshagumba is the backbone of the economy of Darchula district as the income from Yarshagumba dominates the total income of household i.e. 68% on an average. Yarshagumba is Himalayan gold for this region as the BC ratio found was 11.67. Small school going children were used to took in Yarshagumba collection because of their sharp eyes to catch out fungus and larvae quickly. Government interventions, improper implementation of rules and regulation, huge royalties, unfavourable weather and climate, conflicts, improper pricing system, inadequate awareness about market and prices etc., were major problems of the ANCA yarshagumba collection. Considering this situation, the national government may need to interfere in order to manage the conflict, to clarify rights, roles and responsibilities as well as to build institutions that are able to resolve future disputes. So far, the Government of Nepal has not found a definitive way to deal with the increasing conflicts in an integrative manner, neither at the national level nor at the local level. At the local level in ANCA, efforts were made to elaborate and implement local Yarsagumba management guidelines. Proper regulation of the pricing of Yarshagumba,

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abundance awareness about the conservation and sustainable harvesting method among harvester are important for the harvester as well as royalty takers.

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Authors contribution
K.K. had his major contribution in proposal and report writing. A.K., J.B., P.T., and S.P. had helped well during survey.

Conflict of interest
The authors declare that there is no conflict of interest regarding publication of this manuscript.

REFERENCES

Adhikari, M. K. (2000). Mushrooms of Nepal. P.U. Printers, Kathmandu, Nepal Negi, C.S. 2007. Changing face of polyculture in theDarmaand Johaar valleys, Pithoragarh, Kumaun Himalayas. *International Journal of Sustainable Development and World Ecology*, *14*(4), 428-436.

Adhikari, M. K. (2008). The diversity of *Ophiocordyceps* fungi (Ascomycota;Clacivicipitales) reported from Nepal. *Department of Plant Resource Bulletin,30*,1- 9.

Ajayi, O.O., Catherine, E.S., Carlson, B., & Farid, S. (2005). Designing Household Survey Samples: Practical Guidelines. *United Nations. Series F No.98*

ANCA. (2014). A Short Progress Report on Api-Nampa Conservation Area. Darchula: Department of National Parks and Wildlife Conservation, Ministry of Forests and Soil Conservation, Kathmandu, Nepal.

ANSAB. (2003). Non-timber Forest Products in Nepal National policy workshop. Asia Network for Sustainable Agriculture and Bioresources (ANSAB), New Baneshwor, Kathmandu,Nepal.

Bista, S., & Webb, E. (2006). Collection and marketing of non-timber forest products in the far western hills of Nepal.

CBS. (2011). Preliminary results of 2011 population census. Kathmandu, Nepal: *Central Bureau of Statistics* (in Nepali).

Chakraborty, S., Chowdhury, S., & Nandi, G. (2014). Review on Yarsagumba (*Ophiocordyceps sinensis*) - An exotic medicinal mushroom. *International Journal of Pharmacognosy and Phytochemical Research*, *6*(2),339-346.

Chhetri, R. (2015). Yarsagumba Policy, Market, Trade and Management in Nepal. Regional Workshop on Tracking options for sustainable management and trade on Yarsagumba (*Ophiocordyceps sinensis*) in the Kailash Landscape, Paro, Bhutan.

Journal of Agriculture and Natural Resources (2020) 3(1): 219-232
ISSN: 2661-6270 (Print), ISSN: 2661-6289 (Online)
DOI: https://doi.org/10.3126/janr.v3i1.27175

Chhetri, R., & Gotame, B. (2010). Employment generation and economic up scaling from collection and trade of Yarsagumba (*Ophiocordyceps sinensis*) (Berk.) in Nepal. *Proceeding: Forest- People Interaction.* Pokhara, Nepal, UMB/ NUFU Project, Institute of Forestry, Pokhara, Nepal, pp. 13–19.

Chhetri, R., & Lodhiyal L.S. (2008). Collection of Cordyceps sinensis (Berk.) Sacc. (Yarsagumba) and its implications in rural livelihood and biodiversity conservation: a case of Darchula district, Nepal. In: P.K. Jha, S. B. Karmacharya, M.K.Chhetri, C.B. Thapa and B.B. Shrestha (eds) Medicinal Plants in Nepal: *An Anthology of Contemporary Research. Ecological Society*, Kathmandu, Nepal, pp. 214–223.

Devkota, S., & Shrestha, A. (2007). Ecology, regeneration pattern and collection techniques of Yarsagumba. Central department of botany, Tribhuvan University, Kathmandu, Nepal.

Krishi Dairy. (2016). Agriculture Information and Communication Centre, Hariharbhawan, Lalitpur, Nepal.

Maraseni, T.N., Shivakoti, G.P., Cockfield, G., & Apan, A. (2006). Nepalese non-timber forest products: an analysis of the equitability of profit distribution across a supply chain to India.

Nepal Rastra Bank, (2016). NRB report 2016 A.D. Singhadurbar, Kathmandu, Nepal

Nielsen, E.S., Robinson, G. S., & Wagner, D.L. (2000). Ghost moths of the world: A global inventory and bibliography of the Exoporia (Mnesarchaeoidea and Hepialoidea) (Lepidoptera). *Journal of Natural History, 34* (6), 823-878.

Olsen, C.S., & Larsen, H. O. (2003). Alpine medicinal plant trade and Himalayan mountain livelihood strategies. *Geographical Journal*, *169*(3), 243 -254.

Pandit, B. H. (2008). Economics of non-timber forest production promotion and marketing: a case study from Malekhu khola Watershed of Dhading district, Nepal.

Pandit, B.H., & Thapa, G.B. (2004). Poverty and resource degradation under different common forest resource management systems in the mountains of Nepal.

Shrestha, B. (2010c). Yarsagumba (*Ophiocordyceps sinensis*): *A national pride of Nepal. SONSIK Souvenir, 2*(1), 7- 10.

Shrestha, B. (2011). Yarsa gumba (*Ophiocordyceps sinensis*): Its importance, current situation and future policies. *SONSIK Journal,* 3, 6-11

Shrestha, U. B. (2012). Asian medicine: a fungus in decline. *Nature, 482*, 35.

Shrestha, U. B and Bawa, K. S (2013). Trade, Harvest and Conservation of Caterpillar Fungus (Ophiocordyceps sinensis). *Biological Conservation*, *159*, 514–520. doi:10.1016/j.biocon.2012.10.032.

Shrestha, U. B. and Bawa, K. S. (2014). Economic Contribution of Chinese Caterpillar Fungus to the Livelihoods of Mountain Communities in Nepal. *Biological Conservation, 177*, 194–202. doi:10.1016/j.biocon.2014.06.019.

Shrestha, U.B., Dhital, K.R., & Gautam, A.P. (2017). Economic dependence of mountain communities on Chinese caterpillar fungus *Ophiocordyceps sinensis* (yarsagumba): a case from western Nepal

Thapa, B.B., Panthi, S., Rai R.K., Shrestha, U.B., Aryal, A., Shrestha, S., & Shrestha, B. (2014). An assessment of Yarshagumba (*Ophiocordyceps sinensis*) collection in Dhorpatan hunting reserve, Nepal. *Journal of Mountain Science, 11*, 555–562

Winkler, D. (2008). Yartsa Gunbu (*Cordyceps sinensis*) and the fungal commodification of the rural economy in Tibet AR. *Economic Botany*, *62* (3), 291–305.

ISSN: 2661-6270 (Print), ISSN: 2661-6289 (Online)
DOI: https://doi.org/10.3126/janr.v3i1.27175

Winkler, D. (2010). Caterpillar fungus production and sustainability on the Tibetan Plateau and in the Himalayas. *Chinese Journal of Grassland, 32,* 96-108

Zang, M., & Kinjo, N. (1998). Notes on the Alpine Cordyceps of China and nearby nations. *Mycotaxon, 66*, 215-229.4

Zhu, J. S., Halpern, G. M., & Jones, K. (1998). The scientific rediscovery of an ancient Chinese herbal medicine: *Ophiocordyceps sinensis* Part 1. *Journal of Alternative and Complementary Medicine*, *4*, 289 -303.