



## A Review Article on Cordyceps Sinensis

<sup>1</sup>Priyanka Saini\*, <sup>2</sup>Dr. Rajesh Chandra Mishra, <sup>3</sup>Dr. Hiral Patel, <sup>4</sup>Dr. Eresh K. Jamwal, <sup>5</sup>Dr. Rakesh Kumar Sharma

<sup>1,3,4,5</sup>M. D. Scholar P.G Dept. Of Dravya Guna Vigyan, Madan Mohan Malviya Govt. Ayurved College, Udaipur (Raj.)

<sup>2</sup>.Associate Professor, PG Dept. Of Dravya Guna Vigyan, Madan Mohan Malviya Govt. Ayurved College, Udaipur (Raj.)

Email id – [prisaini23@gmail.com](mailto:prisaini23@gmail.com)

### ABSTRACT-

*Ophiocordyceps sinensis*, another name for *Cordyceps sinensis*, is what is commonly referred to as *Yarsagumba*. The uncommon and valuable fungus *Cordyceps sinensis*, often referred to as the "caterpillar fungus," is a unique fungus that grows primarily in the Himalayan regions of Tibet, Nepal, Bhutan, and parts of China. It is well-known for its unusual life cycle, in which it parasitizes *Hepialis aromoricanis* moth caterpillars. Because of this fungus's supposed health benefits which include increased energy, better stamina, support for immune system and renal function, among other things—traditional Chinese medicine has utilized it for generations. It is becoming more and more popular in dietary supplements and health products. Due to the growing interest in mycology and medicine, research is required to provide an overview of the genus *Cordyceps sinensis* therefore in this study we provide a general information about *cordyceps sinensis*.

**Key words** - *Ophiocordyceps sinensis*, *Cordyceps sinensis*, *Yarsagumba*, Caterpillar fungus, *Hepialis aromoricanis*.

### Introduction -

Latin name- *Ophiocordyceps sinensis* (syn. *Cordyceps sinensis*)

Family - Ophiocordycipitaceae

The Latin terms "cord" and "ceps," which translate to "club" and "head," respectively, are the source of the name Cordyceps. These words only discuss the fungus's appearance. *Cordyceps sinensis* is an Ascomycete fungus whose mycelia parasitize the *Hepialis aromoricanis* moth caterpillar to create the fruiting body stroma. *Cordyceps sinensis*'s head is a club-shaped mycelia, and its body is a caterpillar moth.<sup>1</sup> The fruit body is dark brown to black, and the root of organism, the larval body pervaded by the mycelium, is yellowish to brown color.<sup>2</sup> Due to this herb's extensive therapeutic and commercial usefulness, it is also known as "*Himalayan Viagra*" or "*Himalayan Gold*." Cordyceps feeds on the host, or immature larvae, which are normally found 6 inches underground. The fungus consumes more than 90% of the diseased insect as it matures, effectively mummifying its host. As the stroma ages, it expands and gives rise to perihelia. Cordyceps have an average weight of 300 to 500 mg.<sup>3</sup> Cordyceps are unique macrofungi due to their parasitic habits on insect larvae and pupae. Cordyceps a pleomorphic fungus found around the planet is especially prevalent in tropical forests and damp temperate regions. *Cordyceps sinensis* popularly known as "winter worm, summer grass," has long been the most well-known tonic plant in traditional Chinese medicine (TCM). *Cordyceps sinensis* is a plentiful natural resource with a variety of biological activities, and it has long been utilized as a tonic and health supplement for subhealth patients, particularly elderly in China and other Asian nations.<sup>4</sup> In Chinese medicine *Cordyceps sinensis* is considered sweet and warm, it enters the lung and kidney channels, the typical dosage is 3-9 grams.

### Taxonomical classification of Cordyceps Sinensis <sup>5</sup> --

**Domain** : Eukaryota  
**Kingdom** : Fungi  
**Phylum** : Ascomycota  
**Class** : Sordariomycetes  
**Order** : Hypocreales  
**Family** : Ophiocordycipitaceae  
**Genus** : Ophiocordyceps

**Related species :** *Cordyceps mililaris*, *Cordyceps barnesii*, *Cordyceps ophioglossoides*, *Cordyceps hyphae* etc.

**Vernacular name** <sup>6</sup> --

**English name :** Caterpillar fungus , *Cordyceps* mushroom

**Local Name :** Yarsa gumba, Yarcha gumba

**India :** Keeda jadi, keeda ghas or ghaas fafoond

**Nepali :** Yarsagumba, Jeebanbuti, Kiraghans - Keera jhar, Keeda ghass, Chyokira, Sanjeevani bhooti etc.

**Tibetian :** Yartsa gunbu , Yarsa gumba

**Chinese :** Dong chong xia cao( winter worm, summer grass)

**Japanese :** Tochukaso

---

### Background History -

*Cordyceps sinensis*, popularly known as the caterpillar fungus or *yarsa gunbu*, has a rich history in traditional Tibetan and Chinese medicine. Here is a summary of its history:

The author Wu-Yiluo's Ben-Cao-Cong-Xin contains the earliest known written account of this herbal remedy. Written in the Qing Dynasty, circa 1757 AD, this ancient medicinal manuscript outlines the traditional uses of cordyceps as a Yin/Yang double invigorant, lung protectorate, and kidney improver.<sup>7</sup> During the 13th century, the Ming Dynasty of China popularized the use of *Yarsagumba* from the Himalayan region, most likely Nepal. They used to present a great surprise award to individuals who worked hard to import *Yarsagumba* from Nepal.<sup>8</sup> The veggie worm initially gained popularity at the 1994 Asian Games in Hiroshima, when two female Chinese athletes, Wang Junxia and Qu Yunxia, used it to demonstrate remarkable power and break world records in the 1,500, 3000, and 10,000 meters. Later, it was discovered that they used it on the recommendation of their coach, which has been known for 2,000 years as a folk medicine that offers enormous power and lengthens life.<sup>9</sup> In Chinese pharmacopoeia, only *Cordyceps sinensis* has been officially recognized as a herbal remedy since 1964. Around 1000 years later, the Emperor's physician in the Qing Dynasty discovered and used this information with their own skills to create strong aphrodisiacs. Cordyceps was originally mentioned as a medicinal fungus around 101 BC by an unnamed author in a book called Sheng Nung Bon Cas Chien.<sup>10</sup> Another written record of the Cordyceps fungus comes from China, in the year 620 AD, during the Tang Dynasty (618 AD-907 AD) adding substance to the once-intangible allegorical narrative which spoke of a magical creature whose annual existence alluded to a miraculous transformation from animal to plant in summer and then back to animal in winter. Wu-Yiluo, author of the Ben Cao Congxin during the Qing Dynasty wrote the first objective and scientifically reliable description of Cordyceps fungus in 1757.<sup>11</sup> Western reports of the Cordyceps fungus's health advantages first appeared in the eighteenth century. The first such article was from a French Jesuit priest named Perennin Jean Baptiste du Halde who described his encounter with this Himalayan aphrodisiac while visiting the emperor's court in China. Cordyceps first appears in a medical literature, "New Compilation of Materia Medical," in 1757.<sup>12</sup> Its current high international prominence and demand emerged only in 1993, when numerous Chinese long distance runners smashed world records while taking this Cordyceps fungus. In the mid-nineteenth century, this Cordyceps fungus was promoted in the United States. The first Tibetan author to describe *Yartsa gunbu* appears to be the famed Tibetan doctor Zurkhar Nyamnyi Dorje (1439-1475), referenced above in "An Ocean of Aphrodisiacal Qualities - A Special Work," who founded the so-called Zur Medical tradition. In his dissertation Ten Millions of Instructions: A Relic (often and wrongly referred to as "Oral Instructions on a Myriad of Medicines"), he cites *Yartsa gunbu* as one of the drugs that cure rotsa (ro tsa) ailments—those relating sexual vigor. Collection, trade, and use of *Yartsa gunbu* (dbYar rTswa dGun 'Bu) have a long history in *Rigpa Sowa*, where it is categorized as "medicinal essences" (rTsi sMan). According to Phunsho Namgyel, although knowledge of cordyceps as an important medicinal plant exists in the Himalayan kingdom of Bhutan, the Bhutanese traditional medicine system, which is akin to Tibetan medicine, just began including it in its formulations a few years ago.<sup>13</sup><sup>14</sup> However, there is no written confirmation in Ayurveda that this product is used by the same name. However, it is believed that the 'Sanjeevani' brought from the Himalayas by Hanuman in *Ramayana* is the same plant that was used for Laxman.

---

### Extraction -

*Cordyceps sinensis* extraction is a rigorous process due to its natural habitat and growing circumstances. Harvesting usually entails collecting the fungus in its natural environment or cultivating it under controlled settings. After harvesting, various extraction procedures like Hot water extraction, Ethanol extraction, Dual extraction ( Water and ethanol) , Ethyl acetate extraction, Methanol extraction etc. are used to concentrate the bioactive components for therapeutic purposes.

### Chemical composition of *Cordyceps sinensis*<sup>15</sup>

| Components | Unit |
|------------|------|
|------------|------|

|                |        |
|----------------|--------|
| Water          | 10.84% |
| Fat            | 8.4%   |
| Coarse protein | 25.32% |
| Coarse fiber   | 18.53% |
| Carbohydrate   | 28.9%  |

#### Important Constituents of *Cordyceps sinensis* -

| Constituents                        | Compounds   |
|-------------------------------------|---|
| Sterols                             | Ergosterol, Cerevisterol, beta-sitosterol. <sup>16</sup><br>Ergosteryl-3-O-D-glucopyranoside, Ergosterol peroxide. <sup>17</sup><br>3-O-ferulylcycloartenol, Daucosterol, Stigmasterol, Stigmasterol 3-O- acetate ,<br>Fungisterol. <sup>18</sup> Cholesterol, Campesterol, Dihydro brassicasterol. <sup>19</sup>   |
| Nitrogenous compounds               | Uracil, Guanosine, Thymidine, Tridine,<br>Dideoxyuridine, Guanine, Inosine. <sup>20,21</sup> Adenine, Hypoxanthine, Adenosine, Cordycepin. <sup>21,22</sup><br>Caffeine, Tetracosanamide. <sup>16</sup><br>Cordycydeptide A. <sup>23</sup><br>Dideoxyadenosine, Inosine, Guanosine, Uridine. <sup>21,24,25</sup><br>Cordyceamides A, Cordyceamides B, Aurantiamide acetate. <sup>26</sup><br>Thymine, Cordysin A, Cordysin B, Cordysin C, Cordysin D, Cordysin E. <sup>18</sup> |
| Polysaccharides                     | D-glucan, Cordysinocan, Mannoglucan,<br>D mannitol. <sup>27,28,29</sup>   |
| Proteins and related compounds      | Cadaverine, Spermidine, Spermine, Putrescine. <sup>24</sup><br>Flazin , Perlolyrine. <sup>18</sup><br>Cordymin, L-tryptophan. <sup>30,31</sup>  |
| Fatty acids and other organic acids | Lauric acid, Myristic acid, Penta decanoic acid, Palmitoleic acid, Linoleic acid, Oleic acid,<br>Stearic acid, Docosanoic acid , Lignoceric acid. <sup>32</sup><br>Palmitic acid, Succinic acid. <sup>16,18</sup>   |
| Phenolics and acids                 | p-hydroxybenzoic acid, Vanillic acid, Syringic acid, p-methoxybenzoic acid, p-<br>hydroxyphenylacetic acid, 3,4-dihydroxyacetophenone, 4 hydroxyacetophenone,<br>protocatechuic acid , acetovanillone, salicylic acid, Furancarboxylic acid. <sup>18</sup>  |
| Isoflavones                         | Trihydroxyisoflavone, Glycitein, Daidzein, Orobol, Genistein. <sup>18</sup>   |
| Vitamins                            | B1, B2, B12, E, and K. <sup>20</sup>  |
| Inorganics                          | K, Na, Ca, Mg, Fe, Cu, Mn, Zn, Pi, Se, Al, Si, Ni, Sr, Ti, Cr, Ga. <sup>20</sup>  |
| Volatile compounds                  | Aldehydes: Benzaldehyde, Benzene acetaldehyde, Nonanal , Decanal<br>Alcohols: Phenylethyl alcohol, 2-(methylthio)-3-pyridinol, 7-octadien-1- ol Aromatics:<br>Azulene, 2,6-dimethylnaphthalene, 1,6-dimethyl-naphthalene Phenols: 2-methyl-<br>phenol, Butylated hydroxytoluene Acids : Phosphonic acid. <sup>33</sup>  |

#### Traditional Medicinal value of *Cordyceps sinensis*:

The way that *Cordyceps sinensis* is used differs by location. The entire fruit body of *Cordyceps sinensis* should be cooked in chicken or duck soup, according to traditional Chinese medicine (TCM). Chinese people think it cures bleeding, strengthens kidneys, increases Yang, and lessens phlegm.<sup>7</sup> About 1500 years ago, Yak herders in Tibet, the surrounding regions of Sikkim, and Nepal discovered this Himalayan aphrodisiac. They noticed that their Yak got more vigorous after consuming this fungus.<sup>34</sup> This is how it is used to treat a variety of illnesses, including hyperlipidemia, hyperglycemia,

respiratory disorders and renal failure.<sup>35</sup> Clinical studies have indicated that *Yarsagumba* is particularly helpful in the treatment of arrhythmia, chronic renal failure, and hypercholesterolemia. It helps to improve the immune system of individuals undergoing chemotherapy, anti-tubercular medications, and other procedures. The Host Defense Potentiators (HDP) found in *Yarsagumba* protect the host (patient) from foreign invasion by germs, cancer cells, and viruses hence increasing immunity. It also promotes hormone production, giving it anti-aging properties.<sup>9</sup> When 1-3 pieces of *Yarsagumba* are frequently consumed mixed with milk or Shilajatu, they are thought to have aphrodisiac and tonic properties in Nepal.

Research indicates that it may be effective in the treatment of cardiac arrhythmia, angina pectoris, liver illness, and even cancer. It serves as a building block for gene repair during cell replication and is essential for ATP and AMP (energy) metabolism. *Cordyceps sinensis* produces a variety of components, including deoxy-nucleosides such as 2,3 deoxyadenosine, which is marketed in the United States as an AIDS therapy under the trade name Didanosine.<sup>7</sup> Similarly Quinic acid generated from Cordycepin, which is found in Cordyceps, has antiviral and antibacterial properties.<sup>36</sup> According to Balfour-Browne (1955), the Bhutanese utilize it to treat persistent ailments including typhoid and impotence.<sup>37</sup>

---

### Major pharmacological functions of *Cordyceps sinensis*.<sup>38</sup>

#### Hepatic function -

Stimulation of energy metabolism

Activation of Kupffer cell function: water-soluble fraction

Reduction of post-hepatitic cirrhosis: unknown

#### Renal function -

Reduction in aminoglycoside antibiotic induced nephrotoxicity

Reduction in hematuria and proteinuria in experimental IgA nephropathy 6gA N): low MW sterols (CS-HI-A)

#### Endocrine and steroid system -

Stimulation of corticosteroid production in animals unknown

Stimulation of corticosterone production by cultured rat adrenal cells : water soluble fraction.

#### Cardiovascular function -

Inhibition of platelet aggregation adenosine and other related nucleosides.

Reduction in aconitine, BaCl, and ouabain-induced anhythmia: low MW metabolites

#### Anticancer activities -

Sterols and their glucosides

Low MW metabolites other than cordycepin

Modified nucleosides

Antitumor function via immunopotiation and cytokine production: polysaccharides

#### Immunomodulation -

Immunopotiation, polysaccharides

Immunosuppression: cyclosporine like metabolites and others hypoglycemic activity in STZ-induced diabetes polysaccharides

#### Erythropoiesis and hemopoiesis -

Proliferation of fibroblast observed in vivo and in vitro

Platelet hernoipoiesis

#### Collection and cultivation of *Cordyceps sinensis* -

In the spring and early summer, when the snow melts and fungus appears on the hills, this commodity is harvested.<sup>39</sup> Because natural Cordyceps (wild *Cordyceps sinensis*) is uncommon and expensive countries such as China and Korea have made significant investments in research to cultivate this fungus. However, the specific method of cultivating this fungus is yet unknown in Nepal. Some individuals and corporate organizations are working on this issue. Cordyceps commercial strains were originally isolated in 1982 by the Institute of Materia Medica, Chinese Academy of Medical Sciences. This strain, CS-4, was fermented in an aseptic environment to produce a mycelium, which underwent extensive human testing and clinical trials in the 1980s. Commercial production of *Yarsa gumba* began in China under the name Jin Shui Bao capsules. It was recommended that a broad population use it as a clinical trial to determine its chemical makeup, therapeutic activity, toxicity, and many other details<sup>40</sup>.

### Side effect of *Cordyceps sinensis* –

Since *Cordyceps sinensis* has been used as food for such a long time and this tendency is still going strong, it makes sense that any side effects would be extremely rare or nonexistent. Significant side effects have not yet been documented, however a small number of persons have experienced moderate gastrointestinal (GI) issues, diarrhea, and nausea. It is healthy to consider the possibility that there might be unidentified adverse effects and to strive for them. A hypothesis proposed that *Cordyceps sinensis* could have immunomodulatory or immunosuppressive effects based on the strain. One such strain was found to be a potent immune suppressor, with strength comparable to that of "cyclosporin A," an immunosuppressive medication used in organ transplants<sup>42</sup>.

### Adulterants of *Cordyceps sinensis*-

Due to the scarcity and value of this medication, adulterants originating from the same *Cordyceps* genus have become more prevalent. *Cordyceps gunnii* (also known as "Gunichongcao"), *Cordyceps liangshanensis* (also known as "Liangshanchongcao"), and *Cordyceps gracilis* (also known as "Xinjiangchongcao") are the adulterants that are frequently discovered in the market.

### Material and Methods :

Data about *Cordyceps sinensis* collected from academic journals and other scholarly publications.

### Conclusion and discussion –

Traditional Chinese medicine *Cordyceps sinensis*, has always been associated with the wealthier segments of society. However as time has gone on scholars have become interested in learning the traditional usage scientific foundation. Many of the stated uses today have a scientific basis. The discovery of *Cordyceps sinensis* is evidence of the convergence of conventional wisdom and cutting-edge scientific research. Its potential therapeutic effects keep drawing interest from both researchers and medical professionals, establishing it as an important natural resource for holistic medicine. As of now, the majority of the studies have been conducted by Chinese and Japanese researchers. This could be because cordyceps has only recently entered the western world, and cordyceps is not easily available in the west, so it has been ostracized by default, leading to a lack of awareness among the western community, as opposed to Asians, where it is widely used at home and by local healers in addition to pharmaceutical purposes. However, cordyceps is gaining popularity in the West due to its good healing capacity and few side effects, particularly among people who prefer herbal remedies over chemicals or synthetic medications. This review summarizes the many elements of *Cordyceps sinensis*. With so many advantages, it is imperative that every effort be made to provide the world's medical community with access to this myco-medicinal herb.

### References:

- Holliday J, Cleaver M (2008) Medicinal value of the caterpillar fungi species of the genus cordyceps (Fr.) Link (Ascomycetes) A Review. Int J MedMushrooms 10: 219-234.
- Kinjo N, Zang M. Morphological and phylogenetic studies on coryiceps Sinensis. Mycoscience. 2001;42:567–74. [Google Scholar]
- J Ayurveda Integr Med. 2011 Jan-Mar; 2(1): 9-13. doi: 10.4103/0975-9476.78183 PMID: PMC3121254 | PMID: 21731381 Traditional uses and medicinal potential of Cordyceps sinensis of Sikkim -Ashok Kumar Panda and Kailash Chandra Swain<sup>1</sup>)
- Hindawi Publishing Corporation Evidence-Based Complementary and Alternative Medicine Volume 2015, Article ID 575063, <http://dx.doi.org/10.1155/2015/575063> Review Article- The Chemical Constituents and Pharmacological Actions of Cordyceps sinensis Yi Liu,<sup>1</sup> Jihui Wang,<sup>2</sup> Wei Wang,<sup>1</sup> Hanyue Zhang,<sup>3</sup> Xuelan Zhang,<sup>1</sup> and Chunchao Han<sup>1</sup>
- <https://en.wikipedia.org/wiki/Cordyceps> )
- Discovering Cordyceps sinensis in Ayurveda - Dr. Dinesh Gyawali, Mr. Sushil Gyawali
- John C. Holliday, Phillip Cleaver, Megan Loomis, Dinesh Patel: The hybridization of Cordyceps sinensis strains and the modifications of their culture parameters, in order to optimize the production of target medicinal compounds )
- China Science Institute Shimyang Edible Center: Citation made from unpublished article Nepals Pride Yarsagumba by Dr. Rana B. Rawal )
- Tang Teng-han et al: Citation made from unpublished article Nepals Pride Yarsagumba by Dr. Rana B. Rawal)
- The Classic Herbal of the Divine Plowman). (17. Hung Chang Kee, Brief history of Chinese medicine in the Pharmacology of Chinese herbs, 2nd edition, CRC press, Florida, pp -9-21,1999.)
- Karma Chopel, Beautiful Rosary of Precious and Elegant Teachings: A Materia Medica on the Medicines which are Elixir of Immortality, Tibetan People Press Lhasa,1993.)
- Wu, Yiluo,"Ben cao cong xin" -"New compilation of materia medica" (in Chinese),1757.
- Jam dpal rdo rje, An Illustrated Tibeto-Mongolian Materia Medica of Ayurveda,Chandra L, ed. International Academy of Indian Culture, New Delhi,1971.)

14. Bod ljongs rgyun spyod krung dbyi'i sman rigs. Bod ljongs mi dmangs dpe skrunghang. 1973: 579. [A List of Chinese Traditional Medicines of Tibetan Everyday Use, Tibetan People Press, Lasa, 1973.]
15. Discovering Cordyceps sinensis in Ayurveda - Dr. Dinesh Gyawali, Mr. Sushil Gyawali)
16. Li SP, Zhao KJ, Ji ZN, Song ZH, Dong TTX, Lo CK, Cheung JKH, Zhu SQ, Tsim KWK. A polysaccharide isolated from Cordyceps sinensis, a traditional Chinese medicine, protects PC12 cells against hydrogen peroxide-induced injury. *Life Sciences* 2003; 73: 2503- 2513.
17. Bok JW, Lerner L, Chilton J, Klingeman HG, Towers GHN. Antitumor sterols from the mycelia of Cordyceps sinensis. *Phytochemistry* 1999; 51:891-898.
18. Yang ML, Kuo PC, Hwang TL, Wu TS. Anti-inflammatory principles from Cordyceps sinensis. *Journal of Natural Products* 2011; 74: 1996-2000.
19. Kadota S, Shima T, Kikuchi T. Steroidal components of I-Tiam-Hong and Cordyceps sinensis, separation and identification by high performance liquid chromatography. *Yakugaku Zasshi* 1986; 106:1092- 1097.
20. Zhu JS, Halpern GM, Jones K. The scientific rediscovery of a precious ancient Chinese herbal regimen: Cordyceps sinensis: Part I. *Journal of Alternative and Complementary Medicine* 1998; 4: 289-303.
21. Liu Y, Xu F, Chen B, Zhang J, Yao S. CZE determination of nucleosides and nucleobases from natural Cordyceps sinensis and cultured Cordyceps militaris. *Yaowu Fenxi Zazhi* 2010; 30: 24-29
22. Huang LF, Liang YZ, Guo FQ, Zhou ZF, Cheng BM. Simultaneous separation and determination of active components of Cordyceps sinensis and Cordyceps militaris by LC/ESI-MS. *Journal of Pharmaceutical and Biomedical Analysis* 2003; 33:1155-1162.
23. Jia JM, Ma XC, Wu CF, Wu LJ, Hu GS. Cordyceptide A, a new cyclodipeptide from the culture liquid of Cordyceps sinensis (Berk.) Sacc. *Chemical & Pharmaceutical Bulletin* 2005; 53:582- 583.
24. Holliday J, Cleaver M. Medicinal Value of the Caterpillar Fungi Species of the Genus Cordyceps (Fr.) Link (Ascomycetes). A Review. *International Journal of Medicinal Mushrooms* 2008;10(3):219-234.
25. Li SP, Zhang GH, Zeng Q, Huang ZG, Wang YT, Dong TTX, Tsim KWK. Hypoglycemic activity of polysaccharide, with antioxidation, isolated from cultured Cordyceps mycelia. *Phytomedicine* 2006; 13:428- 433.
26. Jia JM, Tao HH, Feng BM. Cordyceamides A and B from the culture liquid of Cordyceps sinensis (Berk.) Sacc. *Chemical & Pharmaceutical Bulletin* 2009; 57:99-101.
27. Wu Y, Sun C, Pan Y. Studies on isolation and structural features of a polysaccharide from the mycelium of a Chinese edible fungus (Cordyceps sinensis). *Carbohydrate Polymers* 2006; 63: 251-256.
28. Cheung JKH, Li J, Cheung AWH, Zhu Y, Zheng KYZ, Bi CWC et al. Cordysinocan, a polysaccharide isolated from cultured Cordyceps, activates immune responses in cultured T-lymphocytes and macrophages: signaling cascade and induction of cytokines. *Journal of Ethno pharmacology* 2009; 124: 61-68.
29. Wu Y, Hu N, Pan Y, Zhou L, Zhou X. Isolation and characterization of a mannoglucan from edible Cordyceps sinensis mycelium. *Carbohydrate Research* 2007; 342: 870-875.
30. Qian GM, Pan GF, Guo JY. Anti-inflammatory and antinociceptive effects of cordymin, a peptide purified from the medicinal mushroom Cordyceps sinensis. *Natural Product Research* 2012; (DOI:10.1080/14786419.2012.658800).
31. Zhang SS, Zhang DS, Zhu TJ, Chen XY. A pharmacological analysis of the amino acid components of Cordyceps sinensis Sacc. *Acta Pharmaceutica Sinica* 1991; 26: 326-330.
32. Yang FQ, Feng K, Zhao J, Li SP. Analysis of sterols and fatty acids in natural and cultured Cordyceps by one-step derivatization followed with gas chromatography-mass spectrometry. *Journal of Pharmaceutical and Biomedical Analysis* 2009; 49: 1172- 1178.
33. Yu S, Zhang Z, Fan M. Analysis of volatile compounds of mycelia of Hirsutella sinensis, the anamorph of Ophiocordyceps sinensis. *Applied Mechanics and Material* 2012; 140: 253-257.
34. Devkota, S., "Yarsagumba (Cordyceps sinensis): Reflection on Historical Perspectives" *Society & Life*, 13,40-41,2007.)
35. Zhou, Halpern and Jones, 1998 Zhu JS, Halpern GM & Jones K: The scientific rediscovery of a precious ancient chinese herbal regime: Cordyceps sinensis, part I. *J Alt Complement Med* 1998; 4(3): 289-303 )
36. NEPHA 2006: Extension Material Series, Nepal Herbs and Herbal Products Association
37. Balfour-Browne (1955): Citation made from unpublished article Nepals Pride Yarsagumba by Dr. Rana B. Rawal
38. Wang SY, Shiao MS. Pharmacological function of Chinese medicinal fungus Cordyceps sinensis and related species. *J Food Drug Anal.* 2000;8:248-57. [Google Scholar]

- 
39. Gyawali 2006: Article titled "Himali Money Yarsagumba", Himal Magazine, Issue 174, July 2006)
40. Bau TT, 1995. Further Study of Pharmacological Functions of JinShuiBao. Journal of Traditional Chinese Med 1995;5 (suupl):6
41. Lawenda BD (2012) A medicinal mushroom warning (cordyceps sinensis). Buyer be aware!, from integrative oncology - essentials.