

Chapter 8

Asparagus cochinchinensis (Lour.) Merr.

天冬 (Tiandong, Chinese Asparagus)

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8.1 Botanical Identity

Asparagus cochinchinensis (Lour.) Merr. is a perennial plant (*Liliaceae*), whose dry root tubers are used as a traditional Chinese medicine, called Tiandong (Fig. 8.1). It is usually harvested in the autumn or winter months. After rinsing and removing their stems, peel and fibrous roots, they are boiled or steamed and then dried.

Tiandong has been used in traditional Chinese medicine for a long time. Nearly 2000 years ago, it was initially described in Shennong's Classic of Materia Medica and was listed as a top grade herb. *Asparagus cochinchinensis* is widely distributed throughout China, mainly in Hebei, Shanxi, Shaanxi, Gansu, Anhui, Henan, Jiangsu, Zhejiang, Jiangxi, Hunan, Hubei, Sichuan, Guizhou, Yunnan, Guangxi, Guangdong, Fujian, Taiwan as well as other regions. Although it grows widely in China, the region of Southern Yangtze River is the major place of origin of this plant. Among all of these regions, Guizhou province produces the herb with the highest quality.

8.2 Chemical Constituents

Many kinds of steroidal saponins have been identified in this herbal medicine, including asparagus furan sterol oligosaccharides, methylprotodioscin, pseudoprotodioscin, and other six steroidal saponins, whose aglycones include yamogenin (**1**),

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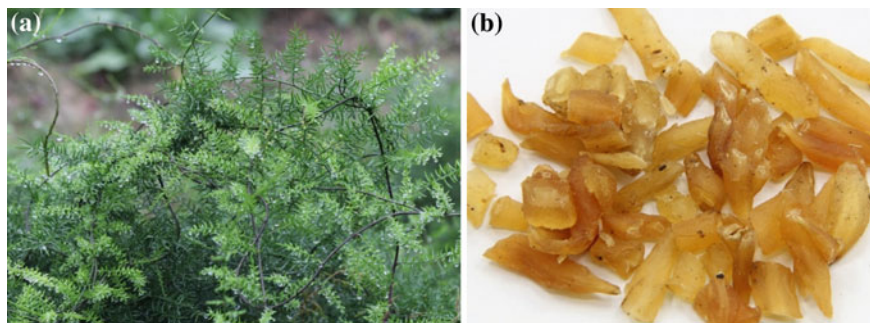


Fig. 8.1 Growing areal part (a) and crude drug (b) of *Asparagus cochinchinensis*

diosgenin (2), sarsasapogenin and smilagenin. This herb also contains saccharides including oligosaccharides, glucose, fructose, sucrose, and asparagus polysaccharides. There are 17 amino acids isolated in this herb, including asparagine (3), citrulline (4), serine, threonine, proline, glycine, alanine, valine, leucine, isoleucine, methionine, phenylalanine, aspartic acid, glutamic acid, arginine, histidine, and tyrosine. In addition, β -sitosterol (5) and 5-methoxymethylfurfural (6) are also found in this herb [1]. Representative structures of these constituents are shown in Fig. 8.2.

8.3 Pharmacological Studies

Current pharmacological studies of Tiandong mainly focus on anti-oxidative, anti-tumor and anti-bacterial properties [2]. Studies showed that the major component asparagus polysaccharide ACP1 could clear superoxide anion free radicals produced by NADH-PMS-NBT system in vitro, reduce the content of hepatic microsomal lipid peroxidation malonaldehyde in mice, and inhibit hydrogen peroxide-induced hemolysis of red blood cells in rats, suggesting that ACP1 had potent free radical scavenging and anti-lipid peroxidation activities [3]. Furthermore, the water decoction of Tiandong was found to inhibit the growth of many Gram-positive bacteria, including *Anthrax*, *Hemolytic streptococcus*, *Corynebacterium diphtheriae*, *Streptococcus pneumoniae*, *lemon Staphylococci*, *Staphylococcus aureus* and *Bacillus subtilis* [4]. The same study showed that the methanol extract of Tiandong at 150 $\mu\text{g/ml}$ exhibited significant anti-bacterial activities against *Escherichia coli* and *Shigella dysenteriae* [5].

In terms of anti-tumor activity, the ethanol extract of Tiandong could potentially inhibit the leukocyte dehydrogenase in acute lymphocytic leukemia, chronic myelogenous leukemia and acute monocytic leukemia, and suppress the white cell respiration in acute lymphocytic leukemia [6]. Moreover, the 80 % ethanol extract of Tiandong could inhibit S₁₈₀ sarcoma in mice with the tumor inhibition rate

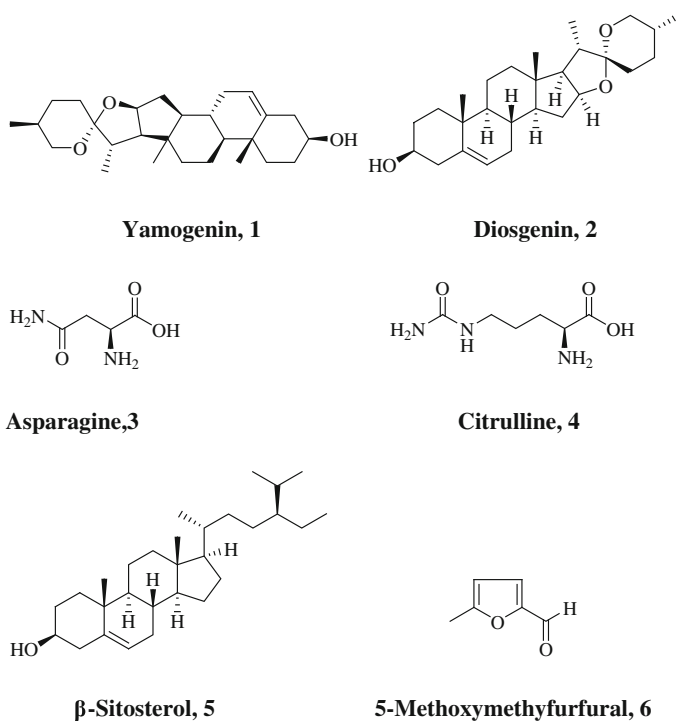


Fig. 8.2 Chemical structures of major constituents in Tiandong

falling between the ranges of 35–45 % [7]. Oral administration with water decoction of Tiandong (5 and 15 g crude herb/kg/day) could inhibit the growth and reduce the weight of S₁₈₀ sarcoma and H₂₂ liver tumours in mice.

8.4 TCM Applications and Dietary Usage

8.4.1 TCM Applications

The main functions of Tiandong as described in Chinese Pharmacopoeia are for nourishing Yin and clearing fluid retention in the lungs. It relieves symptoms such as coughing, sticky phlegm, and dry throat. In clinical applications, Tiandong is usually prepared in a variety of different forms depending on the medical conditions of patients. Some of these forms are as follows: Tiandong Ointment for moistening the lung; Tiandong powder for emaciation; Tiandong decoction for coughing and sticky phlegm; and Tiandong pill for consumptive lung disease, cough, and emaciation after typhoid [8, 9].

8.4.2 Dietary Usages

Tiandong is a traditional Chinese medicine that has the function of nourishing Yin. Not only is it considered for medicinal purposes, but is also known to be a form of food nourishment. The raw material of the nourishing medicinal food is used to create products such as medicinal liquor, or implemented into the ingredients of porridge to increase the health benefits of the product.

8.4.2.1 Tiandong Tea

Tiandong can be used to brew tea individually or with the combination of other herbs. The most common way is to place 8 g of Tiandong slices and 1 g of green tea in boiling water for 5 min. Tiandong tea promotes the secretion of saliva, and is thought to quench thirst, and eliminate phlegm.

8.4.2.2 Tiandong Wine

Tiandong can be used alone or with other herbal medicines to aid in the improvement of health benefits in certain wines. The most common way is to put Tiandong (center part of root removed) into the bottle of wine for approximately 15 days. Tiandong wine provides a range of health benefits for women, and has a sweet and refreshing taste.

8.4.2.3 Tiandong Maidong Snow Pear Soup

The soup ingredients comprise 10 g of Tiandong, 10 g of Maidong (root tuber of *Ophiopogon japonicus*), one snow pear (core removed), sugar, and water. After boiling, it is left to simmer for 1 h. Tiandong and Maidong are the cold properties that contain nourishing components for women, while the snow pear is rich in dietary fiber and pectin.

8.4.2.4 Sugar-Free Tiandong Sweetmeat

Tiandong Sweetmeat is traditionally a famous food of Sichuan province in China [7], which is sweet and tasty. Usually fresh Tiandong is used, and xylitol is used instead of white granulated sugar. This sugar-free sweetmeat is suitable for special populations such as patients with diabetes, hypertension, hyperlipidemia, and obesity, and the elderly people.

8.4.2.5 Tiandong Black Bean Porridge

The porridge is made by cooking 30 g of Tiandong with black beans, black sesame seed, glutinous rice, and a little bit sugar. It is suitable for those who always feel dizzy or for people with blurring vision and tinnitus. In addition, it improves soreness of waist, neurasthenia, and constipation.

8.5 Clinical Evidences

Oral administration of Tiandong Tablet (each tablet contains 0.3 g crude herb), 9 tablets/time, 3 time/day, or intravenous injection with Tiandong (60 g/time) diluted with saline or glucose solution 10–30 ml, 1 time/day and 20 days as a course of treatment, was effective for the treatment of breast lobular hyperplasia. The interval between two courses could be 7–10 days. In clinical trials, 42 cases received this treatment, and 16 cases were cured and 19 cases showed efficaciousness and improvement. Generally, the tumors were softened and reduced, and vanished after 2–3 courses of treatment [10, 11].

8.6 Safety Evaluation and Toxicity Issues

Clinical reports on toxicity and side effects of Tiandong are rare.

References

1. Xu et al (2005) Studies on the active constituents of *Asparagi Radix*. *Nat Prod Res Dev* 17 (2):128–130 (in Chinese)
2. Ou et al (2010) A general situation and prospect of pharmacology and clinical application in *Asparagus Cochinchinensis* (Lour) Merr. *J Huaihua Univ* 29(2):69–71 (in Chinese)
3. Li et al (2000) The chemical structure and antioxidative activity of polysaccharide from *Asparagus cochinchinensis*. *Acta Pharmaceut Sin* 35(5):358–362 (in Chinese)
4. Weng et al (1993) Pharmacological screening of 9 medicinal plants of the Genus *Asparagus* (Liliaceae) in China. *J Shanghai Univ Tradit Chin Med* 20(2):107–111 (in Chinese)
5. Mandal et al (2000) Evaluation of antibacterial activity of *Asparagus racemosus* willd root. *Phytother Res* 14(2):118–119
6. Li et al (1995) Determination of constituents in *Asparagus* and *Rhizoma Anemarrhenae* polysaccharide using gas chromatography. *J Anhui Agr Sci* 23(4):380–382 (in Chinese)
7. Luo et al (2000) Inhibitory effects of ALWB and ACM on mice bearing tumor. *J Guiyang Med Coll* 25(1):15–16 (in Chinese)
8. Shen, Peng (1997) Efficacy analyses of 513 cases of hyperplasia of mammary glands treated with asparagine. *Gen Clin Med* 13(2):138–139 (in Chinese)
9. Wang (2011) The progress of clinical research on Tian Dong. *Chin Med Mod Dist Educ* 9 (23):60–61 (in Chinese)

10. Wu et al (2010) Treatment of breastlobular hyperplasia using traditional Chinese medicine. *Mod J Integr Tradit Chin W Med* 19(20):2591–2593 (in Chinese)
11. Wei et al (2011) The progress of the tradition Chinese medicine Tian Dong's research. *Hubei Agr Sci* 50(20):4121–4124 (in Chinese)