

Studies on Chemical Constituents and Biological Activities of Medicinal Plants in Southwest China

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Abstract: The geographical and climatic conditions of Southwest China are abundant and rich in animal and plant resources. With the development of China's pharmaceutical industry, the importance of plant medicinal resources has increased significantly. However, there are few studies on medicinal plants in southwest China at home and abroad, especially the lack of research on the chemical constituents and biological activities of medicinal plants. This paper describes the types of medicinal plants in southwestern China, and analyzes the chemical composition and biological activity of medicinal plants in southwestern China. This study aims to provide a scientific basis for the conservation, sustainable use and rational development of such plant resources.

1. Research background

1.1 Literature review

Yang et al analyzed chemical constituents such as phenylpropanoids, triterpenoids, flavonoids, benzoic acid and phenols, aliphatic chain hydrocarbons and steroids. These chemical components were found to have anti-inflammatory and analgesic effects, anti-oxidation effects, antiviral effects, anti-tumor effects, and activating blood circulation and removing blood stasis (Yang et al, 2016). Cai et al found that boswellic acid has anti-inflammatory, anti-bacterial, anti-tumor and other pharmacological activities (Cai et al, 2016). Lu et al. gave a brief overview of the main components of the medicines such as Xinmailong Injection, Ganlong Capsule and Rehabilitation New Liquid. The comprehensive description of the Chinese medicine in tissue repair, liver protection, myocardial protection and anti-inflammatory Swelling and other effects, and proposed secondary metabolites such as isoflavones and isocoumarins (Lv et al, 2017). Zhang et al conducted in-depth research on the unique plant gold iron lock in southwestern China, from traits, reproduction and cultivation techniques, Chemical composition, pharmacological activity, resource distribution, tissue culture, etc. were elaborated (Zhang et al, 2013). Han et al. found that quinones, lignins, flavonoids, and volatile oils were common in pine plants. It has good anti-tumor, antibacterial, anti-aging and antioxidant activities (Han and Zhang, 2018).

1.2 Purposes of research

The location is rich in plant resources due to the geographical location and climatic conditions of Southwest China. Among plant resources, medicinal plant resources play an important role in providing good material guarantee for local economic development (Yang et al, 2016). With the development of China's pharmaceutical industry, the importance of plant medicinal resources has increased significantly. However, there are few reports on medicinal plants in southwest China at home and abroad, especially the lack of chemical composition and biological activity of medicinal plants in the region. This paper analyzes the types of medicinal plants in southwestern China. Analyze the chemical composition and biological activity of medicinal plants in southwestern China. In order to provide a scientific basis for the protection, sustainable use and rational development of such plant resources.

2. Analysis of medicinal plant species in southwest china

There are many varieties of medicinal plants in southwestern China, and according to surveys, there are about 4,800 species. Therefore, the southwestern region has the reputation of the medicinal plant kingdom. In the southwestern region, Yunnan medicinal plants account for about 30% of the total number of medicinal plants in the country. There are approximately 4,758 medicinal plants. Yunnan ranks first in the number of medicinal plants in various places. There are about 4,000 species of plants in Sichuan, accounting for 22% of the total medicinal plants in China. The abundance of angiosperms and ferns is second only to Yunnan, and the richness of gymnosperms ranks first in the country. As an area rich in medicinal plants in Sichuan, Emei Mountain has about 1,645 medicinal plants. The climate and geographical conditions in the southwestern region have advantages and the vegetation coverage is high. In addition, due to the complex terrain in the southwest, many small climate zones have emerged and emerged. Therefore, the vegetation distribution in the southwestern region has a vertical zonality, forming a source of medicinal plants rich in resources. The southwestern region is rich in plant diversity, especially medicinal plants. There are more than 15,000 species of plant resources in the region, and medicinal plants account for more than 30% (Li et al, 2017).

Sichuan's plant resources are also very rich, with about 10,000 species of higher plants. It accounts for 30% of the total number of species in the country. Among the abundant plant resources, there are about 3,200 species of medicinal plants. It can be seen that the richness of medicinal plants in Sichuan is high. The distribution of medicinal plants in Sichuan is relatively scattered. A medicinal plant in a wide range of evergreen broad-leaved forests in the Sichuan Basin. A medicinal plant with a growing coniferous forest in the alpine valley of western Sichuan. The western Sichuan Plateau mainly grows medicinal plants such as shrubs and meadows (Guo et al, 2014).

The medicinal plants in Yunnan and Guizhou Plateau have the highest abundance. Yunnan and Guizhou have abundant reserves of wild resources. Among them, more than 80% of the national varieties include alfalfa, Scrophulariaceae, Eucommia, Dendrobium, Huhuanglian, Jinguolan, Realgar, Chuanwu, Cinnabar, Ophiopogon, Dianza, and Magnolia. The reserves of resources account for about 50-80% of the total number of species, such as honeysuckle, Tiannanxing, Baiqian, winter sunflower, Achyranthes, Xinyi, piglet, Ligustrum lucidum, Mudanpi, Qianhu, Jiulong, and Wu Pin snake, Pinellia, Chuanxiongzi, Tianma, Asparagus, etc.

Plant diversity in Yunnan Province ranks first in the ranking of plant diversity in all provinces of the country. The area is rich in plant species and has excellent geographical and climatic conditions. At the same time, it has vertical zonality in plant distribution, which provides good growth conditions for various plants in Yunnan. Therefore, many plants that existed in ancient times have survived and thrived. There are about 15,000 species of higher plants, 86% of seed plants, 9% of ferns, and about 10% of bryophytes. The area is about 31% medicinal plants in the region, and it is the region with the largest total amount of medicinal plants in the country. Among the medicinal plants, herbs account for about 27%, and about 7.6% of them are currently available for manual production and included in the saleable list.

The plants grown in Guizhou have obvious subtropical properties. Plants are flourishing, with a wide variety and complex fauna. At the same time, there is a large overlap in the geographical distribution of various vegetation growth, which makes the plant growth conditions more complicated. There are about 3800 species of wild plants in Guizhou, and the proportion of wild medicinal plants is more than 90%, mainly including Eucommia, Asparagus, Gastrodia elata, Platycodon grandiflorum and gentian. The wild medicinal plants in Guizhou account for 80% of the total Chinese herbal medicine varieties in China. At the same time, the Guizhou region is rich in a variety of medicinal plants that occupy an important position both inside and outside China, such as Magnolia, Dendrobium, Gastrodia elata, Phellodendron, Polygonum, Ganoderma lucidum, Radix Codonopsis, Wusong, Eucommia and so on.

Because the overall medicinal plant species in the southwestern region account for a relatively high proportion of the total number of medicinal plant species in the country, there are many rare

medicinal plant species. Among them, Yunnan has the most rare medicinal plants, about 100 species. There are about 82 rare and rare plants in Sichuan, of which fern plants account for about 8.5%, gymnosperms account for 27%, and angiosperms account for 65%. Among the rare plants in Sichuan, there are five first-class key protected plants, namely, Davidia involucrata, Bald fir, Metasequoia, Silver fir, and alfalfa. There are about 20 kinds of rare and endangered plants in China in Guizhou, and 16 kinds of national key protected medicinal plants. Such as Magnolia, Dendrobium, and Eucommia are rare and precious medicinal plants and rare and endangered plants.

3. Chemical composition

3.1 Phenylpropanoids

Studies have shown that a variety of phenylpropanoids, such as 5-(3"-hydroxy-3"-methylbutyl)-8-methoxyfuran coumarin, are isolated from medicinal plants in the southwest. 5-(3",3"-dimethylallyl)-8-methoxyfurancoumarin and 5-(3"-methylbutyl)-8-methoxyfuran coumarin , 5-(3"-methyl-2"-enbutyl)-8-methoxyfurocoumarin, 6-hydroxy-5,7-dimethoxycoumarin, 7-hydroxyl -8-methoxycoumarin, caffeic acid, n-octadecyl ferulate.

3.2 Flavonoids

With the deepening of research on medicinal plants in Southwest China, the structure of flavonoids is continuously enriched. There are five main chemical skeletons of this compound, namely, dihydroflavone, dihydroflavonol, flavonol, flavonoids and isoflavones. The type of substituent is no less than the number of compound skeleton species. There are mainly methoxy, isopentenyl, butyryloxy, methyl and the like. In addition, there are some structures such as pyran, phenylpropanoid, and furan. Some compounds contain polymethoxy substituents such as 5,7,8-trimethoxydihydroflavone. Most of the flavonoids contain hydroxyl substituents such as luteolin, 5,7,3',4'-tetrahydroxyflavone, quercetin and kaempferol. Some compounds not only have a methoxy group but also a phenolic hydroxyl group. Such as 5,7-dihydroxy-4'-methoxyflavone, 5,7,3',6'-tetrahydroxy-8,2'-dimethoxyflavone, 5-hydroxy-7,8-dimethyl Oxyflavone, 5,7-dihydroxy-6-methoxyflavone, 5,7-dimethoxy-4'-hydroxyflavone and 7,4'-dimethoxykaempferol. In addition, some flavonoids with special structures are also extracted from medicinal plants in the southwest. For example, dihydroflavone glycoside-7-O-(6"-propionyl)- β -D-glucopyranoside, luteolin-7-O-[6"-3'" -Hydroxy-4""methoxycinnamoyl)-[beta]-D-glucopyranoside and dimeric flavonoids.

3.3 Terpenoids

Terpenoids are also the main components of medicinal plants in the Southwest. There are two types of terpenoids, namely free hydrazine and conjugated hydrazine compounds. The free bismuth compound mainly includes chrysophanol, aloe-emodin, ω -hydroxy emodin, laccase D, emodin methyl ether, emodin and the like. The ruthenium-binding compound mainly includes emodin-8-O- β -D-glucose, glycoside, chrysophanol-8-O- β -D-glucoside, emodin methyl ether-8-O- β -D-glucoside , aloe emodin - ω -O- β -D-glucoside, emodin - gentian diglucoside and the like.

3.4 Other compounds

From the medicinal plants in the southwest, not only flavonoids and phenylpropanoids, but also other kinds of compounds have been obtained. Such as β -sitosterol, ergoster-7-ene-3 β alcohol, soybean meal-4,22-dien-3-one, β -myristyl alcohol, β -carrot, β -sitosterol-3- β -D-Steroidal compounds such as glucoside, 19-cyclo lanostane, 3,4,5-trimethoxyphenyl-D-glucopyranoside, 2-hydroxymethyl-5-methoxyphenyl-O-D-Pyranoglucoside, L-n-butyl sorbitan, L-orientalis, hexadecanol, 4-hydroxy-3-methoxystyrene, syringic acid, rosmarinic acid, tridecanoic acid A series of compounds such as succinic acid, gallic acid, linoleic acid, 3, 4-dihydroxy-5-methoxybenzaldehyde, vanillin, 4,4'-methylene bisphenylethanol.

4. Biological activity analysis

4.1 Antioxidant effect

The results of studies on the biological components of medicinal plants in some southwestern China indicate that medicinal plants in Southwest China have strong ability to remove DPPH free radicals. At the same time, it has a certain inhibitory effect on superoxide anion. And the inhibition of superoxide anion is enhanced with the increase of the total flavonoid concentration. Some medicinal plants in southwestern China also have a reducing effect, and the reducing ability is positively correlated with the concentration of total flavonoids in medicinal plants. Medicinal plants in the Southwest can not only remove DPPH free radicals, but also prevent linoleic acid oxidation. Volatile oils of medicinal plants in Southwest China can inhibit AV and POV values very well.

4.2 Antibacterial and antiviral effects

The volatile oil of medicinal plants in some southwestern regions generally inhibits the growth and reproduction of streptococcus and Staphylococcus aureus (inhibition zone >19mm). At the same time, medicinal plants also have a certain inhibitory effect on Pasteurella and Escherichia coli. The antibacterial effect was higher than that of berberine (inhibition zone <0.01), slightly worse than that of sputum (inhibition zone <0.01) and norfloxacin niacin (inhibition zone <0.05). The bacteriostatic effect was comparable to that of oregano oil (inhibition zone > 0.06) and Yunlinmycin (inhibition zone > 0.05). Therefore, the volatile oil of medicinal plants in southwestern China has a significant effect on anti-pathogenic bacteria. At the same time, the concentration of 0.3 g / L and 0.79 g / L of medicinal plant volatile oil in Southwest China has significant effect on anti-NDV, and the anti-NDV effect is not less than 1.0 g / L ribavirin, even more than Gluconazole which is 1.0 g / L. Some of the volatile oils of medicinal plants in Southwest China play an anti-HCV role, mainly extracting ethyl acetate, extracting chloroform and extracting n-butanol. The volatile oil of medicinal plants in this area not only has anti-HCV effect, but also plays an effective role in inhibiting Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa and Shigella.

4.3 Anti-inflammatory analgesic effect

The ethanol extract of some medicinal plants in southwestern China has an effective therapeutic effect on mouse ear edema. The pathogenic factors of mouse ears are arachidonic acid and croton oil, etc., so that the ethanol extract of medicinal plants in southwestern region can effectively decompose arachidonic acid and croton oil. The volatile oil of medicinal plants can effectively inhibit the writhing caused by acetic acid. At the same time, the medicinal plant extract can effectively treat the inflammation caused by serotonin and carrageenan, and has significant anti-inflammatory and analgesic effects.

4.4 Other effects

Some medicinal plants in southwestern China have certain insecticidal effects. Experiments have shown that some of the medicinal plants in southwestern China have strong deworming effects on the adult larvae. After more than 3 days of treatment, the repellent effect is still as high as 85%. Some medicinal plant extracts in the southwest can promote digestion. Studies have shown that medicinal plant volatile oil can inhibit the spontaneous contraction of the stomach of rats, rabbits and guinea pigs. The ED50 of the inhibitory effects of rats, rabbits, and guinea pigs were 14.2 $\mu\text{g}\cdot\text{mL}^{-1}$, 7.6 $\mu\text{g}\cdot\text{mL}^{-1}$, and 3.6 $\mu\text{g}\cdot\text{mL}^{-1}$, respectively. Some medicinal plants in the southwestern region can also achieve a reduction in blood lipids. Some of the extracts of medicinal plants in the southwestern region also have the effect of enhancing immunity.

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