Technical Report

ISO/TR 18986

First edition
2024-02

Traditional Chinese medicine — Report on the global industry and standardization development of *Panax ginseng*

Médecine traditionnelle chinoise — Rapport sur le développement de l'industrie mondiale et de la normalisation du Panax ginseng

Reference number
ISO/TR 18986:2024(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 249, *Traditional Chinese medicine*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Panax ginseng is the dried root and rhizome of *Panax ginseng* C. A. Meyer. It has the effects of greatly tonifying the original qi, restoring the pulse and relieving collapse, invigorating the spleen and benefiting the lungs. It is used primarily for symptoms such as weakness, cold extremities with faint pulse and spleen deficiency with reduced appetite.[2] As a kind of rare and valuable Chinese materia medica, *Panax ginseng* has a long history of medicinal use. Its single and compound formulas, as well as a variety of modern preparations, play an important role in clinical practice. Furthermore, *Panax ginseng* is widely applied in many other fields such as food, healthcare and daily chemical products.

As one of the Chinese materia medica with the largest global trade volume, *Panax ginseng* occupies a large market scale. It is mainly cultivated in China, the Republic of Korea, the Democratic People's Republic of Korea, Japan and the Russian Federation, among which China and the Republic of Korea are the main countries for its production and consumption, accounting for over 80 % of the total yield in the world. In addition, *Panax ginseng* is also widely used in Europe and the United States, as well as some other countries in Asia.

Panax ginseng has been recorded in many national pharmacopoeias and regional standards. However, due to the restrictions on different national regulations and different purposes for standard development, the requirements specified by such pharmacopoeias and regional standards differ in their scope, items, indicators and other aspects.[3] The lack of unified quality and safety standards gives rise to some negative phenomena, such as unqualified and fake products available on the market, substandard products sold at high prices and confusion with specification and grades of *Panax ginseng* products. In addition, the lack of unified standards in terms of the terminology and processing technology leads to confusion with products' names and brings lots of difficulties not only to supervision authorities but also to consumers. Therefore, it is urgent to develop unified International Standards for the whole industry chain of *Panax ginseng*, including the production, processing, marketing and other links.

Standards for the whole industry chain of *Panax ginseng* would guarantee the sustainable development of the industry and international trade in the aspects of promoting the manufacturing, improving the quality, regulating the market and protecting the consumers' interests. This document conducts a comprehensive survey on the industry of *Panax ginseng* in terms of its origin and application history, medicinal value, geographical distribution, cultivation methods, processing methods, the development of industry, international trade and standardization status. It will be beneficial to provide reference and information support for the follow-up formulation of the International Standards for *Panax ginseng*.

Traditional Chinese medicine — Report on the global industry and standardization development of *Panax ginseng*

1 Scope

This document reports on the global industry and standardization development of *Panax ginseng*. It includes its origin and application history, medicinal value, geographical distribution, cultivation and processing methods, industry development, international trade, current status and development demands for standardization.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
fresh ginseng
ginseng root harvested from the field, before being washed

[SOURCE: ISO 19610:2017, 3.1]

3.2
washed ginseng
raw ginseng root washed with drinking water to remove any foreign matter and then used as the starting material for manufacturing red ginseng

[SOURCE: ISO 19610:2017, 3.2]

3.3
steamed ginseng
ginseng produced through a process of steaming the washed ginseng to gelatinize the starch content

[SOURCE: ISO 19610:2017, 3.3]

3.4
red ginseng
ginseng root from *Panax ginseng* C.A. Meyer, treated with steam and then dried and packaged as whole or cut roots

[SOURCE: ISO 19610:2017, 3.4]

4 Origin and application history

4.1 Origin

Panax ginseng is one of the oldest relict plants on earth. The character "參" was first discovered in the oracle bone inscriptions of the Shang Dynasty of China, dating back 3 500 years. The character "參" on the oracle bone was pictographic, showing the typical characteristics of the aboveground and underground parts of *Panax ginseng*.[4] *Fan Zi Ji Ran*[5] (《范子計然》), written in the Warring States Period (465 BC), clearly recorded the origin and properties of *Panax ginseng*, which is the earliest available document of *Panax ginseng*.

4.2 Application history in China

4.2.1 Qin and Han dynasties

The Qin and Han dynasties were the initial medicinal and clinical application stages of *Panax ginseng*. As recorded in *Sheng Nong's Herbal Classics*[6] (《神農本草經》), *Panax ginseng* has rich therapeutic effects, such as calming the spirit, improving vision, enhancing intelligence and prolonging life.

Medicine Inscribed Wooden Slips of the Han Dynasty in Wuwei[7] (《武威漢代醫簡》), the earliest literature on the clinical application of *Panax ginseng*, summarized the medication rules of *Panax ginseng* in treating various diseases. In the Eastern Han Dynasty, the clinical application of *Panax ginseng* was expanded and it was widely used in various formulas. In the *Treatise on Febrile Diseases*[8] (《傷寒論》), 23 of a total of 113 formulas contained *Panax ginseng*.

4.2.2 Jin and Southern-Northern dynasties

The clinical application of *Panax ginseng* was further explored in the Jin and Southern-Northern dynasties. The single prescription of *Panax ginseng* "Ginseng Powder" was first recorded in the *Handbook of Prescription for Emergency*[9] (《肘後備急方》) in the Eastern Jin Dynasty. It is mainly used for the treatment of sudden reversed flow of qi and life-threatening diseases. *Annotation of Materia Medica*[10] (《本草經集注》), written during the Liang Dynasty, elaborated the therapeutic effects of *Panax ginseng* on diseases occurring in specific Zang-fu organs, which extended the scope of functions and indications of *Panax ginseng*. The cultivation of *Panax ginseng* in gardens was first recorded in the *Individual Biography of Shi Le from The Book of Jin*[11] (《晉書·石勒別傳》).

4.2.3 Tang and Song dynasties

The Tang and Song dynasties witnessed the rapid development of application and dissemination of *Panax ginseng*. *Tang Materia Medica*[12] (《新修本草》), the first official pharmacopoeia of China, recorded in detail about the functions, indications, usage, properties and main production areas of *Panax ginseng*. In addition, a large number of prescriptions containing *Panax ginseng* is included in *Prescriptions Worth Thousand Gold for Emergencies*[13] (《備急千金要方》) and *Supplement to Invaluable Prescriptions for Ready Reference* [14] (《千金翼方》), with 445 and 310 prescriptions, respectively. With frequent foreign trade and exchange activities, *Panax ginseng* spread more widely overseas in the Tang Dynasty. *Panax ginseng* produced in the Bohai State (an ancient kingdom existing from 698 AD to 926 AD) was continuously paid to the central plains as tributes. Master Jianzhen, an eminent Chinese monk in Tang Dynasty, propagated the herb of *Panax ginseng* and its application to Japan. This herb is still preserved in Shosoin of Japan today.[15]

Traditional Chinese medicine writings flourished in the Song Dynasty. *Illustrated Classics of Materia Medica*[16] (《本草圖經》) first systematically described the morphological characteristics of the original plant of *Panax ginseng* in the form of illustrations. *Classified Materia Medica*[17] (《證類本草》) further explained the medicinal theory of *Panax ginseng*. In the Song Dynasty, the resources of *Panax ginseng* increased with the eastward expansion of its main production areas. Meanwhile, a quantity of *Panax ginseng* was imported through border trade to ensure domestic demand for medicinal use.[15]

4.2.4 Ming and Qing dynasties

The Ming Dynasty was the peak period of clinical theory and practical application of *Panax ginseng*. *Biography of Panax ginseng* (《人參傳》), the first monograph of *Panax ginseng*, comprehensively summarized its pharmacology and medicinal properties. On this basis, *Compendium of Materia Medica*[18] (《本草綱目》) made a detailed collation of the prescriptions and indications of *Panax ginseng*, including 67 prescriptions applied to 15 kinds of diseases. However, due to the severe destruction of resources, the production areas of *Panax ginseng* moved northward. Thus, the supply of *Panax ginseng* in the Ming Dynasty fell into a difficult period. Under such circumstances, the government opened cross-border markets to import large quantities of *Panax ginseng* from the Liao Dynasty and the Joseon Dynasty of Korea in order to ease domestic demand for supply. At the same time, large-scale artificial cultivation of *Panax ginseng* was realized through seed propagation among the people.[19]

In the Qing Dynasty, the theories and management of *Panax ginseng* were well developed. *Essential of Materia Medica*[20] (《本草備要》) divided *Panax ginseng* into "raw" and "cooked" ginseng. *Ginseng spectrum*[21] (《參譜》) discussed ginseng production, purchase and sales, identification of quality, processing methods and value in detail. At the same time, the authorities tightened the control over *Panax ginseng* by establishing monopoly institutions and implementing various policies and systems for the management of *Panax ginseng*. In addition, the grades and specifications of *Panax ginseng* were clearly specified.[22] In the late Qing Dynasty, the garden cultivation of *Panax ginseng* was rapidly developed to make up for the shortage of its natural resources.[15]

4.2.5 Modern times

Panax ginseng has been greatly developed covering such aspects as modern basic research, industrial scale and regulation supervision. With the development of modern medicine, biology and chemistry, people have a growing understanding of the pharmacological effects of *Panax ginseng*. Meanwhile, remarkable achievements have been made in the research of the material basis of *Panax ginseng*. Supported by modern science and technology, the industry of *Panax ginseng* continues to expand. The manufactured products of *Panax ginseng*, such as general food, health functional food, cosmetics and drugs have become the main components of the international industry of *Panax ginseng*. In order to promote the rapid and healthy development of this industry, relevant regulations and standards have been successively issued by various countries.

Panax ginseng was one of the first Chinese materia medica included in Chinese Pharmacopoeia 1963, with a detailed description of its source, processing, usage and dosage.[2] The industry development of *Panax ginseng* in the People's Republic of China can be roughly divided into four periods:

— Expansion period (1970 to 1990): A production model of high quality and high yield was achieved in terms of the planting of *Panax ginseng*.[23]

— Turbulent period (1990 to 2002): The conflict between the lands and forests on *Panax ginseng* cultivation led to a drop in price and a slowdown in the industry.

— Recovery period (2003 to 2012): The government paid more attention to the industry of *Panax ginseng* and facilitated with modern technology to promote its industry development.

— Growth period (2012 to present): The industry of *Panax ginseng* developed rapidly after its approval as "new resource food".

4.3 Application history in Korea

4.3.1 The Samhan Period

According to literature,[24,25] *Panax ginseng* has been cultivated and used to make medicine since the Samhan Period. It is recorded that *Panax ginseng* grown on the Korean peninsula was traded to the Tang Dynasty, China, during the periods of Kings Jinpyeong (A.D. 627) and Sungdeok (A.D. 723) of the Silla Dynasty.

4.3.2 Goryeo Dynasty (Goryeo Period)

The Goryeo period was characterized by active trade with neighbouring nations. Naturally, *Panax ginseng* was one of the major commodities actively traded with the outside world, including the Khitans, the Song Dynasty, the Yuan Dynasty and the Ming Dynasty.[26] During the period of King Injong (1123), *GoryeoDogyeong*[25] (《高麗圖經》) contains information regarding ginseng steamed (red ginseng of today) due to distribution issues, showing that people of the time steamed and dried ginseng for long-distance transport.

Panax ginseng was actively traded not only with China but also with Japan. In the reigning period of King Wu, Goryeo delivered ginseng as a gift when sending envoys to Japan to effectively handle trouble caused by Japanese pirates.[26] *Panax ginseng*, which was used as medicine and tributes during the Samhan period, was regarded as a commodity that royal families trade for profit and was subject to taxation in the Goryeo Dynasty. In particular, it was one of the nation's representative items considered significant in terms of diplomatic relations with China and Japan.

4.3.3 Joseon Dynasty

The clinical application and processing and cultivation method of *Panax ginseng* were greatly developed in the Joseon Dynasty. *Principles and Practice of Eastern Medicine*[27] published during the reign of King Seonjo contains more than 170 prescriptions based on *Panax ginseng*. Moreover, steamed ginseng in the Goryeo Dynasty was converted into pasam (steamed, compressed and threaded ginseng) and pansam (steamed, compressed and pasted ginseng) that are the ancestors of red ginseng.[28] During the periods of Kings Sukjong and Jeongjo, the red ginseng production method was fully developed to enable the stable and long-distance transport.

In the Joseon Dynasty, trading ginseng privately was thoroughly controlled, so that ginseng was used as medicine or tributes by the royal families or those in authority for profit.[28] However, the prices of *Panax ginseng* were sharply raised due to lack of wild ginseng, which requires the development of ginseng cultivation methods. *Imwongyeongjeji* shows that ginseng cultivation methods were fully established in the mid-Joseon Dynasty.[29] Against this backdrop, the development of *Panax ginseng* and red ginseng cultivation methods greatly contributed to the financial health of the nation and the royal families.

4.3.4 Modern times

Throughout the history of Korea, *Panax ginseng* has been traded as one of Korea's major commodities.[30] In 1899, the Ginseng Policy Team (Samjeonggwa) initiated producing red ginseng under the leadership of the central government. In 1908, the *Red Ginseng Monopoly Act* and the *Ginseng Tax Act* were promulgated to lead the government to monopolize the red ginseng market. The *Ginseng Policy Handbook (Samjeongyoram)* [30] published by the Ginseng Policy Team shows that research on ginseng cultivation methods, pest control, red ginseng manufacturing processes and the age of *Panax ginseng* optimized for red ginseng manufacturing was systematically conducted.

In 1996, the *Red Ginseng Monopoly Act* and the *Ginseng Industry Act* were abolished and established, respectively, thereby transferring the authority to control *Panax ginseng* and red ginseng to the private sector for the first time in 600 years. The *Ginseng Industry Act* specifies matters required for the cultivation, manufacturing and testing of *Panax ginseng* and ginseng products, leading *Panax ginseng* to be protected and promoted as a speciality and significantly increasing the number of related firms and red ginseng products. [30] After diverse animal and clinical tests, the functionality of *Panax ginseng* has been officially recognized in several areas by the Ministry of Food and Drug Safety.[31]

4.4 Application history in other countries

Panax ginseng is mainly used for Kampo medicines and health food in Japan. In ancient Japan, *Panax ginseng* was frequently used by Kampo practitioners.[32] With the prosperity of Kampo medicine, prescriptions containing *Panax ginseng* were more widely used in the treatment of several diseases. Japan attaches great importance to the quality standards of Kampo medicine preparations and *Panax ginseng* varieties with high extract content and short leaching time are often used as raw materials.[33]

Wild *Panax ginseng* is listed in the *Red Book of Primorsky Krai* as an endangered species in the Russian Federation. Cultivated *Panax ginseng* has been planted in Siberia since the 19th century. In 1968, it was included in the State Pharmacopoeia of the Soviet Union. *Panax ginseng* is popular in the Russian Federation as medicine, health products and food.[34]

5 Medicinal value

5.1 Traditional use

Panax ginseng has the effects of greatly tonifying the original qi, restoring the pulse and relieving collapse, invigorating spleen and benefiting lung, engendering fluid and nourishing blood, quieting the spirit and sharpening the wits. It is used primarily for symptoms such as weakness, cold extremities with faint pulse and spleen deficiency with reduced appetite.[2]

Both single and formulas of *Panax ginseng* can be used in traditional clinical application. Nevertheless, there are some incompatibilities. For example, *Panax ginseng* is antagonized by *Veratrum nigrum* root and rhizome, restrained by *Trogopterori* faeces and inhibited by *Raphanus sativus* seed.[18]

5.2 Modern application

5.2.1 Phytochemistry and pharmacological effects

Panax ginseng is mainly composed of saponins, polysaccharides, volatile oils, organic acids and esters, sterols, flavonoids, lignans, inorganic elements and vitamins.[35] A variety of pharmacological actions also have been proven in *Panax ginseng*, including anti-fatigue, anti-stress, anti-mutagenesis, anti-oxidation, anti-cancer, as well as protection of the cardiovascular system.[36]

Ginsenosides are well believed as the primary bio-active ingredients in *Panax ginseng*. More than 170 kinds of ginsenosides have been reported,[37] which can be mainly divided into protopanaxadiol type (PPD), protopanaxatriol type (PPT) and oleanolic acid type (OA) according to their structure properties. Ginsenosides of different types possess varied of pharmacological characteristics. For example, PPT is recognized for the effects of stimulating central nervous system, improving memory, nourishing and promoting protein synthesis, whereas OA exerts the effects of anti-inflammation and anti-platelet release.

Besides, polysaccharides and volatile oils are also important ingredients of *Panax ginseng*. Up to now, there have been reports of 64 polysaccharides[38] and 160 volatile oils from *Panax ginseng*.[39] Ginseng polysaccharides are mainly composed of neutral and pectin-like acidic polysaccharides, which play critical roles in enhancing immunity, anti-aging, anti-tumour and reducing liver injury. Ginseng volatile oils with special fragrance are primarily made up of sesquiterpenes, long-chain saturated acids and aromatic hydrocarbons. Among them, sesquiterpenes are the mostly constituents, while polyacetylenols such as panaxynol and panaxydoxynol are regarded as the principalcharacteristic compounds.[40] Ginseng volatile oil has significant effects on antifungal, anti-inflammatory, central nervous system depression and bi-directional regulation of blood pressure.

In addition, the traditional processing methods of *Panax ginseng* could alter its chemical composition and pharmacological effects to achieve the purpose of efficiency enhancing. Various processed *Panax ginseng* products have been exploited to better the therapeutic demands (see Clause 8).

5.2.2 Modern traditional Chinese medicine preparations

Ginsenoside monomer compounds, extract and preparations of *Panax ginseng* have been widely developed into drugs for the treatment of different diseases. Ginsenoside Rg3, 20 (S) -ginsenoside Rg3 and Ginsenoside Rd[41,42] have been developed into new anticancer and antiviral drugs. Capsules developed from the fruits and total saponins of *Panax ginseng* leaves have been used as adjuvant medicine for the treatment of coronary heart disease, climacteric syndrome, diabetes and tumours.[43,44] Ginseng polysaccharide injection has been also mainly used for fighting various chronic infections, diabetes and various immune diseases.[45]

5.3 Healthcare and functional products

Except for medicinal value, *Panax ginseng* has been widely developed into healthcare and functional products because of its rich nutrients. These products are mainly helpful for immunity enhancement, anti-aging, blood sugar control and auxiliary protective effects against liver injury, sleep improvement and anti-oxidation.[46]

Functional foods with *Panax ginseng* include capsules, sticks, ampoules, pills, drinks, baked food, prepared food and condiments For example, ginseng polysaccharide fermented milk beverage[47] is used for improving immunity, preventing and treating hypertension, and fermented ginseng rice wine is used for anti-oxidation, with rare saponin CK produced and the content of ginsenoside increased significantly after fermentation.[48]

The use of natural and non-toxic botanical sources has become the trend of cosmetics industrial development. Ginseng extracts and ginsenoside have been used in the field of cosmetics since the 1980s and nowadays have become the most widely used starting materials in plant cosmetics.[49] For example, moisturizing cream, whitening cream, facial mask, eye cream and shampoo made with *Panax ginseng* are mainly used to improve the antioxidant activity of skin cells, inhibit melanin transfer, improve skin colour and reduce hair loss.[50,51]

In addition, as a non-edible product, it is used in various ways such as cosmetics and toothpaste, and premium pet food and products using ginseng fruit, not the root, are being released.[52]

6 Geographical distribution

The production areas of *Panax ginseng* are mainly distributed in northeast Asia between latitude 33° N and 48° N. Information on the main production areas and climatic features is listed in Table 1.

Panax ginseng grows in special and strict conditions, mostly in deciduous broad-leaved forests or mixed coniferous broad-leaved forests hundreds of metres above sea level. It prefers sandy loam with loose texture, good ventilation, good drainage and high nutrient availability. As shade-tolerant plants, it is well adapted to a cool and moist climate. In addition, *Panax ginseng* is resistant to low temperature and prefers weakly scattered light rather than strong direct light. The relative moisture of the soil is usually maintained at 35,0 % to 50,0 % during the growth of *Panax ginseng*.[53] High soil moisture can restrain its root growth and result in root rot, while low soil moisture can lead to its poor growth.

Table 1 — Main production areas and climatic features of *Panax ginseng*

Country	Main production areas	Latitude	Climatic features
People's Republic of China	From Kuandian, Liaoning province in the south, to Yichun, Heilongjiang province in the north. Main production areas: Fusong, Changbai, Jingyu, Ji'an, Dunhua, Antu and other counties or cities of Jilin province	35° N to 48° N	Affected by multiple continental and monsoon climates, with annual rainfall of about 1 000 mm
Republic of Korea	Gyeonggi province, Gangwon province, north Chungcheong province, south Chungcheong province, south Jeolla province, north Jeolla province, north Gyeongsang province, etc. Main production area: Geumsan county	33° N to 42° N	Temperate monsoon climate with annual rainfall of around 1 500 mm
Democratic People's Republic of Korea	Kaesong, Kumchon, Pyongsan, Sohung, etc. Main production area: Kaesong	35° N to 42° N	Ocean climate with annual rainfall of 1 000 mm to 1 500 mm
Japan	From Shimane Prefecture at 35° N to Hokkaido Kitami at 44° N Main production area: Nagano and Fukushima Prefectures	35° N to 44° N	Temperate oceanic monsoon climate and mixed coniferous and broad-leaved forest climate with annual rainfall of 1 000 mm to 1 500 mm
The Russian Federation	Khabarovsk, Vladivostok, the Sikhot Mountains, Anochinsk and other places Main production area of wild *Panax ginseng*: Anozink	42° N to 48° N	Temperate monsoon climate with annual rainfall of 500 mm to 1 000 mm

7 Cultivation methods

7.1 General

Panax ginseng on the market is mainly divided into wild ginseng and cultivated ginseng. Wild ginseng usually refers to that grown in the natural environment without artificial intervention. It stands in a rather important position on the market due to its long growth period and high medicinal value. With the scarcity of wild ginseng resources, cultivated ginseng has become the mainstream variety. The exsiting cultivation methods of *Panax ginseng* are wild-simulated cultivation and field cultivation.

7.2 Wild-simulated cultivation

Wild-simulated cultivation is the method that *Panax ginseng* is artificially grown in the forest to simulate the growing environment of wild ginseng. Wild-simulated cultivation of *Panax ginseng* can be divided into two ways as direct seeds sowing and seedlings transplanting. *Panax ginseng* grown by wild-simulated method is called “woods-grown ginseng” on the market. *Panax ginseng* grown by seedling transplantation is also called “transplanted ginseng” on the market.

The growth period of woods-grown ginseng is usually more than 10 years. During its growth, the rate of seedling dropping and the growth period can be affected by artificial intervention. Those with frequent artificial intervention are usually of lower growth age. Studies have shown that the weight of *Panax ginseng*, increasing with its growth period, is positively correlated with ginsenosides Rg1, Rc and Rb1 and can significantly affect its medicinal value.[54] Thus, woods-grown ginseng of higher growth age is usually more expensive than the others due to its higher quality.

7.3 Field cultivation

For the advantages of shorter growth period and higher yield, the field cultivation method has gradually become a main cultivation mode of *Panax ginseng*. *Panax ginseng* cultivated in this way is usually called field-cultivated *Panax ginseng*.

"1/5 method" (more popularly used in the Republic of Korea), "2/4 Method" and "3/3 Method"are usually adopted for field-cultivated *Panax ginseng*. "1/5 method" means transplanting seedlings after 1-year seeds-growing and harvesting after 5-year planting. "2/4 method" means transplanting seedlings after 2-year seeds-growing and harvesting after 4-year planting. "3/3 method" is in a similar way. The quality of field-cultivated *Panax ginseng* is affected by many factors, such as land selection, soil improvement, seed treatment, cover-seeding, field management and the type of sheds. With the development of modern agricultural technology, a complete set of techniques of cultivation and rotation has been maturely applied.

Field-cultivated *Panax ginseng* can be harvested in 4 to 6 years. However, field-cultivated *Panax ginseng* with different years differs in the active ingredients. Its content of total ginsenoside is positively correlated with its growing years. Due to its advantages of short growth period, low input cost and relatively stable quality, field-cultivated *Panax ginseng* can be easily standardized in quality to better meet the market demand.

8 Processing methods[55,56]

8.1 Cleansing

Cleansing refers to removing the foreign matter on the surface of *Panax ginseng* root and rhizome by hand or machine washing. After cleansing, *Panax ginseng* root and rhizome without any other processing is called washed ginseng.

EXAMPLE When fresh ginseng is put into ginseng-washing machine, the feeding speed is adjusted to ensure that fresh ginseng is thoroughly washed. The water must be kept clear and free of silt before discharge. After discharging, it is put into a basket to filter the remaining water.

8.2 Drying

Drying refers to exposing the washed or steamed ginseng in the sun. *Panax ginseng* root and rhizome after being sun-cured or dried by oven is called dried ginseng.

EXAMPLE It is a better way to accelerate its drying speed and improve its colour if it is alternately sun-cured in the daytime and dried by oven at night.

8.3 Steaming

Steaming refers to heating washed ginseng in a steamer to gelatinize its starch. Generally, *Panax ginseng* root and rhizome can be steamed by cookstoves and ginseng-steaming machine. *Panax ginseng* root and rhizome treated with a whole procedure of steaming, drying and packing is called red ginseng, and that alternately processed with nine times of steaming and drying is called black ginseng.

EXAMPLE 1 A ginseng-steaming machine is often used to produce red ginseng in industry. The steaming procedure is performed during the three stages of elevating, maintaining and lowering its temperature and pressure, which will take 2 h or 3 h for the whole process.

EXAMPLE 2 "Nine steaming and nine exposure" processing method means steaming the fresh ginseng at 98 °C for 2 h to 3 h and then drying it in the air, repeatedly for nine times, to maximumly obtain the distribution and content of ginsenosides.

8.4 Sugaring

Sugaring refers that *Panax ginseng* root and rhizome is uniformly punched and soaked for 10 h to 12 h in a tank with boiled sugar. *Panax ginseng* processed this way is called sugared ginseng.

EXAMPLE After boiled and punched, the preliminary processed *Panax ginseng* root and rhizome is horizontally arranged in a tank with boiled sugar, soaked for 10 h to 12 h. It is then put on a plate to dry. When it is dried and no longer sticky, it is punched and soaked again using the above procedures. After that, it is put into cold water to remove the floating sugar and make it smooth and shiny.

8.5 Scalding

Scalding refers to soaking fresh ginseng in boiling water. *Panax ginseng* root and rhizome processed by a series of processing procedures, including removing rootlet, scalding, and cooling, is called full strength ginseng.

EXAMPLE In the process of scalding, the *Panax ginseng* root and rhizome is placed in a small basket with its rhizome downward. After that, the rhizome and half of the taproot are soaked in water for 5 minutes, and then the rest is soaked in water for about 10 minutes. After being removed from the water, it is immediately immersed in cold water for figuration. During the process of scalding, the water temperature is usually maintained at about 100 °C.

8.6 Freeze-drying

Freeze-drying refers to freezing the fresh ginseng at a low temperature in the freezer. *Panax ginseng* root and rhizome processed by vacuum freezing and drying technology is called freeze-dried ginseng.

EXAMPLE The clean and reshaped *Panax ginseng* root and rhizome are put in an air-tight freezer and frozen at a temperature of −20 °C to −30 °C. They are decompressed and heated up until the ginseng is dried and taken out.

8.7 Extraction

Both traditional and modern methods can be used to extract the active ingredients of *Panax ginseng* root and rhizome, such as ginsenosides, polysaccharides and volatile oils. The traditional methods mainly include decoction, impregnation and reflux. The modern methods mainly include microwave extraction, ultrasonic extraction and supercritical CO_2 fluid extraction.

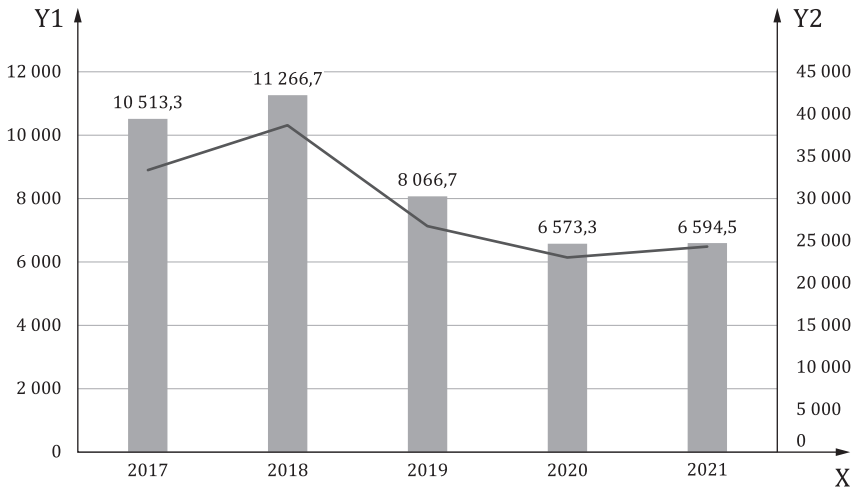
9 Development of industry and international trade

9.1 People's Republic of China

9.1.1 Yield and value

The total yield of *Panax ginseng* in China ranks first in the world, accounting for about 70,0 %. It is mainly distributed in eastern part of Jilin, Heilongjiang and Liaoning provinces.[57] According to statistics in 2019, the yields of *Panax ginseng* produced in Jilin province, Heilongjiang province and Liaoning province were 30 800 tons, 18 400 tons and 3 645 tons, respectively.[58]

Jilin province is the main production area of *Panax ginseng* in China. According to statistics,[59] the yield of *Panax ginseng* in Jilin province accounts for 60,0 % of China's yield and 40,0 % of global yield. Figure 1 shows the changes in cultivation area and yields of *Panax ginseng* in Jilin province from 2017 to 2021. In recent years, its industrial structure has been continuously optimized with its secondary and tertiary industries occupying a larger proportion.



Key

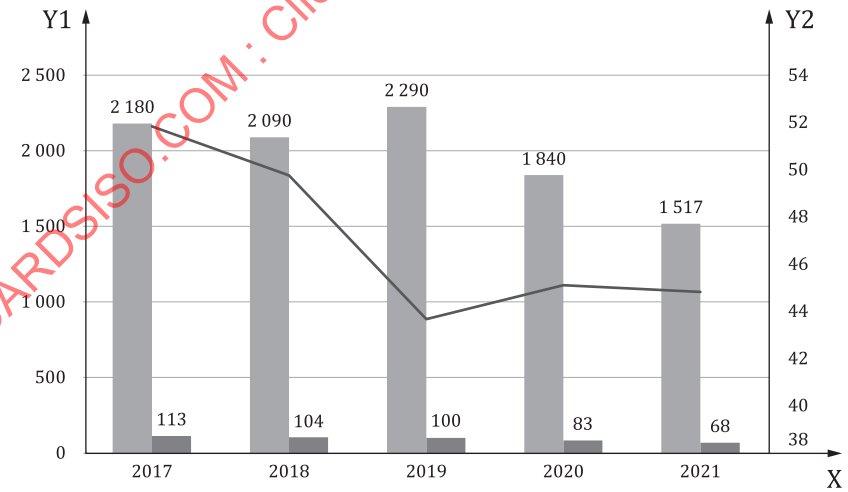
area (hectares)

yield (tons)

Figure 1 — Information on cultivation area and yield of *Panax ginseng* of Jilin province from 2017 to 2021

9.1.2 Import and export

Panax ginseng is important in the field of China's foreign trade business, accounting for more than 8,0 % of the total export value of Chinese materia medica. It has been exported to more than 40 countries and regions in the world, including Japan, Republic of Korea, Europe, the United States, Hong Kong and Macao, accounting for 65,0 % of its annual yield.[60] According to the data from China Chamber of Commerce for Import and Export of Medicines and Health Products (CCCMHPIE), from 2017 to 2020, the annual export volume of Chinese *Panax ginseng* has stabilized at about 2 000 tons, valuing about 100 million dollars. In 2021, its annual export volume decreased to 1 517 tons, valuing 68 million dollars (see Figure 2).



Key

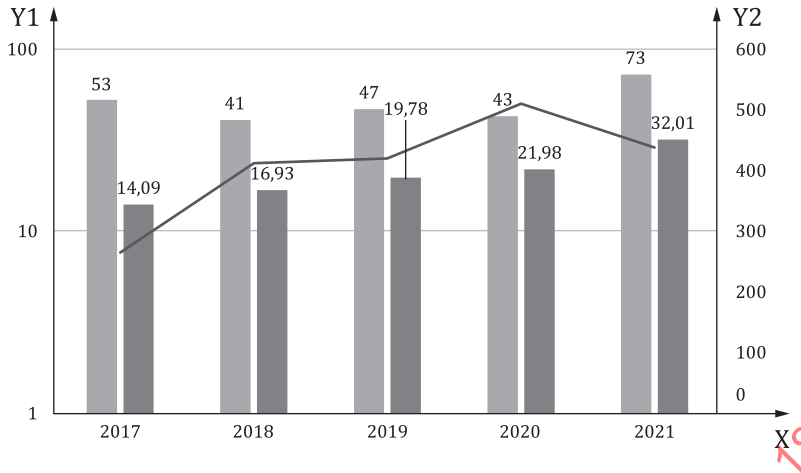
export volume (tons)

export value (million dollars)

average export price (thousand dollars/ton)

Figure 2 — Export statistics of *Panax ginseng* in China from 2017 to 2021

Red ginseng produced in the Republic of Korea is the main variety imported to China. From 2017 to 2020, its annual import volume has reached 40 tons to 50 tons, valuing 15 to 20 million dollars. In 2021, its annual import volume increased to 73 tons, valuing 32,01 million dollars (see Figure 3).



Key

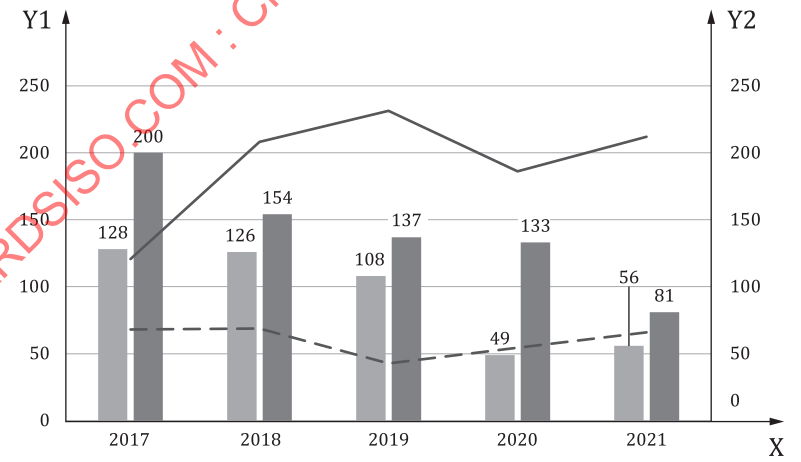
import volume (tons)

import value (million dollars)

average import price (thousand dollars/ton)

Figure 3 — Import statistics of *Panax ginseng* in China from 2017 to 2021

Hong Kong is the global distributing centre and transfer station of *Panax ginseng* for international trade. *Panax ginseng* from Hong Kong is mainly exported to the United States and Southeast Asian countries, accounting for about 30,0 % of the total world trade. As shown in Figure 4, according to the data from CCCMHPIE, the import and export volumes of *Panax ginseng* in Hong Kong are basically stable from 2017 to 2021, with the export volume stabilized at more than 100 tons. However, due to the outbreak of COVID-19, the export volume of *Panax ginseng* dropped to 49 tons in 2020. Hong Kong imports *Panax ginseng* mainly from the Republic of Korea, Malaysia and mainland China, ranging from 81 tons to 200 tons.



Key

export volume (tons)

import value (tons)

average export price (thousand dollars/ton)

average import price (thousand dollars/ton)

Figure 4 — Hong Kong's import and export statistics of *Panax ginseng* from 2017 to 2021

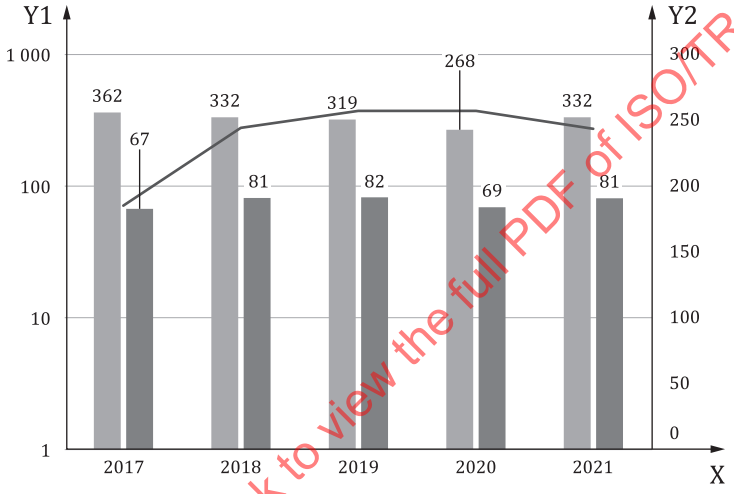
9.2 Republic of Korea

9.2.1 Yield and value

The cultivation area of *Panax ginseng* in the Republic of Korea maintained 15 000 hectares and the annual yield has reached over 20 000 tons, accounting for 17,0 % of the global yield. The main production areas of *Panax ginseng* in the Republic of Korea are Gyeonggi, South Chungcheong and North Jeolla Provinces. Each year, about 23,0 % of the *Panax ginseng* in the Republic of Korea is consumed in the form of high added-value products after the secondary processing.

9.2.2 Import and export

Panax ginseng produced in the Republic of Korea is mainly exported to mainland China, Hong Kong, Japan and other countries and regions in Asia. According to statistics from 2017 to 2021, the annual export volume of *Panax ginseng* in the Republic of Korea reached about 300 tons, with an average annual value of 75,98 million dollars (see Figure 5). Over 90,0 % of *Panax ginseng* produced in the Republic of Korea is exported to Asia, mainly to mainland China and Hong Kong, accounting for 70,0 % of its total export value.



Key

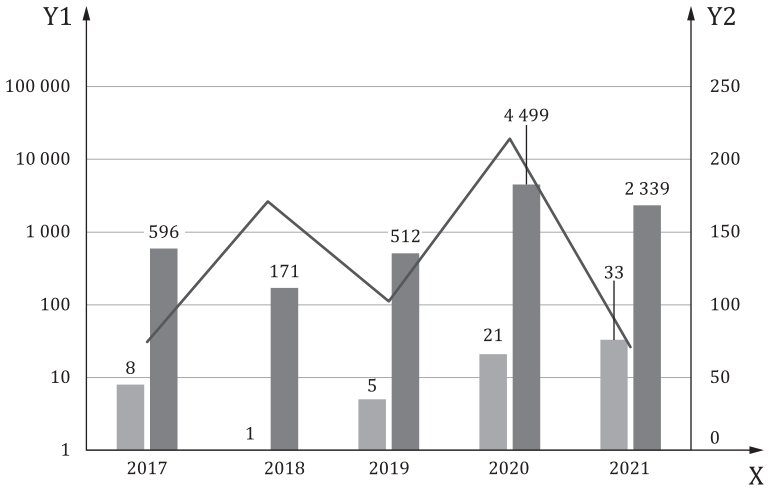
export volume (tons)

export value (million dollars)

average export price (thousand dollars/ton)

Figure 5 — Republic of Korea's export statistics of *Panax ginseng* from 2017 to 2021 (UN data)

Between 2017 and 2021, the average annual import volume of *Panax ginseng* in the Republic of Korea ranged from 1 ton to 33 tons, which is less than 10 % of its exports (see Figure 6).



Key

import volume (tons)

import value (thousand dollars)

average export price (thousand dollars/ton)

Figure 6 — Republic of Korea's import statistics of *Panax ginseng* from 2017 to 2021 (UN data)

9.3 Analysis of global market

Panax ginseng is one of the Chinese materia medica with the largest global trade volume. China and the Republic of Korea are the main countries for its production and consumption. In addition, Europe, United States and Southeast Asia are also the main consumption markets of *Panax ginseng*.

China leads the *Panax ginseng* industry for its large cultivation area and high total yield. According to statistics of Figure 2 and Figure 3, its export volume is much larger than the imports. *Panax ginseng* produced in China is mainly sold in raw materials, supplemented by Chinese patent medicines and healthcare products, accounting for 80,0 % and 15,0 % of the total yield, respectively.[60] In recent years, China's *Panax ginseng* industry has maintained steady development and stepped into a new level with deep-processing products occupying a larger proportion.

The Republic of Korea has the advantage in *Panax ginseng* industry for its advanced processing technology. The process of *Panax ginseng* production in the Republic of Korea is highly organized, standardized and modernized. As a result, the Republic of Korea has achieved high exports in spite of its relatively small cultivation area and yield.

In addition to China and the Republic of Korea, *Panax ginseng* is also circulated and used in Japan, Europe and the Russian Federation. It is mainly used in the fields of Kampo medicines and health food in Japan. Meanwhile, European countries represented by Germany pay more attention to the research and development of *Panax ginseng* extracts and related products.

10 Standardization status and development demand

10.1 National pharmacopoeias

Panax ginseng, as one of the most distinctive Chinese materia medica, has been widely recorded in many national pharmacopoeias and regional standards. However, due to its pharmaceutical properties, the different national pharmacopoeias differ in its drafting concepts, technical requirements and evaluation indexes. The test items and requirements of *Panax ginseng* and its processed products recorded in different national pharmacopoeias and regional standards are listed in Annex A for additional information.

10.2 Laws and national standards

10.2.1 People's Republic of China

Panax ginseng, as an agricultural product and Chinese materia medica, has been used in China in a variety of fields, such as food, drugs, health food, food additives, and daily chemical products. Thus, there are many laws and regulations applicable to *Panax ginseng*, involving planting, processing, production, sales, inspection and so on. Except for *Chinese Pharmacopoeia*, Table 2 lists 19 existing national standards for *Panax ginseng*, including three standards for agricultural planting, 11 standards for quality and grades, two regulations for technical operations and three methods for detection and inspection.

Table 2 — National standards for *Panax ginseng* in China

Number	Standard	Title	Property
1	GB 6941-1986	Ginseng seed	Mandatory
2	GB 6942-1986	Ginseng seedling	Mandatory
3	GB/T 22531-2015	Operation rules of comprehensive protection and cultivation of wild ginseng	Voluntary
4	GB/T 18765-2015	Identification and grade quality standards of wild ginseng	Voluntary
5	GB/T 22532-2015	Identification and grade quality of transplanted ginseng	Voluntary
6	GB/T 22533-2018	Grade quality of cultivated ginseng	Voluntary
7	GB/T 22534-2018	Grade quality of fresh-keeping ginseng	Voluntary
8	GB/T 22535-2018	Grade quality of lyophilized ginseng	Voluntary
9	GB/T 22536-2018	Grade quality of dried ginseng	Voluntary
10	GB/T 22537-2018	Grade quality of boiled ginseng	Voluntary
11	GB/T 22538-2018	Grade quality of red ginseng	Voluntary
12	GB/T 22539-2018	Grade quality of sugar ginseng	Voluntary
13	GB/T 22540-2018	Grade quality of honeyed ginseng	Voluntary
14	GB/T 19506-2009	Product of geographical indication - Jilinchangbaishan ginseng	Voluntary
15	GB/T 22996-2008	Determination of ginsenosides in ginseng - LC-UV method	Voluntary
16	GB/T 17980.47-2000	Pesticide–Guidelines for the field efficacy trials(I)–Herbicides against weeds in root vegetables	Voluntary
17	GB/T 34789-2017	Cold of practice on good quality cultivation of ginseng	Voluntary
18	GB/T 31766-2015	The technical specification of wild ginseng processing and preservation	Voluntary
19	GB/T 41726-2022	Identification and detection methods of monomer ginsenoside	Voluntary
Key GB national standard T voluntary			

In addition to national standards, 14 industrial standards and 74 provincial standards have been published by relevant industries, provinces and cities in China according to their needs of industrial development. See Annex B, Tables B.1 and B.2 for additional information.

10.2.2 Republic of Korea

10.2.2.1 General

There are more than 30 laws and regulations about *Panax ginseng* in the Republic of Korea, nearly covering all fields of *Panax ginseng* industry, such as agricultural products, food and drugs. See Annex C, Table C.1 for additional information. Among them, *Ginseng Industry Act* and *Korea Food Code* are the most important laws.

10.2.2.2 Ginseng Industry Act

The current version of the *Ginseng Industry Act*, formulated in 1996, is the only national law for crops. It covers the important links, such as planting, processing, circulation, inspection, acquisition, R&D, import and export of *Panax ginseng*. Accordingly, *Enforcement Order of Ginseng Industry Act* and *Enforcement Regulations of Ginseng Industry Act* are promulgated to promote the enforcement of *Ginseng Industry Act*. These three laws and regulations together with other relevant laws and regulations applicable constitute a complete legal system of *Panax ginseng*.

This act applies to cultivated ginseng, not to wild mountain ginseng. Applicable products include fresh ginseng (Aquatic ginseng), red ginseng, Taiji ginseng, white ginseng, and other varieties of *Panax ginseng* (black ginseng and ginseng manufactured from fresh ginseng and notified by the Minister of Ministry of Agriculture, Food and Rural Affairs).

10.2.2.3 Korea Food Code

Korea Food Code is the basic law for food safety in the Republic of Korea. Provisions concerning *Panax ginseng* products were first recorded in *Korea Food Code* in 1988. The safety requirements about the pesticide residues limits of *Panax ginseng* were first specified in the *Korea Food Code* in 1996. This Code defines the classification of ginseng products in food raw materials, the definitions of related terms, the specifications of ginseng products as food and the determination methods of pesticide residues in food.

10.2.2.4 National standards

In addition to strict laws and regulations, *Panax ginseng* industry in the Republic of Korea is restricted by relevant standards. There are eight existing national standards for *Panax ginseng* in the Republic of Korea (see Table 3), including five standards for products, one for cultivation and two for detection. Among the five standards for products, there are three standards for ginseng products, one for dried ginseng and one for extracts.

Table 3 — National standards for *Panax ginseng* in the Republic of Korea

Number	Standard	Title
1	KS H 2117:2012	Ginseng tea
2	KS H 2152:2013	Testing methods for ginseng products
3	KS H 2153:2013	Ginseng and ginseng products — Determination of ginsenoside contents — Method by high performance liquid chromatography
4	KS H 2177:2013	Ginseng extracts
5	KS H 2178:2013	Dried ginseng
Key KS Korean standard H food sector M chemical sector		

Table 3 *(continued)*

Number	Standard	Title
6	KS H 2304:2015	Ginseng beverage
7	KS H 3117:2014	Chicken stew with ginseng
8	KS M[c] 3495–2006	Reclaimed plastics bars in ginseng cultivation for sun protective screen
Key KS Korean standard H food sector M chemical sector		

10.2.3 Other countries

In addition to China and the Republic of Korea, Europe is also a main market for *Panax ginseng*. The Russian Federation and Spain have also developed standards for the cultivation and relevant products of *Panax ginseng* (see Table 4).

Table 4 — Standards for *Panax ginseng* in other countries

Number	Standard	Title	Country
1	ГОСТ 10064-1962	Ginseng wild growing	The Russian Federation
2	ГОСТ 23938-1979	Ginseng culture growing fresh. Specifications	The Russian Federation
3	UNE 84667:2006	Cosmetic raw materials. Plant extracts. Ginseng hydroglycolic extract (*Panax ginseng* C.A. Meyer).	Spain
4	UNE 84667	Ginseng hydroglycolic extract	Spain

10.3 Regional standards

Codex Alimentarius Commission (CAC) is the only inter-governmental organization established by the Food and Agriculture Organization of the United Nations and World Health Organization in 1962 to coordinate food regulations and technical standards in member countries. The pesticide residue limits for different kinds of ginseng products are specified in the pesticide residue standards of CAC (see Table 5).

Table 5 — Categories required in the pesticide residue limits of CAC

Category	Pesticide residue limits
Panax ginseng	Fenoconazole, Azoxystrobin, Dioxonil, Tebuconazole, Dithiocarbamates
Dried ginseng and red ginseng	Fenoconazole, Azoxystrobin, Pyraxil, Chlorothalonil, Tebuconazole, Dithiocarbamates
Ginseng extract	Fenoconazole, Azoxystrobin, Tebuconazole

Regional standard for manufactured ginseng products was published by CAC in 2009. The standard for ginseng products was published in 2015, which is only applicable to edible ginseng products, rather than medicinal ginseng products (see Table 6).

Table 6 — CAC standards for ginseng products

Number	Standard	Title
1	CODEX STAN 295R-2009	Regional Standard for Ginseng Products
2	CODEX STAN 321-2015	Standard For Ginseng Products

10.4 International Standards

In 2009, ISO established the Technical Committee of Traditional Chinese Medicine (ISO/TC 249) and began to formulate International Standards for quality and safety of Chinese materia medica. So far, ISO has published two International Standards for *Panax ginseng*, including general requirements on seeds and seedlings and the industrial manufacturing process of red ginseng (see Table 7).

Table 7 — ISO standards for *Panax ginseng*

Number	Standard	Title
1	ISO 17217-1:2014	Traditional Chinese medicine — Ginseng seeds and seedlings — Part 1: *Panax ginseng* C.A. Meyer
2	ISO 19610:2017	Traditional Chinese medicine — General requirements for industrial manufacturing process of red ginseng (*Panax ginseng* C.A. Meyer)

10.5 Development demands for international standardization of *Panax ginseng*

Due to the increasing demands of the international market for Chinese materia medica and the restrictions on the varieties included in national pharmacopoeias and regional standards, the following points are worth concerning in terms of the formulation of international standardization of *Panax ginseng*:

a) Developing series standards of whole industry chain of *Panax ginseng* to ensure its quality and safety, break through the international trade barrier, and promote the rapid development of *Panax ginseng* industry.

b) Developing standards for quality and grading of *Panax ginseng* to regulate the order of market, promote superior products and eliminate inferior ones, thus ensuring the healthy and orderly development of *Panax ginseng* industry.

c) Developing standards for new forms of *Panax ginseng*, such as extracts, granules, ultrafine powder and other related products to expand the scope of its international use.

Annex A
(informative)

Information on quality standards of *Panax ginseng* and its processed products recorded in different national pharmacopoeias and regional standards

Panax ginseng, as one of the most distinctive Chinese materia medica, has been widely recorded in many national pharmacopoeias and regional standards, such as Chinese Pharmacopoeia,[2] the Korean Pharmacopoeia,[61] the Japanese Pharmacopoeia,[62] the US Pharmacopoeia,[63] European Pharmacopoeia,[64] British Pharmacopoeia[65] and Chinese Hong Kong Chinese Materia Medica Standards.[66] The test items and requirements of *Panax ginseng* and its processed products recorded in different national pharmacopoeias and regional standards are listed in order to clarify the differences (see Table A.1 and Table A.2).

Table A.1 — Referenced values of national and regional limits in *Panax ginseng* root and rhizome

Items		Authority regulation						
		Chinese Pharmacopoeia (2020)	**The Korean Pharmacopoeia (12th)**	**The Japanese Pharmacopoeia (18th)**	**The US. Pharmacopoeia (43-NF38)**	**European Pharmacopoeia (10.0)**	**British Pharmacopoeia (2013)**	**Chinese Hong Kong Chinese Materia Medica Standards (Volume 1)**
Plant species		*Panax ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.
Identification	Macroscopic features	√	√	√	√	√	√	√
	Microscopic features	√	√	√	√	√	√	√
	TLC	Reference crude drug; Ginsenoside Rb_1, Re, Rf and Rg_1	Ginsenoside Rg_1	Ginsenoside Rg_1	Arbutin; escin (The sequence of zones present in the chromatograms obtained with the reference solution and the test solution)	Arbutin; escin (The sequence of zones present in the chromatograms obtained with the reference solution and the test solution)	Arbutin; escin (The sequence of zones present in the chromatograms obtained with the reference solution and the test solution)	Ginsenoside Rb_1, Rc, Rf, Rg_1 and F_{11}
Examination	Moisture (%)	≤ 12,0	≤ 15,0	≤ 14,0	≤ 12,0	≤ 10,0	≤ 10,0	≤ 13,0
	Total ash (%)	≤ 5,0	≤ 5,0	≤ 4,2	≤ 8,0	≤ 7,0	≤ 7,0	≤ 4,0
	Acid-insoluble ash (%)	–	–	–	≤ 1,0	≤ 1,0	≤ 1,0	≤ 0,5
	Foreign matter (%)	–	≤ 2,0	≤ 2,0	≤ 2,0	–	–	≤ 1,0
Extractives	Water-soluble (%)	–	–	–	–	–	–	≥ 27,0 %
	Dilute ethanol-soluble (%)	–	≥ 14,0 %	≥ 14,0 %	≥ 14,0 %	–	–	≥ 22,0 %
Heavy metals	Arsenic	≤ 2,0 mg/kg	≤ 3,0 ppm	≤ 2,0 ppm	–	–	–	≤ 2,0 mg/kg
	Lead	≤ 5,0 mg/kg	≤ 5,0 ppm	≤ 15,0 ppm[a]	–	≤ 5,0 mg/kg	–	≤ 5,0 mg/kg
	Mercury	≤ 0,2 mg/kg	≤ 0,2 ppm		–	≤ 0,1 mg/kg	–	≤ 0,2 mg/kg
	Cadmium	≤ 1,0 mg/kg	≤ 0,3 ppm		–	≤ 1,0 mg/kg	–	≤ 1,0 mg/kg
	Copper	≤ 20,0 mg/kg	–	–	–	–	–	–

Key

√ index is set in the pharmacopeia

– index is not set in the pharmacopeia

[a] The heavy metals are the metallic inclusions that are darkened with sodium sulfide test solution in acidic solution, as their quantity is expressed in terms of the quantity of lead (Pb), not more than 15 ppm.

Table A.1 *(continued)*

Items	Authority regulation						
	Chinese Pharmacopoeia (2020)	**The Korean Pharmacopoeia (12th)**	**The Japanese Pharmacopoeia (18th)**	**The US. Pharmacopoeia (43-NF38)**	**European Pharmacopoeia (10.0)**	**British Pharmacopoeia (2013)**	**Chinese Hong Kong Chinese Materia Medica Standards (Volume 1)**
Residual pesticides	PCNB: ≤ 0,1 mg/kg; Total BHC: ≤ 0,1 mg/kg; Heptachlor: ≤ 0,05 mg/kg; Chlordane: ≤ 0,1 mg/kg	"Dried Ginseng" in [Attachment 5] MRLs for Ginseng in KFDA Notice "Standards and Specifications for Food."	Total DDTs: ≤ 0,2 ppm; Total BHCs: ≤ 0,2 ppm	Meets the requirements in Pesticide residue analysis <561>	69 kinds of pesticide residues shall not be detected	–	Aldrin and Dieldrin: ≤ 0,05 mg/kg; Chlordane: ≤ 0,05 mg/kg; DDT: ≤ 1,0 mg/kg; Endrin: ≤ 0,05 mg/kg; Heptachlor: ≤ 0,05 mg/kg; Hexachlorobenzene: ≤ 0,10 mg/kg; Hexachlorocyclohexane isomers: ≤ 0,30 mg/kg; Lindane: ≤ 0,60 mg/kg; Quintozene: ≤ 1,0 mg/kg
Sulfur dioxide residues	≤ 150,0 mg/kg	≤ 30,0 ppm	–	–	–	–	≤ 150,0 mg/kg
Assay	Total of Ginsenoside Rg_1 and Re: ≥ 0,30 %; Ginsenoside Rb_1: ≥ 0,20 %	Ginsenoside Rg_1: ≥ 0,10 %; Ginsenoside Rb_1: ≥ 0,20 %	Ginsenoside Rg_1: ≥ 0,10 %; Ginsenoside Rb_1: ≥ 0,20 %	Ginsenoside Rg_1: ≥ 0,20 %; Ginsenoside Rb_1: ≥ 0,10 %	Total of Ginsenoside Rg_1 and Rb_1: ≥ 0,40 %	Total of Ginsenoside Rg_1 and Rb_1: ≥ 0,40 %	Total of Ginsenoside Rg_1 and Re: ≥ 0,19 %; Ginsenoside Rb_1: ≥ 0,20 %

Key

√ index is set in the pharmacopeia

– index is not set in the pharmacopeia

[a] The heavy metals are the metallic inclusions that are darkened with sodium sulfide test solution in acidic solution, as their quantity is expressed in terms of the quantity of lead (Pb), not more than 15 ppm.

Table A.2 — Referenced values of national and regional limits in steamed *Panax ginseng* root and rhizome (red ginseng)

Items		Authority Regulation					
		Chinese Pharmacopoeia (2020)	**The Korean Pharmacopoeia (12th)**	**The Japanese Pharmacopoeia (18th)**	**The US. Pharmacopoeia-Herbal medicines compendium (2017)**	**European Pharmacopoeia (10.0)**	**Hong Kong Chinese Materia Medica Standards (Volume 1)**
Plant species		*Panax ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.	*P. ginseng* C. A. Mey.
Processing method		Steaming	Steaming	Steaming	Steaming	Steaming	Steaming
Identification	Macroscopic features	√	√	√	√	√	√
	Microscopic features	√	√	–	√	√	√
	TLC	Reference crude drug; Ginsenoside Rb_1, Re, Rf and Rg_1	Ginsenoside Rg_1	Ginsenoside Rg_1	Ginsenoside Rg_1; USP powered Asian Ginseng Extract	*Arbutin*; escin (The sequence of zones present in the chromatograms obtained with the reference solution and the test solution)	Ginsenoside Rb_1, Re, Rf, and Rg_1
Examination	Moisture (%)	≤ 12,0	≤ 15,5	≤ 15,5	≤ 12,0	≤ 10,0	≤ 13,0
	Total ash (%)	–	≤ 4,5	≤ 4,5	≤ 5,0	≤ 7,0	≤ 4,0
	Acid-insoluble ash (%)	–	–	–	≤ 1,0	≤ 1,0	≤ 0,5
	Foreign matter (%)	–	≤ 2,0	≤ 2,0	≤ 1,0	–	≤ 1,0
Extractives	Water-soluble (%)	–	–	–	–	–	≥ 34,0 %
	Dilute ethanol-soluble (%)	–	≥ 18,0 %	≥ 18,0 %	≥ 3,0 %	–	≥ 28,0 %
Heavy metals	Arsenic	–	≤ 3,0 ppm	≤ 2,0 ppm	–	–	≤ 2,0 mg/kg
	Lead	–	≤ 5,0 ppm	≤ 15,0 ppm[a]	–	–	≤ 5,0 mg/kg
	Mercury	–	≤ 0,2 ppm		–	–	≤ 0,2 mg/kg
	Cadmium	–	≤ 0,3 ppm		–	–	≤ 1,0 mg/kg

Key

√ index is set in the pharmacopeia

– index is not set in the pharmacopeia

[a] The heavy metals are the metallic inclusions that are darkened with sodium sulfide test solution in acidic solution, as their quantity is expressed in terms of the quantity of lead (Pb), not more than 15 ppm.

Table A.2 *(continued)*

Items	Authority Regulation					
	Chinese Pharmacopoeia (2020)	**The Korean Pharmacopoeia (12th)**	**The Japanese Pharmacopoeia (18th)**	**The US. Pharmacopoeia-Herbal medicines compendium (2017)**	**European Pharmacopoeia (10.0)**	**Hong Kong Chinese Materia Medica Standards (Volume 1)**
Residual pesticides	PCNB: ≤ 0,1 mg/kg; Heptachlor: ≤ 0,05 mg/kg; Chlordane: ≤ 0,1 mg/kg	"Red Ginseng" in [Attachment 4] MRLs for Agricultural Products in KFDA Notice "Standards and Specifications for Food."	Total DDT's: ≤ 0,2 ppm Total BHC's: ≤ 0,2 ppm	Meets the requirements in Pesticide residue analysis <561>	69 kinds of pesticide residues shall not be detected	Aldrin and Dieldrin: ≤ 0,05 mg/kg; Chlordane: ≤ 0,05 mg/kg; DDT: ≤ 1,0 mg/kg; Endrin: ≤ 0,05 mg/kg; Heptachlor: ≤ 0,05 mg/kg; Hexachlorobenzene: ≤ 0,10 mg/kg; Hexachlorocyclohexane isomers: ≤ 0,30 mg/kg; Lindane: ≤ 0,60 mg/kg; Quintozene: ≤ 1,0 mg/kg
Sulfur dioxide residues	≤ 150,0 mg/kg	≤ 30,0 ppm	–	–	–	≤ 150,0 mg/kg
Assay	Total of Ginsenoside Rg_1 and Re: ≥ 0,25 %; Ginsenoside Rb_1: ≥ 0,20 %	Ginsenoside Rg_1: ≥ 0,10 %; Ginsenoside Rb_1: ≥ 0,20 %	Ginsenoside Rg_1: ≥ 0,10 %; Ginsenoside Rb_1: ≥ 0,20 %	Total of Ginsenoside Rg_1, Re, Rf, Rb_1, Ro, Rc, Rb_2, and Rd: ≥ 1,00 %	Total of Ginsenoside Rg_1 and Rb_1: ≥ 0,40 %	Ginsenoside Rb_1: ≥ 0,39 %; Ginsenoside Rf: ≥ 0,049 %; Ginsenoside Rb_1: ≥ 0,39 %; Total of Ginsenoside Rg_1 and Re: ≥ 0,34 %

Key

√ index is set in the pharmacopeia

– index is not set in the pharmacopeia

[a] The heavy metals are the metallic inclusions that are darkened with sodium sulfide test solution in acidic solution, as their quantity is expressed in terms of the quantity of lead (Pb), not more than 15 ppm.

Annex B
(informative)

Industrial and provincial standards of *Panax ginseng* developed by China

Table B.1 — Industrial standards of Panax ginseng developed by China

Number	Standard	Title
1	NY/T 32–1986	Recording method of ginseng field investigation
2	NY 316-1997	American ginseng products
3	NY 318-1997	Ginseng products
4	NY/T 1043–2016	Green food – Ginseng and American ginseng
5	NY/T 1604–2008	Environmental requirement for ginseng growing area
6	NY/T 1842–2010	Determination of ginsenosides in ginseng
7	NY/T 2301–2013	Ginseng—Vocabulary
8	NY/T 2332–2013	Determination of total sugars in red ginseng—Spectrophotometry
9	NY/T 2748–2015	Guidelines for the conduct of tests for distinctness, uniformity and stability: Ginseng(*Panax ginseng* C.A. Meyer)
10	NY/T 2784–2015	Technical specifications for red ginseng processing
11	SN/T 0794–2018	Rules for the inspection of American ginseng for import and export
12	SN/T 1001–2001	Method for the inspection of ginseng for export
13	SN/T 5131–2019	Identification method of *Panax ginseng* C.A.Meyer
14	LY/T 2474 –2015	Culturing technical regulations for transplanted wild ginseng
Key		
NY agricultural industrial standard		
SN industrial standard for commodity inspection		
LY forestry industrial standard		
T voluntrary		

Table B.2 — Provincial standards of Panax ginseng developed by China

Number	Standard	Title	Province
1	DB11/T 244–2004	Technical code of American ginseng cultivation in farmland	Beijing
2	DB11/T 323.1-2005	Quality standards for seeds of medicinal plants—Part1: American ginseng	Beijing
3	DB21/T 1381–2017	Technical code of *Panax ginseng* production	Liaoning
4	DB21/T 3009–2018	Technical code of reproduction of transplanted wild ginseng in Huanren	Liaoning
5	DB21/T 3010–2018	Identification and grade quality standards of transplanted wild ginseng in Huanren	Liaoning
Key			
DB provincial standard			
T voluntrary			

Table B.2 *(continued)*

Number	Standard	Title	Province
6	DB21/T 3115–2019	Technical code of sowing cultivation of *Panax ginseng* in mountainous areas of eastern Liaoning	Liaoning
7	DB2104/T 0002–2019	Technical code of *Panax ginseng* cultivation in Xinbin farmland	Liaoning
8	DB22/T 811–2108	American ginseng seed	Jilin
9	DB22/T 816–2018	Technical code of practice for American ginseng processing	Jilin
10	DB22/T 817–2019	Code for investigation of American ginseng production and field trials	Jilin
11	DB22/T 1066–2018	Technical specifications for American ginseng processing	Jilin
12	DB22/T 1233–2019	Ginseng safe production technical specification of pesticide application	Jilin
13	DB22/T 1531–2011	Determination of copper,lead and cadmium in ginsengs—inductively coupled plasma -mass spectrometry	Jilin
14	DB22/T 1532–2011	Determination of arsenic and mercury in ginsengs—Atomic fluorescence spectrometry	Jilin
15	DB22/T 1535–2011	Determination of aflatoxin B1 in Ginsengs—Liquid chromatography	Jilin
16	DB22/T 1562–2012	Technical specifications of insurance loss exploration for ginseng planting	Jilin
17	DB22/T 1605–2012	Rapid and nondestructive detection of ash content,moisture,water-insoluble solids,water-saturated butanol extract in the Ginseng —Near infrared spectroscopy	Jilin
18	DB22/T 1668–2012	Determination of total ginseng saponin component in Ginseng foods— Spectrophotometric method	Jilin
19	DB22/T 1670–2012	Determination of Lignin content in *Panax ginseng*— Spectrophotometric method	Jilin
20	DB22/T 1680–2012	Determination of kresoxim-methyl residues in ginseng and its products—LC-MS/MS method	Jilin
21	DB22/T 1685–2012	Determination of ginseng polysaccharides in Ginseng— Spectrophotometric method	Jilin
22	DB22/T 1726–2012	Guidelines for safe application of 12 pesticides on ginseng	Jilin
23	DB22/T 1727–2012	Technical guidelines of plant protection for safe production of ginseng	Jilin
24	DB22/T 1728–2012	The safety and quality production technical specification of ginseng	Jilin
25	DB22/T 1729–2012	Construction standard of *Panax ginseng* production base	Jilin
26	DB22/T 1730–2012	Technical regulations of *Panax ginseng* cultivated under forest production	Jilin
27	DB22/T 1736–2012	Nonforest land plant ginseng—Part1:Environmental Technology	Jilin
28	DB22/T 1746–2012	Technical specification for ginseng cultivated in farmland	Jilin
29	DB22/T 1812–2013	Rapid and nondestructive detection of polysaccharides in the Ginseng—Near infrared spectroscopy	Jilin
30	DB22/T 1847–2013	Determination of Phoxim residues in ginseng— LC-MS/MS Method	Jilin
31	DB22/T 1848–2013	The Method of Determining Azoxystrobin and 11 others Pesticide Residues in Ginsengs and its Productions	Jilin
32	DB22/T 1934–2013	Ginseng extract soap	Jilin

Key

DB provincial standard

T voluntrary

Table B.2 *(continued)*

Number	Standard	Title	Province
33	DB22/T 1975.1-2013	Application regulation of pesticides in ginseng Part 1: Application regulation of propiconazole in ginseng	Jilin
34	DB22/T 1975.2-2013	Application regulation of pesticides in ginseng Part 2: Application regulation of tebuconazole in ginseng	Jilin
35	DB22/T 1975.3-2013	Application regulation of pesticides in ginseng Part 3: Application regulation of myclobutanil in ginseng	Jilin
36	DB22/T 1975.4-2013	Application regulation of pesticides in ginseng Part 4: Application regulation of carbendazim in ginseng	Jilin
37	DB22/T 1975.5-2013	Application regulation of pesticides in ginseng Part 5: Application regulation of thiram in ginseng	Jilin
38	DB22/T 1975.6-2013	Application regulation of pesticides in ginseng Part 6: Application regulation of flumorph in ginseng	Jilin
39	DB22/T 1975.7-2013	Application regulation of pesticides in ginseng Part 7: Application regulation of pyraclostrobin in ginseng	Jilin
40	DB22/T 1975.8-2013	Application regulation of pesticides in ginseng Part 8: Application regulation of iprodione in ginseng	Jilin
41	DB22/T 1975.9-2013	Application regulation of pesticides in ginseng Part 9: Application regulation of prochloraz in ginseng	Jilin
42	DB22/T 1975.10-2013	Application regulation of pesticides in ginseng Part 10: Application regulation of cymoxanil in ginseng	Jilin
43	DB22/T 1975.11-2013	Application regulation of pesticides in ginseng Part 11: Application regulation of propamocarb in ginseng	Jilin
44	DB22/T 1975.12-2014	Application regulation of pesticides in ginseng Part 12: Application regulation of copper oxychloride in ginseng	Jilin
45	DB22/T 1975.13-2014	Application regulation of pesticides in ginseng Part 13: Application regulation of thiamethoxam·fludioxonil·metalaxyl-M in ginseng	Jilin
46	DB22/T 1975.14-2014	Application regulation of pesticides in ginseng Part 14: Application regulation of hetalaxyl-M·hymexazol in ginseng	Jilin
47	DB22/T 1975.15-2014	Application regulation of pesticides in ginseng Part 15: Application regulation of hexaconazole·kresoxim-methyl in ginseng	Jilin
48	DB22/T 1975.16-2016	Application regulation of pesticides on ginseng –- Part 16: propiconazole • azoxystrobin	Jilin
49	DB22/T 1975.17-2016	Application regulation of pesticides on ginseng – Part 17: trifloxystrobin and tebuconazole	Jilin
50	DB22/T 1975.18-2016	Application regulation of pesticides on ginseng Part 18: 1 billion living spores/g Bacillus subtilis	Jilin
51	DB22/T 1975.19-2016	Application regulation of pesticides on ginseng Part 19:100 billion living spores/g Bacillus subtilis	Jilin
52	DB22/T 1975.20-2016	Application regulation of pesticides on ginseng Part 20: 300 million CFU/g Trichodema harzianum	Jilin
53	DB22/T 2072–2014	Protocol for the identification of Ginseng new varieties — DUS testing (*Panax ginseng* C.A.Meyer)	Jilin
54	DB22/T 2192–2014	Ginseng soil conditioner	Jilin
55	DB22/T 2257–2015	General management rules of sensory identification for wild ginseng and transplanted ginseng	Jilin
56	DB22/T 2478–2016	Determination of ginsenosides in ginseng-gravimetric method	Jilin

Key

DB provincial standard

T voluntrary

Table B.2 *(continued)*

Number	Standard	Title	Province
57	DB22/T 2489–2016	Chinese-korean cuisine samgyetang	Jilin
58	DB22/T 2492–2016	Tsting agency staff behaviour	Jilin
59	DB22/T 2598–2016	Determination of indole acetic acid and indole butyric acid in ginseng ——HPLC-MS/MS method	Jilin
60	DB22/T 2758–2017	Black ginseng	Jilin
61	DB22/T 2992–2019	Determination of 20 pesticides residues including thiabendazole etc in ginseng -Ultra high performance liquid chromatography - tadem mass spectrometry	Jilin
62	DB22/T 3081–2019	Determination of 9 pesticides including procymidone etc resi-dues in soil for growing ginseng - GC method	Jilin
63	DB23/T 1016–2005	Determination of total ginsenosides in food—Spectrophotometry	Heilongjiang
64	DB23/T 2359–2019	Technical regulations of pollution-free production of American ginseng	Heilongjiang
65	DB37/T 1711–2010	Technical regulations of pollution-free production of American ginseng	Shandong
66	DB37/T 2913.1-2017	Technical regulations for American ginseng production Part 1: Seed treatment	Shandong
67	DB37/T 2913.2-2017	Technical regulations for American ginseng production Part 2:Primary processing	Shandong
68	DB37/T 3663–2019	Chinese herbal medicines traceability—Panacis quinquefolii radix	Shandong
69	DB61/T 445.1-2008	American ginseng seed	Shaanxi
70	DB61/T 445.2-2008	American ginseng seedling	Shaanxi
71	DB61/T 445.3-2008	American ginseng—Environmental conditions of production areas	Shaanxi
72	DB61/T 445.4-2008	Technical regulations for American ginseng cultivation	Shaanxi
73	DB61/T 445.5-2008	Technical regulations for control of disease, insect, rat, grass and pest of American ginseng	Shaanxi
74	DB61/T 445.6-2008	Fresh American ginseng	Shaanxi
Key DB provincial standard T voluntrary			