



# A Survey of the Planting and Therapeutic Effects of Dang Shen

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## Abstract

Chinese herbal medicine Dang Shen is the dried root of *Codonopsis pilosula* Nannf. var. *modesta* Nannf. L. T. Shen or *Codonopsis tangshen* Oliv. Dang Shen is widely used in traditional Chinese medicine as a tonic medicine. Dang Shen is commonly used clinically for qi deficiency, cough, asthma, internal heat and thirst. This paper briefly describes the history of Dang Shen as a medicinal herb in China, and briefly introduces the species and growing conditions of Dang Shen. This paper summarizes the role played by Dang Shen on human endocrine system, immune system, digestive system, nervous system, respiratory system, etc. According to the analysis, Dang Shen can help the body to enhance immunity, assist in improving memory, relieve physical fatigue, and improve the function of nutritional anemia and other functions to human health. Some methods of medicinal food are also given in this paper, which can help the Chinese medicine community to strengthen the in-depth research on Dang Shen and expect a greater innovations.

**Keywords:** Dang Shen; Chinese medicine; health care

## Introduction

Dang Shen is a commonly used bulk herb with a long history of medicinal use. The 2015 edition of the Pharmacopoeia of the People's Republic of China contains three species of Dang Shen in the family *Platycodonaceae*: the dried roots of *Codonopsis pilosula* (Franch.) Nannf, *Codonopsis tangshen* Oliv. and *Codonopsis pilosula* Nannf. var. *modesta* Nannf. L. T. Shen. Dang Shen is sweet and flat in nature, and is effective in strengthening the spleen, benefiting the lung, tonifying the qi, and nourishing the blood and promoting the production of body fluid. Dang Shen is a traditional tonic in China and can be used as a substitute for ginseng [1].

## Characteristics and Planting of Dang Shen

In 1757, Wu Yiluo (Qing Dynasty) first included Dang Shen in New Compilation of Materia Medica 《本草从新》: "Dang Shen is a tonic for qi, generates fluid, benefits the qi, harmonizes the spleen and stomach, and removes irritability and thirst. Dang Shen is very suitable for tonifying qi, which is slightly deficient. Nowadays, real Dang Shen has been hard to come by for a long time, and there are many kinds of Dang Shen sold in the shops, all of which are useless. Feng Dang Shen tastes good. Dang Shen with hard lines is pseu-

do." In 1932, Zhang Shanlei's Modification of the Materia Medica 《本草正义》 included Lu Dang Shen and made a detailed distinction between ginseng and Dang Shen.

It is recorded in the An Illustrated Book on Plants 《植物名实图考》 (Qing Dynasty) that "Dang Shen is abundant in Shanxi, with long roots up to two or three feet, trailing, with leaves that do not match, and large nodes like fingers; in the wild, the roots have white juice. In autumn, the flowers are greenish-white, and the qi is extremely turbid". The characteristics of Dang Shen contained in the book are consistent with the accompanying picture and modern Dang Shen. During the Ming Dynasty and before the Ming Dynasty, there was no name of Dang Shen in the herbs. Due to the name of "Shang Dang Dang Shen", the Dang Shen was mixed with ginseng for a long time, the Qing Dynasty Hundred Herbs Mirror 《百草镜》 said: "Dang Shen, a yellow ginseng, the colour of yellow is good, planted in Lu'an and Taiyuan in Shanxi Province. They are white, the best ones are soft, clean and sweet. Tender and small branches was called "Shang Dang Shen" and "Huang Dang Shen" for the oldest one. Zhang Lu (Qing Dynasty), New Compilation of Materia Medica 《本草从新》, listed Dang Shen as a "new species" and records that "the ginseng

produced in Taihang, Shanxi Province is called Shang Dang Dang Shen, which is not sweet and warm, but has the power to clear the lungs, unlike the cold nature of Sha Shen Dang Shen, which is dedicated to leaking lung.”

According to the testimony of previous generations, there was no record of Dang Shen in the herbal literature before the Ming Dynasty, and it was only when the ginseng resources in Shangdang County (the name in Qin Dynasty, the present-day Changzhi area in Shanxi Province) were about to be depleted that Dang Shen was introduced as Shangdang Ginseng, which was the earliest origin of Dang Shen. It was not until the appearance of New Compilation of Materia Medica 《本草从新》 written by Wu Yi Luo in the Qing Dynasty that the name of Dang Shen was formally introduced. He pointed out that the characteristics of Dang Shen were “lion’s head”, before that, there had never been any record of “lion’s head” in any of the herbs [2]. Since then, people’s understanding and research on Dang Shen has been deepened, which has led to the rapid development of Dang Shen. Dang Shen is a popular medicinal herb-homology of medicine and food, and its main resources are mainly *Codonopsis pilosula* (Franch.) Nannf, *Codonopsis tangshen* Oliv. and *Tangshen* Nannf. var. *modesta* Nannf. L. T. Shen [3].

### Plant Morphology and Trait Identification



Figure 1

Wild Dang Shen is a perennial herbaceous vine, 1~2m in length, with white latex and a peculiar odor. The roots are fat and fleshy, long and cone-shaped, with grayish-yellow or brown surface. The stems are sprawling and slenderly branched. Leaves alternate, opposite or false verticilli, leaf blade ovate or broadly ovate, front end obtuse or slightly pointed, base subcordate, margin with undulate obtuse teeth, both sides with ambrosia. Dang Shen’s corolla are broadly campanulate and yellow-green, with purple spots on inner surface. Capsule are compressed-conic. Seeds are minute and numerous, brown and shiny. There are two kinds of Dang Shen used in medicine: wild and cultivated. Dang Shen’s root is cylindrical or

slightly fusiform, slightly twisted, with yellowish or light brown surface and reed head at the top, that is lion’s head. The lion’s head is its root top, which is one of the important identification features of Dang Shen. The lion’s head is large and obvious in wild resources, and relatively small in cultivated resources. The upper part of the root strips of wild Dang Shen has fine horizontal lines, while that of cultivated Dang Shen is sparse, which is more obvious on the dried root strips of Dang Shen. The roots of cultivated Dang Shen are yellowish-white, and the color of wild species is darker than that of cultivated species. The branches of cultivated Dang Shen roots are slightly more than those of wild Dang Shen. Generally, the thicker strips, looser skin, tighter flesh, larger lion’s head, more horizontal lines, and sweet taste without dregs are preferred (Figure 1).

### Distribution and Growing Conditions of Dang Shen Species

China is the main production area and distribution center of Dang Shen in the world, and there are more than 40 species of the genus Dang Shen in the world and as many as 39 species in China [4]. Dang Shen has many origins and wide sources and is mostly named by traits and origin, so there is a big difference between varieties. Dang Shen’s commercial varieties are highly variable, and the main species currently in circulation include:

- a) Lu Dang Shen, produced in Shanxi, is a famous Taoist medicinal herb, with the main production areas in Huguan County and Pinshun County, Changzhi City, Lingchuan County, Jincheng City, etc. Lu Dang Shen has a long history of cultivation and many varieties, with the five-flower core Dang Shen in Lingchuan and the purple group Dang Shen in Huguan are the best, and the existing cultivation area is about 6000 mu. The original plant is *Codonopsis pilosula* (Franch.) Nannf [5].
- b) Tai Dang Shen, produced in Wutai County, Xinzhou City, Shanxi Province, both wild and cultivated, the collection of wild Taidan is small and the cultivation area continues to shrink. The original plant is *Codonopsis pilosula* (Franch.) Nannf.
- c) Wen Dang Shen, produced in Wen County, Gansu Province, both wild and planted, in 1958 began to change the wild into home grown. Commercial Wen Dang Shen, maintaining the quality characteristics of “silkworm head, snake tail, beauty chatter, flesh and fine lines of ice sugar core”, has become the backbone of Gansu Province export herbs. The existing planting area reaches 30,000 mu. The original plant is *Codonopsis pilosula* (Franch.) Nannf. var. *modesta* (Nannf.) L. T. Shen.
- d) White Stripped Dang Shen, produced in Weiyuan County, Longxi County and Lintao County, Dingxi City, Gansu Province. In 1964, there was a successful introduction of “Lu Dang Shen” from Shanxi, with short production cycle and high yield of medicinal herbs, named “White Stripped Dang Shen”. Now the planting area reaches 200,000 mu and has become the main commercial herb in the market. The original plant is *Codonopsis*

sis pilosula (Franch.) Nannf. However, after years of cultivation, there are already obvious differences in plant morphology and herbal traits [6].

e) Tiao Dang Shen, also known as Banqiao Dang Shen, is produced in the eastern and southern parts of Chongqing and Banqiao District, Enshi City, Hubei Province, etc. There are records of planting in the early 19th century, and the existing planting area is 30,000 mu. The original plant is *Condonopsis tangshen* Oliv.

f) Dao Dang Shen, produced in Jiuzhaigou County, Sichuan Province. Dao Dang Shen has been cultivated on a large scale for more than 60 years, and the existing cultivation area reaches 10,000 mu. The original plant is *Condonopsis pilosula* (Franch.) Nannf. var. *modesta* (Nannf.) L. T. Shen.

g) Feng Dang Shen, produced in Feng County, Shaanxi Province, has a long history of cultivation, and was a tribute to the court in the late Qing Dynasty. The original plant is *Dang Shen* *Condonopsis pilosula* (Franch.) Nannf [7].

h) Dong Dang Shen, also known as Jilin Dang and Jilin Dang Dang Shen, produced in the northeast of China, Jilin Province, Antu, Dunhua, Jiaohe, Tonghua and Heilongjiang Province, Shangzhi, Zhenba, Nanzheng, Pingli and other places, wild. The original plant is *Condonopsis pilosula* (Franch.) Nannf.

i) White Dang Shen, also known as "Xudong Dang Shen", is produced in Guizhou, Yunnan and southern Sichuan, and is called White Dang Shen because of its white color. Historically, White Dang Shen was scattered in Xuyong in Yibin area, so it is also called Xudan. The texture is hard and light, and the quality is inferior. The original plant is *Condonopsis tubulosa* Kom [8].

Here is the difference among Dao Dang Shen, Wen Dang Shen, Feng Dang Shen, wild Tai Dang Shen, Lu Dang Shen and White Stripped Dang Shen. Sichuan Dao Dang Shen, Gansu Wen Dang Shen and Shaanxi Feng Dang Shen have 2~3 branches with obvious lion's head feature; Shanxi wild Tai Dang Shen has 2~3 branches with obvious lion's head feature; Shanxi Lu Dang Shen has 2~3 branches, some with a single branch with inconspicuous lion's head feature; Gansu White Striped Dang Shen has 2~3 branches with inconspicuous lion's head feature. The wild Tai Dang Shen is usually curved and spindle-shaped cylindrical, mainly produced in the Wutai Mountain area, wild for many years, with densely distributed rings under the root head, and the lion's head feature is more obvious. Dang Shen is widely distributed and highly adaptable. Fearing high temperature, tolerating cold and humidity, preferring warm and cool climate, Dang Shen mostly grows in mountainous areas above 1200m above sea level, and is distributed in areas with annual average temperature above 5°C, annual average precipitation of 400~650mm and annual frost-free period of 90~180 days. Dang Shen is suitable for growing in deep, loose, well-drained, humus-rich sandy loam and yellow cotton soil, and the soil pH is neutral or acidic [9].

## Planting of Dang Shen

Dang Shen is very adaptable, with slightly different requirements for moisture and sunlight at different growth stages. The seed germination temperature is 18-20 °C, and seedlings prefer shade; adult plants prefer light and can accept high temperatures of 33 °C and are also capable of wintering in the cold zone of -30°C. Its roots are easily corroded under poor drainage, high temperature and high humidity. Dang Shen usually blooms and fruits in the second year of planting and will be fuller after 3 years of planting. Therefore, seedlings with strong roots and free from diseases and pests can be used as seedlings. People can use more phosphorus and potassium fertilizers in the fertilization process and harvest the fruit in September-October of the third year of cultivation if the skin turns yellowish white and partially split, and the plant turns dark brown. The fruits are cut off with the stems and can be harvested in batches depending on the period of maturity. The harvested seeds are put in a ventilated and dry place to dry, threshed, cleaned and selected, mixed with sand, and set aside for the seed field.

The most suitable temperature for germination is 18-20°C. The sowing season is spring and autumn. and Spring sowing can be done in May near a water source. Autumn sowing can be done before the ground freezes. Scattered sowing involves spreading the seeds evenly on the surface of the puddle, covering them with a thin layer of soil to cover the seeds, and then allowing the soil and the seeds to combine firmly to facilitate seedling emergence. For strip sowing, a shallow furrow of 0.5 to 1 cm should be made at a spacing of 10 cm between rows, and the seeds should be placed evenly in the furrow. After sowing, covering the puddle with corn stalks and weeds to ensure soil moisture and shade after the seeds emerge. As the seedlings increase in age, the need for light will also increase. After the seedlings are 15 cm high, they will have a certain degree of light tolerance, and the shade can be gradually removed.

## Effects of Dang Shen on Human Body

Dang Shen has sedative, hypnotic and anticonvulsant effects on the nervous system; anti-hypoxia and anti-fatigue effects on the locomotor system; antibacterial and anti-inflammatory effects on the respiratory system; and reproductive effects on the reproductive system. In this paper, the author summarizes the research on several systems of Dang Shen in recent years to provide a basis for the rational use and development of Dang Shen.

### Effects on Endocrine System

Dang Shen enhances adrenocortical function and hypothalamic-pituitary-adrenocortical axis function through excitation of hypothalamus and pituitary gland, promoting the release of adrenocorticotrophic hormone (ACTH) [10].

### Effects on the Immune System

#### Enhancement of the Immune Function of the Organism

The continuous administration of Lu Dang Shen medicinal



solution can promote the growth of the organism, and the increase of wet weight of the spleen indicates that the solution has an enhancing effect on immune function [11]. Polysaccharide is one of the main components of Dang Shen, which has important pharmacological effects, and clinical pharmacology has proved that Dang Shen polysaccharide has the effect of regulating the immunity of the organism.

### **Delaying Aging**

Dang Shen has the effect of scavenging free radicals, increasing the activity of catalase (CAT) and superoxide dismutase (SOD), and reducing the content of lipid peroxide and lipofuscin in tissues, which has antioxidant, free radical scavenging, inhibiting brain cell apoptosis, and delaying aging. Studies have shown that codonopsis can significantly increase thymus and spleen indices, which can delay the atrophy of immune organs in aging organisms [12].

### **Antitumor**

Dang Shen polysaccharide has antitumor activity. Two new codonopsis polysaccharides, CPS-3 and CPS-4, were isolated from the total polysaccharide of *C. codonopsis* (CPS). CPS-3 inhibited the proliferation of human gastric gland cancer cells (BGC-823). CPS4 inhibited the proliferation of human liver cancer cells (Bel-7402) [9].

### **Effect on Digestive System**

Dang Shen is an important medicine for nourishing the middle and benefiting the qi, which can correct the gastrointestinal motor disorder in pathological state. Lobetyolin is one of the index components in the quality evaluation of Dang Shen, and studies have shown that lobetyolin has a good protective effect on gastric mucosal damage and has a significant anti-ulcer effect [13].

### **Effects on the Circulatory System**

#### **Cardiac Strengthening, Anti-shock, Anti-myocardial Ischemia**

Dang shen improves myocardial energy metabolism, tonifies qi and strengthens the heart, restores the maximum rate of change of left ventricular systolic pressure (LVSP) and intraventricular pressure, reduces left ventricular end-diastolic pressure (LVEDP), inhibits the elevation of malondialdehyde (MDA), lactate dehydrogenase (LDH) and creatine kinase (CK), and enhances the activity of SOD, glutathione superoxide dismutase (GSH-Px), Na<sup>+</sup>-ATP and Ca<sup>2+</sup>-ATP. K<sup>+</sup>-ATP and Ca<sup>2+</sup>-ATP activity. It has a significant protective effect on myocardial ischemia-reperfusion injury [10].

#### **Improving Blood Rheology**

Dang Shen improves blood rheology and microcirculation in the body, reduces the erythrocyte sclerosis index, and inhibits the formation of in vitro test thrombi. Dang Shen combination can inhibit the reduction of blood and plasma viscosity and reduce the area of myocardial infarction.

### **Regulation of Blood**

Blood nourishment is also one of the traditional effects of Dang Shen. Dang Shen and its chemical components can increase the content of hemoglobin, exerting pharmacological effects such as enhancing hematopoiesis, regulating glycolipid metabolism, and preventing hemolysis [11].

### **Effects on the Nervous System**

Dang Shen has a depressant effect on the central nervous system. The aqueous and n-butanol extracts of Dang Shen produce synergistic effects with small doses of central depressants and antagonistic effects on large doses of depressants, showing bidirectional regulation. It's reported that Dang Shen has memory improvement, sedative, hypnotic and anticonvulsant effects [14].

### **Effects on the Respiratory System**

#### **Antibacterial, anti-inflammatory**

The alcoholic extract of Dang Shen inhibits the activity of *Branhamella catarrhalis*, *Staphylococcus epidermidis*, *Streptococcus haemolyticus* type A and B, *Bacillus subtilis*, *Bacillus anthracis*, *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella pneumoniae*, *Aspergillus* and *Salmonella typhi* [15].

#### **Increase in alveolar pulmonary surface active substance (PS) content**

Dang Shen can increase PS content, stabilize alveolar intra-pulmonary pressure, maintain the stability of alveolar expansion, maintain the balance of alveolar-capillary fluid exchange, reduce the lung coefficient, effectively maintain the ventilation function of the lung, and improve the ventilation function of the lung [15].

In addition, the efficacy components of Dang Shen are mainly crude polysaccharides and saponins. The functions of the former are to enhance immunity, assist in improving memory, relieve physical fatigue, improve the function of nutritional anemia, and have auxiliary protective functions for gastric mucous membrane damage. The function of the latter is mainly to assist in lowering blood lipids, lowering blood pressure, improving hypoxia tolerance, improving nutritional anemia.

Dang Shen has the function of nourishing qi, which can benefit qi to correct the pathological bias of deficiency of organ qi in human body. For the evidence of deficiency of lung and cough with phlegm, it is mostly used with medicines to resolve phlegm, stop cough and calm asthma; for the evidence of deficiency of spleen and lung qi, it is mostly used with medicines to tonify qi, strengthen spleen and remove dampness; for the evidence of deficiency of both qi and blood, it is mostly used with medicines to tonify qi and blood; for the evidence of injury to both qi and fluid, it is mostly used with medicines to nourish yin and promote fluid. Dang Shen has a wide application prospect and high development value in medicine and food use, which should be studied in depth in order to expect greater innovation [15].

## Clinical Application

A. Replacing ginseng in some formulas: It is used to nourish the spleen, lung and blood because it is sweet and not dry and greasy, but its effect is far weaker than ginseng and cannot last, so it needs to be increased in clinical dosage. However, it is not suitable to replace ginseng with codonopsis in first aid formulas such as qi deficiency and desiccation. It is often used clinically for treating patients with weakness of spleen and lung, deficiency of qi and blood, tiredness and weakness, prolonged diarrhea or prolapse, in order to resist diseases. It is also commonly used in the treatment of iron deficiency and nutritional anemia.

B. Used in the treatment of thrombocytolytic purpura: It is often combined with Astragalus and Glycyrrhiza and has certain efficacy in leukemia and thrombocytopenia.

C. Treatment of lung dryness and hoarseness, spleen and lung deficiency: this product is decocted with sage and cinnamon flesh, taken on an empty stomach, has the effect of replenishing vital energy, opening the voice and helping, especially for patients with tuberculosis with mild toxic symptoms.

D. Treatment of pediatric mouth sores: clinically tried in pediatric mouth sores have certain efficacy. The powder is then blown and sprinkled on the affected area.

E. Used for indigestion or vomiting and diarrhea caused by weakness of spleen and stomach, weakness of limbs: decoction with Atractylodesmacrocephala, Yun Ling, yam, fried lentils, lotus seeds, barley, roasted grass, orris, and sand kernel has significant efficacy. The above medicine is made from the addition and reduction of ginseng ling san, which has been used in clinical practice for a long time and has definite efficacy in chronic gastroenteritis[11].

## How to Consume Dang Shen

Food compatibility of Dang Shen: It should not be used with quinoa.

Directions on how to cook Dang Shen as a herbal medicine:

- It is advisable to use it in raw form to induce thirst, and to use it in hot form to strengthen the spleen and benefit the qi.
- Insufficient middle energy, weakness of spleen and stomach, loose stools with little food, tiredness and weakness, can be used with atractylodes, poria and glycyrrhiza to strengthen the spleen and benefit the qi [16-20].
- In case of spleen deficiency, fetal movement, fetal atrophy and slippage, it can be used with atractylodes and mistletoe to strengthen the spleen and calm the fetus [10].

## Conclusion

The effect of Dang Shen is similar to that of ginseng but weaker, and the range of biological activity is not as wide as that of ginseng,

so it cannot be used as a complete substitute for ginseng, but for patients with deficiency of qi and blood, tiredness and fatigue, which are not acute diseases, Dang Shen has good therapeutic effects. As a natural product for both medicine and food, Dang Shen has great development value. Dang Shen has the effects of strengthening the spleen, benefiting the lung, nourishing the blood and promoting the production of body fluid, and is described in New Compilation of Materia Medica 《本草从新》 as “tonifying the middle and benefiting the qi, harmonizing the spleen and stomach and eliminating thirst”. The modern pharmacological effects of Dang Shen are extensive, involving the gastrointestinal system, pulmonary function, blood system, immune system, and nervous system, etc. However, the relevant pharmacological mechanisms are not deeply explored, and the material basis of the pharmacological effects is still unclear, while the modern pharmacological effects based on the traditional efficacy of Dang Shen are still in need of further in-depth investigation. This paper reviews the progress of the research on the effects of Dang Shen in order to provide reference for the better development and utilization of this traditional Chinese medicine.

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