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Yarsagumba: A miracle mushroom its history, cultivation, phytopharmacology and medicinal uses

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Abstract

Yarsagumba (*Cordyceps sinensis* / *Ophiocordyceps sinensis*) belonging to Ophiocordycipitaceae family is a fungus that parasitizes larvae of ghost moths and produces a fruiting body valued as an herbal remedy. Yarsagumba has been recognized in Nepal for last thousands of years. It is one of the highly potential medicinal mushrooms in the world. Owing to the herb's high efficacy and potency in curing various diseases, it is well known as an important nourishing tonic. In the present review an attempt has been made to gather the information regarding Yarsagumba, its history, cultivation, taxonomical characters, and various medicinal uses, phytochemical and pharmacological studies conducted so far. Different pharmacological actions such as antiasthmatic, antineoplastic, antibacterial as well as actions on the heart and blood vessels, and on the smooth muscles of intestine and uterus have been reported. With this review we conclude that there is a need for further studies for isolation of individual constituents and screening of various activities on this miracle mushroom.

Keywords: Cultivation, *Cordyceps sinensis*, History, Medicinal uses, *Ophiocordyceps sinensis*

1. Introduction

Yarsagumba a parasitic, annual, non chlorophyllous fungus is from ergot family. Yarsagumba is extremely rare. It is distributed in the alpine region of the Himalayas at the elevation of more than 4000m. It grows in Nepal, mainly found above the snowline in Dolpa, Jumla, Humla, Kalikot, Baglung, Mustang, Manang and Rasuwa districts of western and central Nepal. Major confinement of this species in Jumla district is within Patarasi, Chhumchaur, Dillichaur and Patmara. Also found in Countries such as Tibet, North-East India (Himachal Pradesh and Uttarakhand Himalayas), China and Bhutan. Yarsagumba has two components the lower part is dead caterpillar and the upper part is a fungus. The fungus has a small spike with dark brown fructification and yellowish white stalk. The size of the fungus is about 4 to 12 cm in length and 0.14 to 0.4 cm in girth. Yarsagumba with both the caterpillar and fungal part in an intact single piece is an item of commerce. This species is not cultivated in Nepal. Although, Yarsagumba is being cultivated in America by growing the strain on soybeans for medicinal uses. For its medicinal effects, Yarsagumba has been an important component for a many of years in all over the world. However, due to a constantly growing demand and the difficulties in harvesting, Yarsagumba has become the most expensive medicinal substance in the world^[1, 2]. Major chemical constituents of *O. sinensis* include proteins and nitrogenous compounds, polysaccharides and sugar derivatives, sterols, nucleosides, phenolics, fatty acids, vitamins^[3]. This powerful and natural fungal herb effectively prevents and treats a wide variety of diseases such as asthma, chronic bronchitis, tuberculosis, heart problems including cardiovascular disease and hypertension, kidney problems, acute and chronic hepatitis and tumors of many kinds^[4].

2. History

Cordyceps was discovered about 1500 years ago in Tibet. The Nepalese and Tibetan herders who, in springtime, noticed grazing yaks and goats acting strangely in the high mountain pasture. After eating this strange looking substance, the animals would become frisky and start chasing each other around with lust full intent. Soon the locals after consuming Yarsagumba also experienced this added vigor. The earliest known documentation of Yarsagumba is by Nyamnyi Dorje, a Tibet physician and lama who lived from 1439-1475. His text titled "An Ocean of Aphrodisiacal Qualities", describes the value of the mushroom as a sexual tonic. About 1000 years later, the Emperor's physicians in the Ming Dynasty learned about this Tibetan wonder and used this knowledge with their own wisdom to develop powerful and potent medicine. Initial records of *Cordyceps* as medicine date from the Qing Dynasty in China in 1757. Its current high international profile and demand developed only sometime in

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1993 when many Chinese long distance runners broke world records. The British mycologist Berkely first described it in 1843 as *Sphaeria sinensis* Berk. Later in 1878, Saccardo renamed it as *Cordyceps sinensis*. The scientific name *Cordyceps sinensis* (Berk) Sacc. is referred to the final form, which is the fruiting body of the fungus arising out of the dead body of a caterpillar. The fungus was known as *Cordyceps sinensis* until 2007, when molecular analysis was used to emend the classification of the Cordycipitaceae and the Clavicipitaceae, resulting in the naming of a new family Ophiocordycipitaceae and the transfer of several *Cordyceps* species to *Ophiocordyceps*. Hence *Cordyceps sinensis* also known as *Ophiocordyceps sinensis*. There are more than 350 types of so called *Cordyceps* or its substitutes in terms of their medicinal values have been found worldwide today, such as *Cordyceps militaris* (L.) Link (the most commonly used substitute), *C. martialis* Speg, *C. hawkesii* Gray, *C. liangshanensis* Zang, etc. From Nepal three species of *Cordyceps* namely *Cordyceps sinensis*, *Cordyceps nutans* and *Cordyceps nepalensis* are reported to date. Among them only *Cordyceps sinensis* is used for medicinal values [5].

3. Names in Other Languages

Different languages	Names
English	Cordyceps mushroom, caterpillar fungus
Nepali	Yarsagumba, Jeebanbuti, Sanjivani, Kiraghans
Sanskrit	Sanjiwani
Tibetian	Yarchakunbu, dbyarrtswadgun 'bu**
Japanese	Totsukasu, tochukasu
Chinese	Hiatsao tong tchong, dongchongxiacao, [chongcao]*
Hindi	keerajhar, keedajadi, keedaghas or 'ghaasfaond

* The translation in English- Summer-grass winterworm

**In Tibetan, it is called Yarchakunbu, which literally means 'Yar' for rain; 'Cha' for plant; 'Kun'

for winter; and 'Bu' for insect. So, the literal meaning of Yarchakunbu becomes summer plant winter insect. Tibetan people consider it as a 'Bu', which means living insect. In Buddhism, the collection of 'Bu' is considered as a sin act, which may be the reason of Yarsagumba being protected in the Himalayas for thousands of years. The botanical name of Yarsagumba comes from a latin word 'Cord' and 'Ceps' which mean club and head respectively. So, the meaning derived from its Latin name is an insect with its head in a horse's tail like body [6, 7].

4. Cultivation and Collection

Yarsagumba is not cultivated in Nepal. Since native *Cordyceps* (wild *Cordyceps sinensis*) is rare and very expensive, countries like China and Korea have been investing a great effort in research for cultivation of this fungus. However, the exact method of cultivation of this fungus has not still known in Nepal. Some individuals and business organization are working on in this aspect. In 1982, Institute of Materia Medica, Chinese Academy of Medical Sciences isolated the commercial strains of *Cordyceps* for the first time. This strain named CS- 4 was fermented in aseptic environment to develop a mycelium, which underwent extensive human testing, and clinical trials during the 1980's. In this way, commercial production of Yarsagumba begun from China in the name of Jin Shui Bao capsules. A wide range of population was encouraged to use it as a clinical trial

in order to establish its chemical composition, therapeutic activity, toxicity and many other facts [8].

Usually, Yarsagumba is collected in large quantity before it attains the maturity. The first reason is that it is sold based on its weight. It attains the highest weight just before the maturity due to the compactness of the inner tissue. In Nepal during summer, mature fruiting bodies of Yarsagumba release millions of spores that again infect the larvae in the surrounding areas, grow inside them during winter and sprout from the dead larvae the next summer. Every year, the herb is collected in Nepal during May-July and sold to the business people directly in order to sustain the livelihood in rural areas. [9].

5. Phytochemistry and Pharmacology

It has been shown that Yarsagumba can be used to treat conditions such as hyposexuality, night sweats, hyperglycemia, hyperlipidemia, arrhythmias, and other heart, respiratory, renal and liver diseases. The chemical constituents of natural *Cordyceps* include cordycepic acid, glutamic acid, amino acids, polyamines, cyclic dipeptides, saccharides and sugar derivatives, sterols, nucleotides and nucleosides, 28 saturated and unsaturated fatty acids, fatty acid derivatives and other organic acids, vitamins, and inorganic elements. Palmitic acid, linoleic acid, oleic acid, stearic acid, and ergo sterol are the main components of natural and cultured *Cordyceps*.

5.1 Antioxidant activity: The antioxidant activity of melanin, derived from a black pigment, was isolated from the fermentation broth of *O. sinensis* and showed much stronger scavenging abilities for 1, 1-diphenyl-2-picrylhydrazyl (DPPH) and ferrous ion chelation compared to the mycelial water extract.

5.2 Hypolipidemia, hypotension, and antioxidant activities: Lovastatin, GABA, and ergothioneine are secondary metabolites of fungal growth. It was shown that mycelia of *C. sinensis* contained 1365 mg/kg of lovastatin, 220.5 mg/kg GABA, and detectable ergothioneine and had different hypolipidemia, hypotension, and antioxidant activities [10].

5.3 Aphrodisiac activity: Traditional Chinese medicine (TCM) claims the fungus which is boiled and added to tea or soup can act as an aphrodisiac [11].

5.4 Liver function: In a study performed on *Cordyceps sinensis*, it was demonstrated that it could improve the liver function, reduce liver inflammation, and fight against hepatic fibrosis.

5.5 Anti-inflammatory and Analgesic properties: Cordymin, a peptide purified from the medicinal mushroom *Cordyceps sinensis*, showed potent anti-inflammatory and analgesic properties.

5.6 Anti-tumor activity: The cell wall polysaccharides from *Cordyceps sinensis*, obtained from samples of its mycelia (the vegetative part of the fungus), showed that cordyglucans were the unique component, and cordyglucans were found to exhibit potent antitumor activity.

5.7 Anti-diabetic activity: *Cordyceps sinensis* extract can potentially preserve β -cell function and offer Reno protection, which may afford a promising therapy for Diabetes mellitus (Type 2) [12].

5.8 Hypoglycemic and anti-depressant effect: The caterpillar fungus has a hypoglycemic effect and may be beneficial for people with insulin resistance and an experiment conducted with mice noted the mushroom may have an anti-depressant effect [13, 14].

6. Medicinal Uses of Yarsagumba

Yarsagumba's health benefits are believed to have been known from some 1500 years ago, and in ancient times, it was said to be taken as a potent tonic by kings and noblemen. Since Yarsagumba is a natural product, the chances of any side effects are minimal.

6.1 Anti-ageing benefits: Yarsagumba is highly used for its anti-ageing properties. In other words, to summarize, Yarsagumba is believed to be an excellent tonic for nourishment of the body and for the brain and its long-term use is said to improve organic functioning as well as the immune system [15].

6.2 Strong aphrodisiac: Whole plant is tonic and aphrodisiac. People of both sexes usually take one piece of *C. sinensis* with a cup of milk to enhance their sexual potency and desire. Most traditional healers and elderly people use it to increase longevity and cure erectile dysfunction. In Sikkim, Yarsagumba is used as a tonic, because they claim that it improves energy, appetite, stamina, libido, endurance, and sleeping patterns.

6.3 Memory power: Yarsagumba is useful to increase memory and immune system.

6.4 Treats Respiratory and pulmonary diseases: Yarsagumba is used to treat respiratory disorders such as tuberculosis, asthma, chronic bronchitis.

6.5 Improves functioning of liver: It improves liver functioning and cures hepatitis B.

6.6 Used in treating heart problems: Heart problems including cardiovascular disease and hypertension can be prevented.

6.7 Used by Athletes: The fermentable strain of the mycelia causes normal fat mobilization and beta-oxidation, thereby maintaining blood glucose level during prolonged exercise in athletes [16-18].

7. Conclusion

Medicinal plants are very important to human beings in preserving our health. To date, 25% of modern medicines are derived from plants that have been used by traditional medical practitioners. Yarsagumba being a very rare mushroom has a long history as a medicinal plant with diverse therapeutic applications, also used in many different countries. Yarsagumba is said to be the most expensive herb in the world today, a kilo of it fetching more than 10,000 dollars in the international market. With the present review we can conclude that Yarsagumba have proved to be useful in treating various disorders in humans, Owing to the new attraction for natural products obtained from Yarsagumba a further proper phytochemical, pharmacognostical and Pharmacological study is required, which shall open new pharmacological avenues for this miraculous mushroom which are helpful for clinical experimentation and also in the development of novel drugs. Its uses are multiple and

undoubtedly, the nature's gift to humanity and it remains for us to introduce it to ourselves and thank the nature for its never-ending gift.

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