Collection of *Cordyceps sinensis* (Berk.) Sacc. in the Interior Villages of Chamoli District in Garhwal Himalaya (Uttarakhand) and its Social Impacts

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Abstract: *Cordyceps sinensis*, belonging to the family Clavicipitaceae is a parasitic fungus on Lepidopteran larvae. Mainly it is found in subalpine regions from 3200 to 4000 m asl in grassy lands of Himalayas. It is very much valuable in Chinese and Tibetan medicine also. The residents of *Sutol* and *Kanol* villages (the most interior villages of Chamoli distt.) in Uttarakhand are extracting it. Every year the average collection of *Cordyceps* is about 140 kg from both villages. Near about 700 people were engaged in the collection of *Cordyceps* every year. Per head collection of *C. sinensis* was 200 gm per season. The collection period of this species is from May to July and the potential natural pockets are Bedini Bughyal, Homekund and Simbe. It is also track of famous religious "*Nanda Devi Raj Jat'' Yatra.* Basically the main collectors are men, women, young boys and girls which belong to the age group of 15 to 65 years. There is a drastic change in the economy of villagers and at the other hand some negative social impacts are also pertaining day by day in the last 3-4 years. [Journal of American Science 2010;6(6):5-9]. (ISSN: 1545-1003)..

Keywords: *Cordyceps sinensis*, medicinal value, *keera ghaas*, interior villages, social impacts on rural economy, drastic change

Introduction

Fungi having medicinal properties have been used as nutritional supplements for over 2000 years. Industries have strong interest in novel compounds, extracted from mycelium or fruiting body of fungi (Negi et al, 2006). In 1994, fungi represented a US$3.6 billion industry (Chang, 1996). Garhwal Himalayas are the main sources of the medicinal plants especially the upper region of the Himalays are the reservoir of the medicinal plants. *C. sinensis* is one of the main and highly valuable grasses like mushroom of this region. There are more than 310 species of *Cordyceps* but Webster 1980 and Sarbhoy, 1983 had reported that 150 species of *Cordyceps* are known. Out of these, three species have medicinal value and among them, *Cordyceps sinensis* is one of the highly valuable species of the world (Kobayasi, 1982).

About 1500 years ago in the Tibetan mountain pasture, herdsman observed that while grazing their cattle stumbled upon energetic, natural miracle plant (Zhu et. al.1998). They saw that their cattle and livestock became energetic after consuming a grass like mushroom and even older became vigorous. This miracle plant is known as *Yarsa gumba* or the caterpillar mushrooms in local Tibetan language and is a famous Chinese-Tibetan medicine. *Cordyceps sinensis* (Berk.) Sacc. belonging to family clavicipitaceae, is a mummified insect found is a result of fungal infection on Lepidopteran larvae. It is commonly known as Cordyceps, plantworm or caterpillar fungus. It is valued very highly in Tibetan and Chinese medicine and known as Yar- rsta- dgun- bu (Tibetan), Dong Chong Xia Cao – Chinese (Garbyal et. al, 2004).

1.1 Distribution

It is found in high mountains at an altitude above 4,000 m was noticed and reported in the year 2000. It is found in the alpine and subalpine zones between 3,600 – 4,200 meters above sea level. It is found in Nepal Himalaya, Tibet, Bhutan, Sikkim, Sichun, Qunghai, Xizang and Yunnan provinces of China. In India it is mainly found in the higher altitudes of Arunanchal Pradesh in the alpine medaws of Chiplakedar, Darma Vyas and Ralamdhura in Kumaun Himalaya where it is refered as "*Keera ghaas*" (insect herb) (Negi et al, 2006). Presently it is found in Chiplakot, Ultapara, Brahmkot, Najari and Nangnidhura – Munshyari region of district Pithoragarh. In some parts of Garhwal Himalaya, it is found in Niti and Mana valleys of Chamoli district and known as " *Keera jadi*".

General Features

Keera ghaas is a parasitic lepidopteran larva and these pyrenomyceptes belong to order Sphaeruales. It is found during May – June. They grow on caterpillars and pupae buried in soil of meadows. The caterpillar exploited in the Kumaun and Garhwal Himalaya has not been positively identified. However, caterpillars of *Hepialus oblifurcus* (Hepialidae) are known to be host of *C.sinensis* (Arora and Dhaliwal, 1997). The root has worm- like head, body and legs with numerous thin and fine transverse wrinkles. There are about eight pairs of legs on the body of the root and out of them four middle pairs are more prominent. Its lower part is thin while the upper part is slightly thicker. From the collar of this solitary root grows a dark brown grassy stalk which is thickened at the middle with slightly pointed tip and slender base. The larvae of *C.sinensis* get infected by the fungus at the end of autumn season. It infects the entire body and covers the whole larvae and kills it. The corpse of the insect enlarges and becomes resistant to decay due to a toxin, cordycepin, produced by the fungus (Dube 1983; Nair and Balakrishnan 1995). It remains buried under the ground during winter. It emerges in May on ground level (Garbyal et al, 2004). Its main associate species is *Rhododendron anthopogon* (*Sunpati*), it is one of the main indicators of *Cordyceps'* habitat. Sometimes the sign and pellet of musk deer, blue sheep, dung of yak etc. were observed (Aryal et. al ,2006). It is known as "*Keera jhar*" (insect herb) in the Indian mountains (Sharma, 2004).

Figure 1. *Cordyceps sinensis* in Dry Condition

Medicinal properties

Chinese practitioners of traditional medicine consider that *C.*sinensis is somewhat sweet in taste and warm in nature. Cordycepin, a boiactive metabolic contained in the fruit bodies of these fungi, also exhibits various biological activities (Trigg et al. 1971; Sugar and Mccaffery 1998; Zhou et al. 2002; Li et al. 2003; Yun et al. 2003). *C.sinensis* is effective against bacteria that have developed resistance to other antibiotics. It is also effective in respiratory infections, leprosy and leukemia. It inhibits active enzymes known as monoamine oxidase responsible for ageing. In Tibetan medicine system it is used to increase vitality and in restoring regenerative fluids – especially the fertility of sperms and kidney heat.

Materials and Methods

Study area

Chamoli district lies in the northeastern part of Uttarakhand state. It is bounded by North Latitude 29º 55' 00" & 31º 03' 45" and East Longitude 79º 02' 39" & 80º 03' 29" and falls in Survey of India toposheet nos. 53O, M and N. The geographical area of the district is 7820 km^2. Chamoli, the second largest district of Uttarakhand, is also important from strategic point of view as it shares its northern boundary with Tibet (China). Entire area is mountainous with agrarian economy. Forest cover (58.38%) is the main landuse. The total population, of the district, is 3, 70,359 out of the male and female population are 1, 83,745 and 1, 86,614, respectively (Census, 2001). The population density is 42 persons/km^2 and the male, female sex ratio is 1000:1017.The overall literacy rate is 76.23%.

Agriculture is the main occupation of the people. The agricultural activities are restricted to river terraces, gentle hill slopes and inter mountain valleys. The major crops are rice, wheat, potato, pulses, millets and seasonal vegetables. The net sown area, in the district, is 517.14 sq. km. out of which 173.37 sq. km. is sown more than once in a year. *Kanol and Sutol* are the last and interior villages of Ghat block. The average distance from Ghat is about 30 km. The nearest market of the villagers is Sital and Ghat. The economy of the both villages is based on traditional agriculture and animal husbandry. The total population of *Sutol* and *Kanol villages are* 650 and 900 respectively. There are 275 households in both the villages. *Sutol* and *Kanol* villages are situated on famous tourist track Lord Karjan's track. The biodiversity of this area is very rich. Mainly mixed forest and alpine meadows are present there. The main tree species are *Quercus semicarpipholia, Rhododendron arboreum, Taxus baccata, Cedrus deodara, Hippophae rhamnoides, Abies pindraw, Picea smithiana, Lyonia ovalifolia* etc.

Methods

Data collection and analysis

A random house hold sampling carried out for the records of information about the Yarsa gumba in interior village of Chamoli district. A questionnaire was used for

the information about different parameters of *Keera jhar*. A complete inventory was made about following objectives.

- To know the socio-economic impacts and future prospects of *Keera ghaas.*
- To know about natural collection pockets and states of *Keera ghaas* in study areas.
- To know the Govt. policies about collection of *Keera ghaas.*

Collection of *Cordyceps sinensis* in *Kanol* and *Sutol* villages

Kanol and *Sutol* are the last inhabited and most interior villages of Ghat block in Chamoli district. Basically the economy of the villages is traditional crop based. Potato, *Rajma, Ramdana* etc. are the main crops of the villages. Potato (*Solanum tuberosum*) and Rajma (*Phaseolus vulgaris*) are the cash crops of the farmers but not in wide scale because both villages are far from road head. Both the villages are situated at the average distance of 30 km. from road head. From last five to six years there are drastic changes in the economy of villagers due to collection of *Keera ghaas.* It fetches Rs. 60,000 to Rs. 80,000 per Kilogram in Pithoragarh, passes through Nepal and finally reaches markets in China to be sold at Rs. 1, 00,000 per kg. In 2001, it is believed 4-5 quintals of Yar Tsa Gumba found its way into Nepal from the border township of Dharchula alone (Taklakot in Tibet happens to be its largest market). Every year the average collection of *Keera ghaas* is near about 140 kg from both villages. Near about 700 people were engaged in the collection of *Keera ghaas* every year. Per head collection of *Keera ghaas* was 200 gm per season. The collection period of this species is May to July and the potential natural pockets are *Bedini Bughyal, Homekund* and *Simbe.* It is also found in the track of famous religious "*Nanda Devi Raj Jat Yatra*". Basically the main collectors are men, women, young boys and girls which belong to the age category of 15 to 65 years. The buyers come from Dharchula (mainly *Khampas* - schedule tribes) and Nepal but recently some educated localites and shopkeepers from adjacent areas are working as agents of big buyers. They are earning a good amount from these buyers. The average income of these agents is 50,000 rupees/kg. Based on the above data we can say they are the real beneficiary, because apart from this they are involving other works also. According to localites the average rate of *Keera ghaas* is Rs. 2, 50000 to 3, 00000 lakh.

Figure 2. Information Collection by a Researcher in the Study Area

Results and Discussion

Social Impacts

There are some drastic changes and impacts of *Keera ghaas* in the rural economy of *Sutol* and *Kanol* village. From last three to four years the villagers are quieting or decreasing their traditional crops and they are also not interested in Goat and Sheep rearing while this is the main traditional occupation of these areas. The seasonal migration of the villagers is also decreasing because the collection of *Keera ghaas*. Now they are moving or making the concrete houses instead of traditional stone and wood houses from the earning of *Keera ghaas.* Another positive change which is reflecting in field of education, in the past education of girls was not proper and the dropout rate of girls in compare to boys was too high from schools. Now the trend is changing day by day. The young boys and girls are going for education in adjacent towns and cities e.g. Ghat, Gopeshwar, Dehradun and Rishikesh etc. The drudgery system of local women is also decreasing day by day because collection of *Keera ghaas.* There are some of the negative impacts also. The traditional agricultural system as well as animal husbandry is also decreasing. Social relations between villagers and villages are spoiling because of its illegal trade and collection. There are some restrictions in adjacent villages for the collection of *C. sinensis*. For example there is great anxiety in *Sutol* and *Kanol* villages due to illegal extraction of *Keera ghaas* from nature.

Government Polices about *Cordyceps sinensis*

For ensuring the conservation of species in the wild, Uttarakhand Government issued guidelines for proper and

sustainable collection of *Keera ghaas in Uttarakhand*. The following guidelines are as follows.

- Collection season – May to July
- Issuing authority for the collection of *Keera ghaas- Van Panchyat/ Gram Panchyat.*
- *Van Panchyat* will issued collection authority to local villagers only and the local villagers will pay Rs. 1000 per head to *Van Panchyat*.
- Collector will deposit their collection to *Van Panchyat Sarpanch* then *Sarpanch* will verify the amount and approach to approved buying agencies through the forest department.
- The authorized buying agencies will pay Rs. 5000 per kg to the forest department as a royalty and the Govt. rate of *Keera ghaas* is Rs. 50,000 per kg. The Forest department will be responsible for issuing "*Ravanna*" or transition pass to buying agency.

Conclusion and Future Prospects

Keera ghaas or *Cordyceps sinensis* is unique and valuable for its medicinal properties, while it is not extracted sustainable in planed way in the study areas. There is a wide price gap in forest department and outside funding agencies, so it is supplied illegally. The social relations and customs are also affecting for the collection of *Keera ghaas*. The villagers are not much aware for its conservation priorities. The economic boom is easily seen in villages where the villagers are collecting *Keera ghaas*. There should be a proper understanding between collectors, forest departments and other agencies for the proper harvesting and conservation of this species. Awareness and scientific knowledge is very necessary for the future prospects regarding to conseve *Keera ghaas*.

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