Cordyceps sinensis

Mission Anastore

Promoting Tibetan medicinal plants
**DESCRIPTION AND HABITAT**

**Cordyceps sinensis**

**Distribution zone**
- Sichuan
- Bhutan
- Nepal
- Kathmandu
- India: Delhi
- Tibet: Sichuan, Xining, Litang, Yushu, Garze, Derge, Lhoka, Lhasa, Shigatse, Luhuo, Serta, Qinghai, Chamdo, Chamdo Autonomous region

**Primary distribution zone**
- Sichuan
- Bhutan
- Nepal
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Cordyceps sinensis (Cephalosporium sinensis) is an ascomycota fungus that belongs to the Clavicipitaceae family and the Hypocreales Order. It is found in the Tibetan plateau, China, Bhutan, Nepal and the north-east regions of India at altitudes of between 3,000 and 5,000 metres.

In Tibet it is known as Yartsa gunibu (“summer grass winter worm”), in Nepal as Yarsagumba, in Dolpa as Kira and in China as Hia tsao tong tchong or Dong Chong Xia Cao.

It is an endoparasitic and entomopathogenic fungus that has been used in Traditional Tibetan and Chinese Medicine for centuries, with strong roots in these cultures. This endoparasitic fungus is surrounded by mysticism and legend, in part due to its unique life cycle and the area from which it comes.

Its life cycle proceeds through the following stages: in autumn, fungus spores infect the larvae of the Thitarodes butterfly, known as the “ghost moth”. The spores germinate and the fungus feeds on the body of the caterpillar.

At the end of the winter, the fungus emerges from the larva: it has consumed the body of the caterpillar but retains its shape, with the fruiting body (stroma) of the fungus emerging from the head of the caterpillar. This can be seen on the surface.

Cordyceps was discovered in Tibet over 1,000 years ago when a shepherd noticed that his animals showed improved strength and energy after eating the fungus\(^2\). On an international level, it gained notoriety in the 90s when Chinese athletes setting new world records in various disciplines revealed that the fungus was part of their diet\(^3\).\(^4\). It has been registered in Chines Pharmacopoeia since the 1960s, with its use becoming much more widespread in 2003 due to the SARS outbreak\(^5\).
QUALITY
Cordyceps is always collected in June and July, with a larva-heavy stroma-larva ratio always being favoured. In terms of quality, the colour of the larva exoskeleton is also important: a more intense yellow colour indicates a better quality specimen. Greater consistency is also an indicator of better quality.

**CONSUMPTION**

Cordyceps is consumed so much principally due to the many medicinal properties attributed to it which led to it becoming known as the Viagra of the Himalayas\(^1\)\(^-\)\(^3\). Cordyceps extract can now be found in capsule form\(^6\), but traditionally it was prepared with chicken, duck or pork, depending on which illness it was being used to treat\(^2\)\(^-\)\(^3\),\(^7\). It can also be drunk in a hot water infusion that doesn’t exceed 60°C: it is left to infuse overnight before being drunk in the morning. It can also be taken in soup, with rice wine or prepared in a tea.

Despite current high demand, harvesting of the fungus has decreased for various reasons: excessive collection of immature or even mature specimens (which have no commercial value), which stops the fungus from being able to sporulate and reproduce; a reduction in the butterfly and larva population due to the loss and degradation of its host plants; changes to the spores’ ideal microhabitat caused by harvesters, increased shepherding and climate change\(^1\).

In response to the fact that traditional cultivation methods cannot face the current high demand, various strains have been produced using fermentation\(^6\) and a patent exists for a procedure for growing the fungus on a substrate. Nonetheless, it would be better to maintain its cultivation in its place of origin, not only for conservational purposes, but also because it is estimated that its harvesting and commercialization represents 40% of the income of the rural populations in Tibet\(^1\)\(^-\)\(^3\).
CORDYCEPS: A VALUABLE GIFT
Cordyceps sinensis is a fungus endemic to the Tibetan plateau. It holds much symbolic meaning and is considered a panacea due to the numerous medicinal properties attributed to its use.

Its restricted distribution area, unique life cycle as well as the symbology and legend that surround it make Cordyceps an exclusive and luxury product that obtains high market prices.

Highly-prized in Tibetan and Chinese culture, it is a gift that shows great respect and a desire for the recipient to enjoy a long life.
CHEMICAL COMPOSITION

CORDYCEPINE (3'-DESOXYADENOSINE)

CORDYCEPIC ACID (D-MANITOL)
The following describes the compounds present in Cordyceps sinensis that are of pharmalogical interest:

**NUCLEOSIDES**

Nucleosides are the union of a nitrogen base and a pentose. They are considered to be the primary bioactive compounds of Cordyceps sinensis. The nucleosides identified are adenine, adenosine, cytosine, cytidine, uridine, guanine, guanosine, hypoxanthine, inosine, thymine, thymidine, 2’-deoxyuridine and cordycepin. These molecules play a role in the regulation and modulation of various physiological processes in the central nervous system\(^{3-8}\).

Cordycepin (3’-deoxyadenosine) also carries out an anti-tumour action thanks to its ability to replace adenosine and impede RNA synthesis\(^{9-10}\). It also possesses anti-inflammatory properties.

**POLYSACCHARIDES**

Polysaccharides are macromolecules which can play energetic and structural roles. They have been identified as mannoglucan, exopolysaccharides, heteropolysaccharides and D-glucan\(^{4}\). They are a major component of Cordyceps sinensis and are responsible for a large number of the fungus’s pharmaceutical properties: anti-inflammatory, anti-oxidative, anti-tumour, anti-metastatic, immunomodulatory, hypoglycemic, steroidogenic and hypolipidemic\(^{8-9}\).

**STEROLS**

Various sterols have been isolated in Cordyceps sinensis extracts, notably ergosterol (a component of the cell membrane of the fungus and a precursor to vitamin D2) which carries out anti-tumour activities and has been shown to be naturally occurring in large quantities in Cordyceps sinensis\(^{8}\).

**Other compounds**

Other interesting compounds isolated in Cordyceps sinensis include: proteins, peptides, polyamines, essential amino acids, vitamins, minerals and cyclic dipeptides with antimicrobial properties\(^{4,7}\). D-manitol (cordycepic acid) is also found in high percentages (3.4% of total dry weight) and shows diuretic, antitussive and antioxodative properties\(^{8}\).
MEDICINAL PROPERTIES

Cordyceps sinensis
Numerous therapeutic properties are attributed to Cordyceps: hypocholesterolemic, anti-fatigue, anti-aging, renal function improvement, anti-stress, cerebral damage improvement, anti-inflammatory, anti-tumour activity, hypotensive effect, sexual activity improvement and aphrodisiac qualities\textsuperscript{[5,8,11]}.

Various in vitro and in vivo studies support Cordyceps sinensis extract’s reported pharmacological potential and biological activity\textsuperscript{[3,4]}:

**METABOLISM OF LIPIDS AND ATHEROSCLEROSIS. DIABETES**

Cordycepin can reduce overall levels of cholesterol, low-density lipoprotein and triglycerides in the blood\textsuperscript{[12]}. Furthermore, its effect on glucose metabolism in the blood gives it the potential to regulate glucose levels in the blood.

**ANTI-INFLAMMATORY AND REPARATIVE PROPERTIES. IMMUNOMODULATORY**

It has also been reported to be effective as a therapeutic agent for cases of renal failure and gastric damage, with the aqueous Cordyceps sinensis extract stimulating cell proliferation and migration\textsuperscript{[3]}.

Various studies have demonstrated the effect of using Cordyceps sinensis extract in the treatment of patients suffering from lupus, patients with chronic renal failure and immunosuppressed patients\textsuperscript{[4,6]}.

**ANTIOXYDATIVE AND ANTI-AGING**

There is increasing evidence linking the accumulation of reactive oxygen species (ROS) to degenerative diseases. Various studies show the in vitro antioxidative potential of Cordyceps sinensis extract, with it improving the activity of antioxidative enzymes (superoxide dismutase…) and reducing oxidative stress\textsuperscript{[6-7]}.

One study showed that the symptoms of aging (memory loss, reduced antioxidative enzyme activity and sexual function) improved after treatment with aqueous extracts of Cordyceps\textsuperscript{[13]}.

**ADAPTOGENIC SPECIES**

Cordyceps is an adaptogenic species which increases the ability of an organism to adapt to various environmental factors and deal with stress\textsuperscript{[14]}.
OTHER PROPERTIES
ANTI-FATIGUE
A reduction in fatigue and an increased libido have been reported after consumption of the mycelium (the vegetal body of the fungus) of Cordyceps sinensis. It also increases ATP levels: the cell’s energetic molecule which increases the efficiency of oxygen use(7). Koh and co.(14) investigated the anti-fatigue effect of mycelium extract and confirmed that its ingestion led to prolonged exercise and reduced fatigue.

A study was carried out recently on amateur cyclists who were given a food supplement containing standardized extract of Cordyceps sinensis mycelium. Analysis of the ratio of their saliva testosterone/cortisol content after physical effort showed higher levels of testosterone and lower levels of cortisol. This is linked to the body’s improved response to physical effort. The supplement improved athletes’ endurance capabilities(15).

NEPHRO AND NEUROPROTECTION
Cordyceps sinensis has been recommended for use, in combination with low doses of cyclosporine A (a medication used to prevent transplant rejection), in patients receiving kidney transplants, and its positive effects in the treatment of chronic renal disease have also been studied.

It has been used in China for more than a thousand years to promote respiratory health. Illnesses such as asthma, bronchitis and COPD (chronic obstructive pulmonary disease) have therefore all been treated with this fungus.

APHRODISIAC
In Traditional Chinese Medicine Cordyceps has for a long time been used in cases of male impotence and erectile dysfunction, with various studies describing its efficacy(7). Various investigations link the ingestion of Cordyceps sinensis extracts with improved sperm quality, desire and libido(4). The improvement in sperm quality might be due to the extract’s richness in vitamins, zinc and amino acids(7). Furthermore, Cordyceps sinensis regulates the production of testosterone through the activation of the cAMP/PKA pathway(11).
COLLABORATION WITH ANASTORE
The harvesting of Cordyceps sinensis is carried out in various regions of China (Qinghai and Kham). Under the supervision of Christian Pamies, a collaborative project has been set up between ANASTORE and various Tibetan towns for the harvesting and commercialization of this valuable product.

ANASTORE’s philosophy supports environmental sustainability and the development of towns that harvest Cordyceps. This collaboration provides an extremely important source of income to the inhabitants of these towns as there are no intermediaries between the harvesters and ANASTORE. Furthermore, with the objective of ensuring that the harvest is carried out in a sustainable manner, with respect for the environment, we are currently developing a protocol for good practice in order to ensure better control of harvesting and the quality of the primary material.

Once in our laboratory, the Cordyceps specimens are classified according to their weight and, before being packaged, subjected to cleaning and disinfection procedures. Finally, they are analysed by an external laboratory to certify that they are free of heavy metals and conform to the required microbiological criteria.

On the peaks with the mushroom-pickers at an altitude of 4,750m.

Cordyceps market in Lhasa, Tibet


