

Research Progress in Medicinal Value and Application of *Gardenia jasminoides*

Liu Chuchu¹, Chen Shuyi²

¹ Institute of Life Science, Jiyang College of Zhejiang A&F University, Zhuji, China

² Cuixi Academy of Biotechnology, Zhuji, China

✉ Corresponding author email: natasha@sophiapublisher.com

Medicinal Plant Research, 2023, Vol.13, No.2 doi: [10.5376/mpr.2023.13.0002](https://doi.org/10.5376/mpr.2023.13.0002)

Received: 07 Jul., 2023

Accepted: 12 Jul., 2023

Published: 20 Jul., 2023

Copyright © 2023 Liu and Chen, This is an open access article published under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preferred citation for this article:

Liu C.C., and Chen S.Y., 2023, Research progress in medicinal value and application of *Gardenia jasminoides*, Medicinal Plant Research, 13(2): 1-5 (doi: [10.5376/mpr.2023.13.0002](https://doi.org/10.5376/mpr.2023.13.0002))

Abstract Zhīzǐ (*Gardenia jasminoides* Ellis), also known as Shānzhīhuā, Huángjīzǐ, Huángzhī, Huángzhīzǐ, Huángzhīhuā etc. in Chinese, belongs to the genus of *Gardenia* in the family of Rubiaceae. Its fruit is used as medicine in traditional Chinese medicine, called Shānzhīzǐ, or Zhīzǐ, Shēngzhīzǐ, etc., with cold nature and bitter taste. *Gardenia jasminoides* is the first batch of dual-use resources issued by the Ministry of Health. It has the functions of liver protection, cholagogue, hypotension, sedation, hemostasis, detumescence, anti-inflammatory, antioxidant, and anti-hyperglycemia. It is used to treat icterohepatitis, hypertension, diabetes mellitus, etc. The main effective components of *Gardenia jasminoides* include iridoid, crocin, geniposide, etc. This review focuses on the effective components and pharmacological effects of *Gardenia jasminoides*, providing a reference basis for the further study of *Gardenia jasminoides*.

Keywords *Gardenia jasminoides* Ellis; Traditional Chinese medicine; Medicinal value; Effective components

Zhīzǐ (*Gardenia jasminoides* Ellis) is a plant of *Gardenia* genus in the family of Rubiaceae, with about 250 species distributed in tropical and subtropical regions. There are 4 species in China, produced in Shandong, Henan, Jiangsu, Anhui, Zhejiang, Jiangxi, Fujian, Taiwan, Hubei, Hunan, Guangdong, Hong Kong, Guangxi, Hainan, Sichuan, Guizhou and Yunnan. *Gardenia jasminoides* is also cultivated in Hebei, Shaanxi, and Gansu. Among them, the *Gardenia jasminoides* in Tanghe County, Henan Province has obtained the "National Geographical Indication Certification of Origin" and is the largest *Gardenia jasminoides* production base in China, known as the "Hometown of *Gardenia jasminoides* in China".

In fact, *Gardenia jasminoides* originated in China and is an ancient native herb. However, its initial use was not because of the flower, but because of its fruit. The fruit of the *Gardenia jasminoides* is very unique. It ripens between summer and autumn and has seven ridges, guarding the elliptical fruit. Because its fruit is red like a lantern and has a strong detoxifying effect, it was called "Mùdān" in the *Shénnóng Běncǎo Jīng* (*Classic of the Materia Medica*). It was recorded in *Běncǎo Jīng Shū* (*Annotations of the Classic of Materia Medica*) that "Zhīzǐ, qīng shǎoyīn zhī rē, zé wǔnèi xiéqì zì qù, wèizhōng rèqì yì chū (it roughly means that *Gardenia jasminoides* can treat the Shaoyin disease, so that the pathogenic qi of the five zang viscera can be eliminated, and the stomach qi can also be dispelled)". By the Han dynasty, the role of *Gardenia jasminoides* was mainly reflected in two aspects. One was as a medicine and the other was as a dye. Its fruit was the best raw material for dyeing yellow silk. The silk industry was developed during the Han dynasty, and many people relied on growing *Gardenia jasminoides* to obtain dyes and become rich. By the Wei, Jin and the Southern and Northern Dynasties, the appreciation of flowers of *Gardenia jasminoides* began to rise. At that time, aristocrats and wealthy people were popular in building gardens and extensively collecting rare and precious herbs to enrich their courtyards. In addition, *Gardenia jasminoides* flowers can also be eaten (Zhou, 2002). *Gardenia jasminoides* flowers are also called Zhānbó (from transliterated Sanskrit "Campaka"). *Shānjīā Qīnggòng* of the Southern Song Dynasty records a dish called "Zhānbójiān": "Take large petals, blanch them with hot water, dry them lightly, use licorice water to dilute the flour batter, and fry it with oil-coated dough." This dish fries the *Gardenia jasminoides* flowers after blanching them, dilutes the flour batter with licorice water, and fries them in oil-coated dough, creating a sweet taste.

The fragrance of the *Gardenia jasminoides* flower is rich and pleasant, and it is deeply loved by people. However, its appearance is plain and its shape is monotonous. Despite its admirable fragrance, it cannot be as popular as famous flowers such as orchids and peonies. Therefore, in ancient times, flower farmers began to selectively cultivate *Gardenia jasminoides* and developed many double-petaled varieties.

Due to the selective cultivation by flower farmers, *Gardenia jasminoides* is now generally divided into two types: "Medicinal *Gardenia jasminoides*" and "Ornamental *Gardenia jasminoides*". The original single-petaled wild *Gardenia jasminoides* is used as "Medicinal *Gardenia jasminoides*" (Figure 1) and their fruits are usually used in medicine. In contrast, *Gardenia jasminoides* with artificially cultivated double-petaled flowers are used as "Ornamental *Gardenia jasminoides*" (Figure 2), such as *Gardenia jasminoides* 'Flore Pleno', *Gardenia jasminoides* 'Radicans', and *Gardenia jasminoides* 'Veitchii'. These types of *Gardenia jasminoides* are basically non-fruiting, and even if there are fruits, they cannot be used medicinally.



Figure 1 *Gardenia jasminoides* used for medicine



Figure 2 *Gardenia jasminoides* for ornamental

1 Physiology and Ecological Characteristics of *Gardenia jasminoides*

Gardenia jasminoides is a shrub that can reach a height of 0.3 to 3 m. Its tender branches are often covered with short hairs, and the branches are cylindrical and grayish in color. The leaves are arranged oppositely or in whorls of three and are leathery. The flowering period is from 3 to 7 months, and the fruiting period is from May to February of the following year.

The dried fruit of the *Gardenia jasminoides* plant is elongated or oval-shaped, measuring 1 to 4.5 cm in length and 0.6 to 2 cm in width. Its surface is dark red or red-yellow in color and has 5 to 8 longitudinal ridges (Figure 3). When soaked in water, it can turn the water into a bright yellow color.



Figure 3 The dried fruit of *Gardenia jasminoides*

Gardenia jasminoides generally grows in wild fields, hills, valleys, slopes, and bushes or forests along streams at an altitude of 10 to 1 500 m. It prefers a warm and humid climate, likes sunlight but cannot withstand strong sunlight, and is suitable for growing in loose, fertile, well-drained, and slightly sticky acidic soil. It is a typical acid-loving flower. *Gardenia jasminoides* has strong resistance to harmful gases, strong sprouting ability, and is resistant to pruning.

2 Active Ingredients and Pharmacological Effects of Medicinal *Gardenia jasminoides*

The main active ingredients of medicinal *Gardenia jasminoides* include iridoid glycosides, gardenia yellow pigment, geniposide, organic acids, and others. Modern pharmacological studies have shown that *Gardenia jasminoides* has anti-inflammatory, analgesic, hepatoprotective, choleric, and lipid-lowering effects (Wang, 2015). Research by Chen et al. (2020) indicates that the dried mature fruit of the *Gardenia jasminoides* plant is not only an excellent natural pigment, but also an important traditional medicine used to treat various diseases, such as anti-inflammatory, detoxification, cooling blood, promoting blood circulation and removing blood stasis. Studies have shown that crocins and iridoid glycosides extracted from *Gardenia jasminoides* have antioxidant, anti-inflammatory, anti-atherosclerosis, anti-ischemic brain injury, anti-platelet aggregation, anti-hyperglycemic, anti-hyperlipidemia, and anti-hypertensive effects (Liu et al., 2013). Geniposide can inhibit the enzyme that inhibits insulin production, thereby promoting normal insulin secretion and improving diabetes.

2.1 Pharmacological effects of iridoid glycosides

Iridoids are a widely distributed class of special monoterpenoid secondary metabolites in the plant kingdom, which have various biological activities. They are mainly found in dicotyledonous plants such as Pyrolaceae, Gentianaceae, Scrophulariaceae, and Rubiaceae. These compounds have multiple biological activities (Zheng and Liu, 2009).

Iridoid glycosides are the main chemical components of medicinal *Gardenia jasminoides*. Studies have shown that they not only have significant hepatoprotective, choleric, antipyretic, and sedative effects, but also have a protective effect on ischemic brain injury. However, the mechanism of action requires further research (Yang et al., 2010).

2.2 Pharmacological effects and clinical applications of crocins in gardenia

Crocins are secondary metabolites extracted from the mature fruit of *Gardenia jasminoides*, with a total glycoside content of more than 83%. They have important pharmacological effects and are the main component of the internationally popular natural pigment "gardenia yellow" (Wang et al., 2018).

Crocins in *Gardenia jasminoides* have a certain impact on the nervous, cardiovascular, and respiratory systems. Experiments have shown that the effects of crocins on the nervous system may be related to their pharmacological activity (Zhang, 2000). Zheng et al. (1988) found that crocins also have the effects of reducing myocardial contractility, preventing and treating atherosclerosis, promoting blood circulation and removing blood stasis, regulating blood lipids, and so on. They can not only lower cholesterol and triglycerides, but also accelerate erythrocyte sedimentation rate, and are suitable for patients with hyperlipidemia. Clinical observations have shown that drugs containing crocins as the main ingredient have significant therapeutic effects in improving TC, TG, and other indicators in patients with hyperlipidemia, and can significantly improve the "numbness of limbs" symptoms exhibited by patients with "blood stasis" (Zhang, 2003).

2.3 Properties and pharmacological effects of geniposide

Geniposide, also known as jīngnípínggān in Chinese, is a relatively stable compound that does not undergo significant changes in gastric fluid with a pH of 1.8 at 37 °C. However, it can be metabolized into genipin in intestinal solution. Geniposide has various pharmacological effects, including laxative, analgesic, choleric, anti-inflammatory, treatment of soft tissue injuries, and inhibition of gastric acid secretion and pancreatic amylase. It is soluble in water and ethanol but insoluble in petroleum ether.

Geniposide is the main bioactive component in *Gardenia jasminoides*. Increasing pharmacological evidence has confirmed its various pharmacological properties, including neuroprotection, hepatoprotection, anti-inflammatory, analgesic, antidepressant, antioxidant, and immune regulation effects. Studies have suggested that geniposide could be a drug or lead compound for the prevention and treatment of various diseases, such as Alzheimer's disease (AD), Parkinson's disease (PD), diabetes, and diabetic complications (Zhou et al., 2019).

3 Application Prospects of Medicinal *Gardenia jasminoides*

In fact, as an ancient native herb in China, *Gardenia jasminoides* has a long history of use. Ancient books such as *Běncǎo Jīng Shū*, *Zūnshēng Bājiān · Yīnzhuàn Fúshí Jiān*, and *Shānjiā Qīnggòng* have recorded the medicinal and edible values of *Gardenia jasminoides*. Now, as one of the first batch of medicinal and edible resources issued by the Ministry of Health, *Gardenia jasminoides* has been widely used in the food, pharmaceutical, feed, and cosmetics industries.

In recent years, there have been many studies on the medicinal properties of *Gardenia jasminoides* and its comprehensive development and utilization, and its extraction methods and processing conditions have also been gradually optimized. A new type of compound agricultural growth promoter made from the geniposide in *Gardenia jasminoides* (Ni, 2006) and a drug for promoting blood circulation and lowering blood lipids prepared from the crocins have been applied in clinical practice.

In addition, people nowadays pay more and more attention to health and wellness, and it has been discovered that dietary fiber has good preventive and therapeutic effects on diseases such as diabetes and obesity. *Gardenia jasminoides* contains unique chemical substances that have high medicinal value. Therefore, researching the preparation of dietary fiber from *Gardenia jasminoides* and its application in food will become a research hotspot in the future (Wu et al., 2018, *Modern Food*, 23: 6).

With the deepening research on the medicinal value of *Gardenia jasminoides* and the continuous promotion of its comprehensive utilization, the application prospects of *Gardenia jasminoides* in medicine, health food, cosmetics, and other fields will be more extensive.

4 Conclusion

Based on the above research, we can confirm that the mature dried fruit of the *Gardenia jasminoides* plant is a traditional Chinese medicinal herb with a cold and cool property and a bitter taste. It has functions such as clearing heat and dampness, purging fire and relieving irritability, cooling blood and detoxifying, and clearing the liver and improving vision. *Gardenia jasminoides* fruit extract has various effects, such as antioxidant, anti-inflammatory, anti-atherosclerosis, anti-ischemic brain injury, anti-platelet aggregation, anti-hyperglycemia, anti-hyperlipidemia, and anti-hypertension. It can be used to prevent and treat a variety of diseases and has been applied in clinical practice. Some studies have investigated the active ingredients in *Gardenia jasminoides*, but the clinical application mechanisms, toxic and side effects, and other aspects still require further research.

Authors' contributions

LCC is the project leader, responsible for the conceptualization, initial drafting, revision, and finalization of the paper. CSY participated in the collection and organization of materials. Both authors read and approved the final manuscript.

Acknowledgments

We would like to express sincere gratitude to Dr. Fang Xuanjun for his careful review of the initial draft of this paper and for providing valuable criticisms and suggestions for improvement.

References

- Ni H.Y., Zhang Z.H., and Fu H.Z., 2006, Research and development of Fructus Gardeniae, *Zhongguo Zhongyao Zazhi* (China Journal of Chinese Materia Medica), 7: 538-541
- Wang T., 2015, Research Progress in Effective Constituents and Pharmacological Effects of Gardenia Jasminoides, *Zhongguo Yaoshi* (China Pharmacist), 18(10): 1782-1784
- Wang X.Y., Xu X., Liu M.M., Su P.P., and Wang P.L., 2018, Cloning and expression of *GjLCY b2* gene involved in crocins biosynthesis in fruits of *Gardenia jasminoides*, *Fenzi Zhiwu Yuzhong* (Molecular Plant Breeding), 16(13): 9
- Yang J.X., Zhang H.Y., Zhao C.C., Huang Q.W., and Yang M., 2010, Progress in studies on mechanism of gardenia iridoid glycosides for cerebral ischemic injury, *Zhongguo Shiyan Fangjixue Zazhi* (Chinese Journal of Experimental Traditional Medical Formulae), 6: 277-280
- Zhang L.Y., Ji H.F., Cao Y.P., and Ma X.H., 2000, Effects of crocins extracted from *Gardenia jasminoides* Ellis on nervous, cardiovascular and respiratory systems, *Zhongguo Yaokedaxue Xuebao* (Journal of China Pharmaceutical University), 31(6): 455-457
- Zhang H., 2003, A traditional Chinese medicine extracted from *Gardenia jasminoides* for reducing blood lipids and its preparation method, China Patent, CN1403124A
- Zheng Z.H., Dong Z.H., and Yu J., eds, *Modern Research and Application of Chinese Medicines* (Volume IV), Beijing: Xueyuan Press, 1988: 3166-3187
- Zheng L.S., and Liu X.Q., 2009, Advances in the Research of Iridoids, *Tianran Chanwu Yanjiu Yu Kaifa* (Natural Product Research and Development), 4: 702-71
- Zhou Y.X., Zhang R.Q., Rahman K., Cao Z.X., Zhang H., and Pen C., 2019, Diverse pharmacological activities and potential medicinal benefits of Geniposide, *Evidence-Based Complementary and Alternative Medicine*, 2019: 1-15
<https://doi.org/10.1155/2019/4925682>
PMid:31118959 PMCID:PMC6500620