https://doi.org/10.26651/allelo.j/2022-55-1-1374 0971-4693/94 Euro 20.00
Allelopathy Journal 55 (1): 105-116 (January, 2022) *International Allelopathy Foundation* 2022
Table: 1, Figs : 2

Current Status of Research on Sanchi [*Panax notoginseng* (Burk) F.H. Chen] ginseng

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(Received in revised form: November 9, 2021)

CONTENTS

ABSTRACT

Notoginseng Radix et Rhizoma is the tuberous root and rhizome of *Panax notoginseng* (Burk) F.H. Chen, a perennial plant of Ginseng (family Araliaceae). Traditional Chinese Medicine (TCM) considers it has strong flavour and provides warmth in liver and stomach. It is highly effective medicine to treat blood stasis, haemorrhage and pain. Many scholars have conducted research on the *Panax notoginseng* allelopathy. This review attempts to provide insight into the records of Sanchi in TCM, verify its name, efficacy of its producing areas and information about its cultivation and medicinal development.

Key words: Allelopathy, current status, ginseng, herbal textual research, medicinal uses, original plant, *Panax notoginseng*, producing areas, rhizomes, roots, Sanchi, Traditional Chinese Medicine (TCM)

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1. INTRODUCTION

Sanchi (Fig. 1) is the dried roots and rhizomes of *Panax notoginseng* (Burk) F.H. Chen. In ancient times, it was primarily used as the key medicine to treat traumatic injuries and stop internal and external bleeding. In modern times, it is used in anti-thrombotic therapy and treatment of cerebrovascular diseases (17), post-operative haemorrhage, bleeding symptoms (32,34) and tumors (28). Many in-depth studies have been conducted on its efficacy and ingredients, but till now there is no comprehensive review of existing literature. Therefore, this article aimed to examine TCM literature by focusing on the naming of the original plant, production areas, its cultivation and medical efficacy of Sanchi.

Figure 1. Sanchi (*Panax notoginseng*) plant

2. DISCOVERY OF SANCHI

Sanchi had ancient literature. The first book "*Die Sun Miao Fang*", written in 1523, is the earliest record of Sanchi (27). It consisted of 133 prescriptions, 40 of which used the name "*Shensanqi*". In this Book, the herb was not recorded with the name "Sanchi" and there was no detailed description of its species and characteristics. Thus it is difficult to verify whether the herb in the ancient literatures is the same plant as the present *P. notoginseng*.

In the second book "*Yi Men Mi Zhi* (1576)" by Zhang Siwei (1526-1585 Ming Dynasty) mentioned Sanchi with the name of "Sanqicao". This book gave the earliest description of its characteristics. As per this book, Sanqicao is produced in Guangxi Province, China. It is pronounced as Sanqi because it has three branches and seven leaves. Its root is used as medicine and has an aroma like Baizhi (*Angelica dahurica*). Sanchi is sweet in taste, spicy in smell and warm. It cures blood stasis and cools the blood. These descriptions indicate that the "Sanqicao" has similarities with *P. notoginseng*, but still further research is needed to confirm, if these two refer to the same plant.

In the third Book "*Ben Cao Gang Mu* (1578)" by Li Shizhen (1518-1593) (10). Sanchi is used to treat hematemesis, non-traumatic haemorrhage, hemafacia, abscess, cellulitis, painful swelling from falls and leukorrhea. This book also described its morphology, nature and flavour, origin and efficacy, which are of great help for modern research on *P. notoginseng*. These texts provided sound basis for later generations to identify the authentic Sanchi.

In the Qing Dynasty (1636-1912), Sanchi was highlighted by the TCM doctors because of its powerful effects on treating blood stasis and haemorrhage. Its functions and clinical applications were also recorded in many books viz., "*Ben Cao Xin Bian* (1689)" (2) and "*Ben Cao Gang Mu Shi Yi* (1765)" (35) these books, mainly recorded the efficacy of Sanchi in improving the blood circulation etc. "*Ben Cao Gang Mu Qiu Zhen* (1769)" (5) recorded that Sanchi could cure stomach problem and blood heat and strengthen the liver.

Now the application of Sanchi has become more and more extensive. Since the establishment of the People's Republic of China (P.R.C), "*Chinese Pharmacopoeia*" was prepared. It was re-edited and revised every five years, and the "*Chinese Pharmacopoeia* (2020, XI Edition)" (16). It gives updated records of Notoginseng Radix et Rhizoma including its medicinal uses and the concentration of active ingredients.

We need to combine different terminologies used in documentations of Sanchi over dynasties and prepare a standardized description of Sanchi's morphology and functions.

3. ORIGIN OF SANCHI

According to the book "*Zhong Yao Zheng Bie Ming Ji* (1993)" (4), Sanchi is also called Shanqi, Jinbuhuan, Xueshen, Tianqi, Hansanqi and Panlongqi in different growing areas, because the people from different areas named it according to their understanding of its shapes, efficacy, producing areas, processing methods and harvesting time. Hence, Sanchi has many folk names mainly related to its phenotype characteristics.

The name Sanchi is based on the general morphology of leaves. "Sanchi has 3-branches and 7-leaves and so its name is Sanqi." (37). This nomenclature was later supported by many other scholars. Xu (23) distinguished between the definition of "leaf" in TCM classics and modern taxonomy by conducting comparative studies. *P. notoginseng* has only one palmately compound leaf with 3-leaflets, which after one year increase to seven.

Most books only gave Sanchi's characteristics in prescriptions but did not describe its form, smell and colour, hence, the identification of original plant of *P. notoginseng* is difficult. In literature, 3-species related to Sanchi are recorded in many editions of book "*Ben Cao Gang Mu*" (10) as under: (i). Dry roots and rhizomes of *P. notoginseng*, Araliaceae, the authentic Sanchi for today's understanding, (ii). *P. japonicus* (C. A. Mey.), Araliaceae, also known as Zhujiesanqi or Zhujieshen and (iii). *Gynura segetum* (Lour.) Merr., Compositae, called Tusanqi or Shuisanqi.

The research to identify the original Sanchi plant includes two parts: Species and Medicinal perspectives.

I. Species: The Book "*Ben Cao Gang Mu*" (10) mentioned 3-plants spp. (*P. notoginseng*, *P. japonicus*, *Gynura segetum*) given above. Both *P. notoginseng* and *P. japonicus* are dark yellow in appearance. *P. notoginseng* has round, short roots (*tuan*) with a firm and sturdy texture (*jie*), which is similar to the shape of *gen* (rhizomes) of *Baiji* (*Bletilla striata* (Thunb.) Reichb.f.). Another specie of Sanchi, *Gynura segetum* (Lour.) Merr., is described separately in the book: "This plant sprouts in spring and grows to three or four chi (1 chi = 33.3 cm) in summer". Li (10) also proposed methods to identify Sanchi. Later, ancient scholars improved the methods to identify "*tuanjiezhe*" Sanchi and "*changzhe*" Sanchi. Besides, the book "*Zhi Wu Ming Shi Tu Kao*" (1848) gave picture of Sanchi plant (Fig. 2) (21) and wrote that the Sanchi with leaves resembled tansy that was mentioned in the book "*Ben Cao Gang Mu*", is Tusanqi. These findings suggest that the above mentioned "*tuanjiezhe*" Sanchi is indeed the *P. notoginseng*, Araliaceae (31).

Figure 2. The picture of Sanchi in the Book "*Zhi Wu Ming Shi Tu Kao*"

II. Medicinal parts: The TCM (Traditional Chinese Medicine) literatures show that root is the key part of *Panax notoginseng* used in medicine, which stops the bleeding. Xia *et al*. (22) reported that *P. notoginseng* should be dug in autumn before flowering, washed and partitioned in main root, root branches and rhizomes, then dried to stimulate the *qi* and *yin*. Now the scholars with advanced instrumental analysis technology have analyzed the main active chemical compounds in different parts of *P. notoginseng*. They have found that besides *P. notoginseng*'s roots, its root branches, the stems, leaves and flowers can also be used as medicine to stop bleeding from trauma (38).

Thus the name Sanchi was changed to *P. notoginseng*, based on step-by-step standardization. In modern times, to ensure the safety and standardization of herbal medicines in their uses and to avoid confusion from synonyms, the Latin names for Chinese medicine are therefore universally adopted. *P. notoginseng* is the only source of Sanchi used as a medicinal herb. Since the Ming Dynasty, the rhizomes of *P. notoginseng*, *P. japonicus* and *G. segetum* have been used as medicinal herbs. In modern times, the spectroscopic and chromatographic studies compared the concentrations of active ingredients in each part of

these 3-medicinal herbs. Based on these chemical analysis, the *P. notoginseng* had the highest concentrations of active ingredients and its leaves and flowers can also be used as medicine and food.

4. SANCHI GROWING AREAS

4.1 History of Sanchi cultivation

Cultivation of Sanchi was first mentioned in southwest Guangxi Province in the book "*Yan Pu Za Ji* (1766)" by Zhao Yi (1727-1814) (36) in the Qing Dynasty. According to the "*Zhi Wu Ming Shi Tu Kao*" (21), local people cultivated Sanchi in 1840s. However, it was cultivated only by the chieftains rather than the ordinary farmers. Since 1930s, there were several records of cultivation of Wenshan *Panax notoginseng.* Since 1949, *P. notoginseng* has been cultivated under the management of local government. Presently, it is cultivated in Guangxi, Yunnan, Guangdong, Sichuan, Hunan, Guizhou and Fujian Provinces in China. The most worldwide famous one is Wenshan *Panax notoginseng* in Yunnan Province, which yields nearly 80 % Sanchi (19). Wang *et al*. (20) believed that the first cultivation of *P. notoginseng* should be earlier than the time recorded by Wu (21) because of the less exchange of information from ancient Wenshan. It is hoped to discover earlier historical records on *Panax notoginseng* cultivation in China.

4.2 Sanchi growing areas

Sanchi as described in book "*Ben Cao Gang Mu*" was "grown in caves and deep mountains in Nandan, Guangxi and other places" (10). Based on the verified records of Sanchi, Hechi (Nandan in the Ming Dynasty), Guangxi Province is the origin of Sanchi. The origin of Sanchi changed due to various factors. For example, allelopathic inhibitory effects, causes soil sickness i.e. plants cannot be cultivated continuously in the same field. Nowadays, *P. notoginseng* is primarily produced in Wenshan (11), which is 568 km away from Hechi. Due to the natural environment, its quality is excellent. TCM doctors emphasized the importance of authentic medicinal material for efficacy of treatment (29).

P. notoginseng is also sensitive to changes in environmental factors (light, heat and water). It grows well in a well-ventilated and shady environment (natural light transmittance 8 % to 20 %), temperature between 13 ^{o}C to 20 ^{o}C (13) and air humidity of 75 % to 85 %. The most suitable soil for growing *P. notoginseng* is the well drained forest sandy loam soil with PH 6 to 7.5 (26). The Guangxi province did not develop industries to use *P. notoginseng*, hence, its acreage decreased. In contrast, *P. notoginseng* produced in Wenshan has become very popular due to its promotion by government and commercial trade. As a result, Wenshan, Yunnan has gradually become the major growing area of *P. notoginseng*.

4.3 Factors affecting the growing area

Gu (3) reported the following factors affect the growing area : (i). Changes in natural geographical conditions, (ii). Reduction of natural resources, (iii). Discovery of new sources of medicinal materials, (iv). Change in species, (v). Change in clinical uses, (vi). Economic condition of production areas and (vii). Social factors such as war etc. These factors have

been divided as under in 3-categories: (I). Natural environment, (II). Social activities and (III). Ethnic culture and tradition.

4.3.1 Natural environment: Wenshan is situated in the Yunnan-Guizhou plateau, which has wide variations in daily temperature but less variations in annual weather. Furthermore, soil composition has great influence on the quality and yield of *P. notoginseng*. Zhang *et al*. (33) determined 13 micro constituents (sodium, magnesium, potassium, calcium, vanadium, manganese, iron, copper, zinc, arsenic, silver and platinum) in roots samples of Yunnan-produced and Guangxi-produced *P. notoginseng*. They found that the unique soil geological condition in Wenshan is responsible for the good quality of medicinal *P. notoginseng* (30). Additionally, Wenshan *P. notoginseng* grows in the unique fluvo-aquic soil with excellent drought resistance. Continuous cropping should be avoided and its crop rotation cycle is typically 10-years. Due to the soil sickness continuous cropping problems, the *P. notoginseng's* major production places may be forced to change.

4.3.2 Social activities: Besides the natural environment, human activities greatly influence the geographical distribution of Sanchi. As per the book "*Wen Shan Xian Zhi*", Sanchi was grown on a large scale for profit, which formed the basis for Sanchi cultivation in Wenshan. Meanwhile, Sanchi cultivation in Guangxi province developed spontaneously, unorganizedly and in a primitive manner, making the industrialization very difficult.

The *P. notoginseng* evaluation also progressed with the development of *P. notoginseng* production. With the powerful support of favourable government policies and Yunnan Baiyao, Ltd. (world-renowned Chinese pharmaceutical manufacturer) gradually developed the Chinese pharmaceutical industry. Besides, the Yunnan Baiyao Ltd., improved *P. notoginseng* marketing (7). To guide the scientific development of *P. notoginseng*-related industries in Yunnan, the Wenshan government in 2012 established the Wenshan Sanchi Research Institute and College. Its provided the standards for the *P. notoginseng*-related industry and helped to develop improved cultivation system of *P. notoginseng*. In contrast, Guangxi province neither provided any resources for Sanchi marketing, nor promoted the in-depth research on Sanchi and cultivation.

4.3.3 Ethnic culture and habit: In southwest China, Sanchi was the first medicinal plant discovered and used by the ethnic minorities, had strong emotional connection with the local people. For example, the book "*Qi Xiang Feng Wu Chuan Shuo* (2008)" cited 10-Sanchi-related legends. Besides, the novelists and poets have written many poems, songs, novels and drawings from the working life of Sanchi farmers (40). The ethnic minorities in Wenshan have combined their unique processing techniques with their traditional cultivation methods in Sanchi (6). Over hundreds of years, a professional cultivation pattern was developed and passed on to new generations (14,41). Despite the difficulties in *P. notoginseng* cultivation, the Wenshan region never stopped its cultivating, hence, become the major source to supply *P. notoginseng* accounting for > 90 % cultivation

area in China. These unique cultural and social factors of Wenshan also greatly contributed to its becoming the *P. notoginseng*'s major production area (30).

5. MEDICINAL EFFICACY OF SANCHI

Since ancient times, Sanchi had been used in a wide range of prescriptions and applications (16). Present scientific research has advanced the understanding of its application and efficacy. It is used to treat traumatic injuries, incised wounds, abscess and pyogenic skin infection, non-traumatic haemorrhage and hematemesis and metrorrhagia or metrostaxis, etc. This is consistent with the efficacy and usage of Sanchi recorded in ancient books in China (Table 1) (13).

Table 1. The TCM prescriptions of Sanchi in ancient Chinese books (13)

Chinese Dynasty	Year	Author	Book Title	Name of prescription	Application of prescription
Ming	1523	Yiyuan Zhenren	*Die Sun Miao Fang*	/	Traumatic injuries
Qing	1694	Feng Zhaozhang	*Feng Shi Jin Nang*	*Jiedu Zhibao Shen* Pill	Syphilis, toxic heat, bone-steaming
	1704	Cheng Yunpeng	*Ci You Xin Shu*	*Sanqi Huadu* Pill	Pyphilis, infantile malnutrition with sore, STDs in the genitals or anus with blotch
	1740	Wang Weide	*Wai Ke Zheng Zhi Quan Sheng Ji*	*Shengjin* Powder	Festering sores, incised wound
	1777	Dong Xiyuan	*Yi Ji Bao Jian*	Sanchi Ointment	Snakebite
	1842	Xie Yuanqing	*Liang Fang Ji Ye*	*Tuxue Shenxiao* Prescription	Hematemesis
	1852	Wang Jinfu	*Yi Fang Yi Jian*	*Dieda* Medicated Wine	Traumatic injuries
				Dieda Huanhun Pill	Traumatic injuries
				Shengji Prescription	Wound by cutting, stone, wood, etc., blood syndrome
	1886	Huang Tingjue	*Huang Shi Qing Nang Quan Ji Mi Zhi*	*Bali* Power	Traumatic injuries
				Qili Power	Traumatic injuries
	1883	Wang Qingyuan	*Yi Fang Jian Yi*	*Sanqi* Decoction	Heat injuring the blood vessels
	1893	Ma Peizhi	*Ma Pei Zhi Wai Ke Yi An*	*Shugan Ditan* Decoction	Slight hypochondrial swelling after the liver abscess
				Qinggan Huoyu Decoction	Blood stasis, pain due to *qi* stagnation
	——	Ling Huan	*Wai Ke Fang Wai Qi Fang*	*Zixia* Pill	Carbuncle in the back, tetanus, deep-rooted boil, traumatic injuries, infantile convulsion
		Huang Gaojing	*Gao Jing Zhi Zhi*	*Weijing* Decoction	Infantile cough for a long time

Reference: 13

In terms of preparing Notoginseng Radix et Rhizoma for the traditional medicine prescriptions, ancient TCM (Tradition Chinese Medicine) doctors steamed and used it as

medicine. Compared with raw Notoginseng Radix et Rhizoma, steamed Notoginseng Radix et Rhizoma is weaker in removing stasis and stopping bleeding, but has strong nourishment (17). In ancient China, Notoginseng Radix et Rhizoma's preparation methods included steaming, also included grinding with yellow rice wine or vinegar, stir-frying and torrefying with auxiliary material. These processed products stimulated and strengthened *qi*, blood and body (1). Steamed Notoginseng Radix et Rhizoma is widely used in clinical medicine, primarily for blood shortage caused by lack of blood production ability, massive bleeding, habitual postpartum fainting, etc. Steamed Notoginseng Radix et Rhizoma can also be used for physical weakness and deficiency of *qi* and blood, with patterns including pale complexion, dizziness, weakness of limb, lack of appetite and poor sexual functioning (15). Notoginseng Radix et Rhizoma has also been used clinically to treat nutritional-deficiency and anaemia. However, the gap remains in understanding the functional difference between raw and prepared Notoginseng Radix et Rhizoma (15).

In addition to the medicinal applications mentioned above, Sanchi also plays an important role in diet. Sanchi has been used as nourishment food in folk cultures (12). For example, steamed Notoginseng Radix et Rhizoma stewed with chicken can treat post-partum blood deficiency (24). It is also helpful to treat the blood deficiency (39).

The medicinal efficacy of raw and prepared Notoginseng Radix et Rhizoma has been continuously recorded since the ancient times. In ancient China, Sanchi was mainly used to treat trauma and gynecological diseases. Now, there is more understanding of various types of prepared Notoginseng Radix et Rhizoma and their clinical applications. In modern society, Notoginseng Radix et Rhizoma is also used to prevent diseases such as tumour and cancer (28). Given the current active research in exploring the functions and applications of Notoginseng Radix et Rhizoma, its extract may have greater uses in modern medicine and for the betterment of humanity.

6. SUMMARY AND PROSPECTS

P. notoginseng is a rare and famous medicinal herb with long history of TCM to treat diseases since ancient times. The book *Die Sun Miao Fang* (1523) (written in Ming dynasty) has recorded the Sanchi as herbal medicine. *P. notoginseng* was first clearly recorded as medicinal herb in "*Ben Cao Gang Mu* (1578)" by Li Shizhen.

In addition to removing stasis to stop bleeding and promoting blood circulation to relieve pain, Notoginseng Radix et Rhizoma also nourished, stimulated and strengthened the blood and *qi*. The steaming method to prepare Notoginseng Radix et Rhizoma for medicinal use improved its efficacy than raw Notoginseng Radix et Rhizoma but the difference is not well understood yet. The current annotation on the medicinal effects and clinical use of certain Chinese medicinal material are still not fully understood (25), hence, have limited application of Chinese medicine in foreign countries. In future, modern technologies can be used to fill the gaps in our understanding of TCM, particularly exploring the identification methods to verify the authentic Sanchi and potential new applications of TCM. Meanwhile, to achieve sustainable use of Sanchi, it is important to set the standards to define the product

quality, classify Sanchi's different quality levels, rationalize the growing area and trading flow, define the industrialization strategies and strengthen the cultural dissemination and development of Sanchi.

Wild Sanchi was cultured in Guangxi Province, China as early as the Ming Dynasty. After the Qing Dynasty, the main producing area of Sanchi gradually shifted from Guangxi to Wenshan due to the natural environment, ethnic culture and social perspectives. All these researches lead to study the allelopathy of *P. notoginseng*, especially the mechanism of influencing the soil microorganisms. Therefore, more research should be done on applied aspects of allelopathy to overcome the problem of soil sickness due to its long cropping season of 8-10 years.

7. ACKNOWLEDGEMENTS

This study was financially supported by the Fundamental Research Funds for the Central Universities of China, the "Comprehensive evaluation of the quality of *Panax notoginseng* medicinal materials from different origins based on the concept of precision medicinal materials" project (2020-JYB-ZDGG-049), Open Research Fund of Zhejiang Tiantong Forest Ecosystem National Observation and Research Station (TTK201905), Hangzhou West Lake Scenic Area Science and Technology Development Project (2019-008).

CONFLICT OF INTEREST

The authors announce that they have no conflict of interest.

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PUBLISHER NOTE