Comparative Study on Leaf Morphology-Venation Pattern of *Hedyotis auricularia* L. and Its Adulterants

Luxiao MENG, Feipeng HUANG, Xinxin LU, Piaoling HUANG, Hailin LU, Zhonghua DAI*

Guangxi Key Laboratory of Zhuangyao Medicine/School of Pharmacy, Guangxi University of Chinese Medicine, Nanning 530200, China

Abstract [**Objectives**] To compare the leaf morphology and leaf venation patterns of *Hedyotis auricularia* L. and its adulterants, such as *Mitracarpus hirtus* (L.) DC., *Spermacoce pusilla* Wall. and *Spermacoce alata* Aubl., produced in Guangxi, so as to provide a simple and rapid identification method for the identification of *H. auricularia* L. in Guangxi. [**Methods**] LMVP (leaf morphology-venation pattern) identification method was used to study the characteristics of leaf morphology-venation pattern. [**Results**] Characteristics of leaf morphology-venation pattern: (i) *H. auricularia* L.: circular knotted-curved pinnate leaf venation without reaching the margin; the primary veins run straight without branches, the number of secondary veins is 5 to 9, and the angles included in tertiary veins are mostly near right angles or obtuse angles. (ii) *M. hirtus* (L.) DC.: curved pinnate leaf venation without reaching the margin; the primary veins run straight without obvious changes, the number of secondary veins is 3 to 5, and the tertiary veins are slender, and the included angles are mostly acute. (iii) *S. pusilla* Wall.: curved leaf venation without reaching the leaf margin; there are 4 to 5 pairs of secondary veins, most of which are opposite; the angle between the secondary veins and the primary veins in the middle and near the petiole is mostly medium acute angle, and the extension of the tertiary veins has no fixed direction. (iv) *S. alata* Aubl.: circular knotted-curved pinnate leaf venation; the primary veins are convex and straight without branches, and there are 4 to 6 pairs of secondary veins, alternating. The angle between secondary veins and primary veins is mostly medium acute angle, the angle between tertiary veins and secondary veins is near right angle, and the tertiary veins are mostly transversely extended. [**Conclusions**] The leaf morphology-venation patterns of the above-mentioned *H. auricularia* L. and *M. hirtus* (L.) DC., *S. pusilla* Wall., and *S. alata* Aubl. can be used as their identification features, and the identification method has certain operability, which provides an identification idea for the identification of Chinese herbal medicines.

Key words *Hedyotis auricularia* L., *Mitracarpus hirtus* (L.) DC., *Spermacoce pusilla* Wall., *Spermacoce alata* Aubl., Leaf venation pattern

1 Introduction

Hedyotis auricularia L. is a plant of the *Hedyotis* genus in the Rubiaceae family[1]. The whole plant is used for medicinal purposes and it has the effects of clearing away heat and detoxifying, cooling blood and reducing swelling[2]. It has good therapeutic effect on colds, sore throat, coughs, skin eczema and venomous snake bite[3]. *H. auricularia* L. is also known as Jiyudancao, Xiyeyapochao and Jiejiefua in the *National Compilation of Chinese Herbal Medicines*, and it is bitter and cool in nature[4]. It was first published in *Preparations for Raw Herbal Medicines* and there is another name Jiaojiancao in *Lingnan Medicine Collection Record* and it is recorded that this herb has opposite leaves, long tips, and splintery flowers, born from the leaf axils. According to this description, it is consistent with the characteristics of the current Rubiaceae plant *H. auricularia* L.[5-7] Modern studies have found that the chemical components of *H. auricularia* L. are mainly alkaloids, flavonoids, phenolic acids and terpenes[8-10], which have antiviral, anti-inflammatory and anti-tumor effects[11-16]. In Guangdong and Guangxi, due to the similar environment, many plants have similar external shapes and are difficult to distinguish, so easily confused varieties are prone to appear. *Mitracarpus hirtus* (L.) DC. is a plant of the Rubiaceae family, which is born on highway wasteland, mainly distributed in India, tropical South America, tropical East and West Africa, and distributed in Hainan, Guangdong, Guangxi and other places[17]. According to recent studies, *M. hirtus* (L.) DC. is an invasive alien species[18-22]. *Spermacoce pusilla* Wall. is a plant of the *Spermacoce* genus of the Rubiaceae family, also known as Jiasheshecao and Boliyacao. *Chinese Materia Medica* records that *Spermacoce pusilla* Wall. has a bitter taste and a cool nature, and has the effects of promoting blood circulation, removing blood stasis, reducing swelling and detoxification. It is mainly used to treat bruises, fractures, carbuncle swelling, snake bites and other symptoms[23]. *Spermacoce alata* Aubl. is a plant of the *Spermacoce* genus of the Rubiaceae family, commonly known as Ribencao in Guangdong and Guangxi, and Zhushicao in Yunnan[24]. *M. hirtus* (L.) DC., *S. pusilla* Wall., *S. alata* Aubl. and *H. auricularia* L. are both plants of the Rubiaceae family, with overlapping distribution areas and certain similarities in shape, as well as some differences[25], which are prone to wrong picking and misuse. The leaf venation pattern identification method is suitable for fresh and dried leaves. Compared with the traditional identification meth-

Received: November 13, 2024 Accepted: January 9, 2025

Supported by Guangxi Key Laboratory of Zhuang and Yao Medicine (GuiKeJiZi 201432); Zhuang and Yao Medicine Collaborative Innovation Center (GuiJiaoKeYan 201320); Guangxi Young Talent Project of Guangxi University of Chinese Medicine (2022C030); Ethnic Medicine Resources and Application Engineering Research Center in Guangxi Zhuang Autonomous Region (GuiFaGaiGaoJiHan 20202605); Key Discipline Project of Traditional Chinese Medicine in Guangxi—Zhuang Medicine (GZXK-Z-20-64); Guangxi First-class Discipline of Traditional Chinese Medicine—Ethnopharmacology (GuiJiaoKeYan 201812).

Luxiao MENG, master, research fields: identification of traditional Chinese medicine (Zhuang and Yao).

* Corresponding author. Zhonghua DAI, PhD., associate professor, master supervisor, research fields: research and development of traditional Chinese medicine and ethnic medicine.

ods, the leaf venation pattern identification method is fast, simple, accurate and repeatable[26-27]. Therefore, this paper conducts a comparative study of pharmacognosy from leaf morphology-venation pattern, which provides a reference for identification to ensure the accuracy and safety of clinical medication of *H. auricularia* L.

2 Materials and methods

2.1 Materials

2.1.1 Medicinal materials. The samples were collected from Wuming District, Nanning City, Guangxi, and were identified as the whole plant of *H. auricularia* L., *M. hirtus* (L.) DC. *S. pusilla* Wall. and *S. alata* Aubl. in the Rubiaceae family by associate professor Guo Min of the Department of Medicinal Botany of Guangxi University of Chinese Medicine.

2.1.2 Reagents. 95% ethanol (Guangxi Beilunhe Medical Industry Group Co., Ltd., Batch No.:20211111), formalin (Sinopharm Group Chemical Reagents Co., Ltd., Batch No.: 20180508), glacial acetic acid (Sinopharm Group Chemical Reagent Co., Ltd., Batch No.:20180702), chloral hydrate solution (Sinopharm Group Chemical Reagent Co., Ltd., Batch No.: 20181102).

2.1.3 Instruments. Electric blast drying oven (Shanghai Yiheng Scientific Instrument Co., Ltd., DHG9340A), paraffin slicer (Leica Instruments GmbH, Germany, model RM2235), high-speed pulverizer (Wenling Machinery Co., Ltd., model DFY-300C), fluorescence biomicroscope (Nanjing Hengqiao Instrument Co., Ltd., model Ni-U).

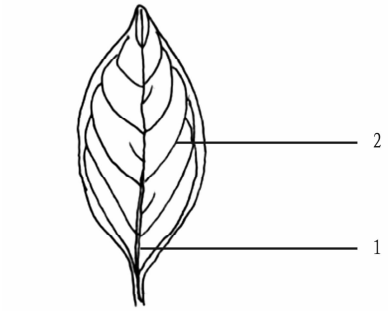
2.2 Methods For the observation of the leaf morphology of *H. auricularia* L., *M. hirtus* (L.) DC., *S. pusilla* Wall. and *S. alata* Aubl. in Guangxi, we refer to the General Principles for Identification of Medicinal Materials and Decoction Pieces of the *Chinese Pharmacopoeia*[28].

The leaf veins of the plants were irradiated with a multifunctional transmitter and then photographed with the macro camera function of the mobile phone. In addition, the leaf venation patterns of the two plants were observed with reference to the LMVP method[29]. Vein preparation: Use alkaline test solution (such as 30% NaOH solution) to boil the leaves for about 40 min and then take them out to remove the mesophyll and the pigments contained, to get clear vein specimens after the leaves become completely transparent.

3 Results and analysis

3.1 Characteristics of leaf morphology-venation pattern of *H. auricularia* L.

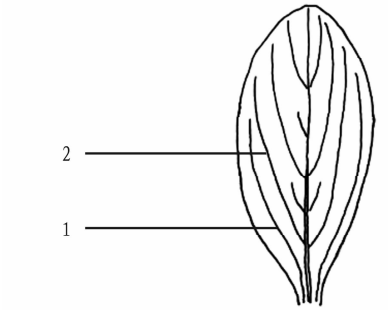
3.1.1 Leaf morphology. The single leaves are opposite, lanceolate to elliptic, 3.5-8.0 cm long and 1.0-3.5 cm wide, with the widest part located in the middle. Leaf blade is flat, leaf tip is acuminate, leaf base is cuneate, leaf margin is entire, sometimes serrate. The upper surface of the leaves is green, the base of the middle vein is slightly convex, and the remaining veins are slightly concave. The lower surface of the leaves is light green with raised veins. The petiole is short and densely covered with brown-yellow tiny hairs. Texture is leathery. The smell is slightly special, the taste is bitter and slightly astringent (Fig. 1).



NOTE 1. primary vein; 2. secondary vein.

Fig. 1 Leaf morphology and primary and secondary leaf venation pattern of *Hedyotis auricularia* L.

3.1.2 Leaf venation pattern. It is a circular knotted-curved pinnate leaf venation that does not reach the margin. The blade has only one primary vein, straight without branches, and some sections are slightly curved. The secondary veins curve upward and connect with each other at the tail to form an obvious vein ring. The vein ring connects with the adjacent secondary veins above at an acute angle. The number of veins on both sides is the same or different, with 5 to 9 veins, and the direction is relatively uniform. The arc shape increases its curvature smoothly or slowly, and the included angles are mostly medium acute angles and narrow acute angles. Secondary interstitial veins are occasionally seen, not obvious, and are simple. The tertiary veins and the primary veins have a vertical relationship, forming a right-angle network, with no branches, and the included angles are mostly near right angles or obtuse angles, arranged in parallel between the secondary veins (Fig. 2).



NOTE 1. primary vein; 2. secondary vein.

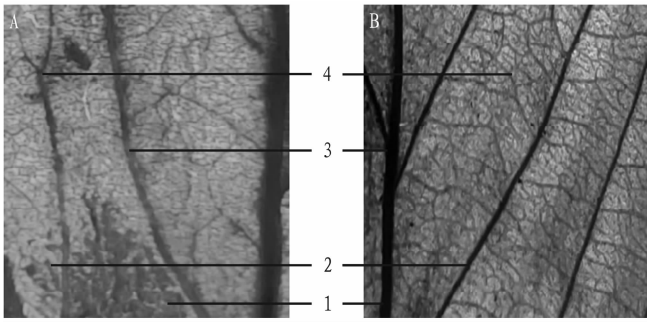
Fig. 2 Leaf morphology and primary and secondary leaf venation pattern of *Mitracarpus hirtus* (L.) DC.

3.2 Characteristics of leaf morphology-venation pattern of *Mitracarpus hirtus* (L.) DC.

3.2.1 Leaf morphology. Simple leaves are opposite, and apical leaves are clustered. The leaves are oblong to lanceolate, with the widest part in the middle, 1.7-3.5 cm long and 0.3-1.6 cm wide. The leaf blade is flat, the tip is short pointed, the leaf base is tapered, and the leaf margin is entire, sometimes slightly wavy. There is no petiole, with fine white hair on the leaf surface, the upper surface is brown-green, and the lower surface is light-col-

ored and dull.

The veins on the upper surface are slightly concave, and the veins on the lower surface are slightly convex (Fig. 3).



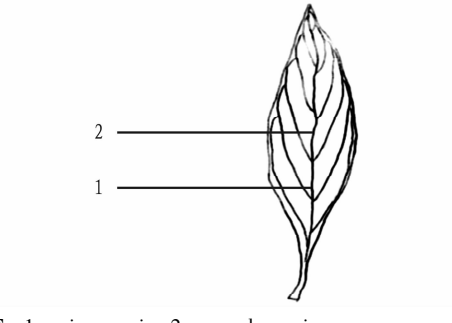
NOTE 1. primary vein; 2. secondary vein; 3. tertiary vein; 4. quaternary vein.

Fig. 3 Partial leaf venation pattern of *Hedyotis auricularia* L. (A) and *Mitracarpus hirtus* (L.) DC. (B)

3.2.2 Leaf venation pattern. It is curved pinnate leaf venation that does not reach the margin. There is only one primary vein, which goes straight and has no obvious change. The secondary veins curve upward, gradually tapering on the inner side of the leaf margin towards the leaf apex without forming an obvious vein ring. The number of veins on both sides is the same or different, with 3 to 5, mostly alternate, and the included angle is mostly narrow acute angle or middle acute angle, and the included angle at the base is narrow acute angle. Secondary interstitial veins are occasionally seen, not obvious, and are simple. The tertiary veins are slender, and the included angles are mostly acute.

3.3 Leaf morphology-venation pattern of *Spermacoce pusilla* Wall.

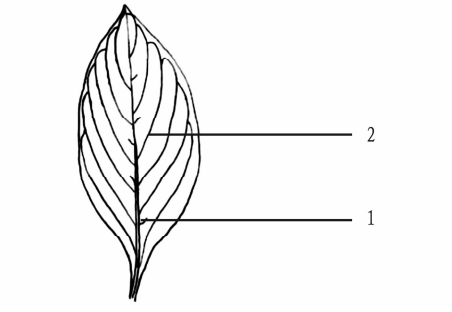
3.3.1 Leaf morphology. The leaves are single, with two opposite, two groups of adjacent leaves above and below are diagonally distributed, and the petioles are close to sessile; the stipules are very close to the petiole, with several long reddish-brown hairs on the top; the leaves are fusiform or lanceolate, narrow and long, 0.3 – 1.1 cm wide and 1.9 – 4.8 cm long. The leaves have no serrations, the apex is acuminate, the middle is the widest, and the base is gradually narrower and closes to the petiole, rough on both sides; old leaves are dark green, young leaves are tender green, and a few are purple.



NOTE 1. primary vein; 2. secondary vein.

Fig. 4 Leaf morphology and primary and secondary leaf venation pattern of *Spermacoce pusilla* Wall.

3.3.2 Leaf venation pattern. It can be seen from Fig. 5 that the leaf venation of *S. pusilla* Wall. is curved and does not reach the leaf margin. The primary veins of fresh leaves are thick and straight, and there are no redundant branches. There are 4 to 5 pairs of secondary veins that curve upward, mostly opposite and occasionally alternate. Compared with the primary veins, they are smaller in diameter and connect with the secondary veins on the upper adjacent side, but they do not reach the leaf margin, the angle between the secondary vein and the primary vein in the middle and near the petiole is mostly mid-acute, and the included angle at the top is a small acute angle. The angle between the tertiary veins and the secondary veins is more acute than that between the secondary veins and the primary veins. The extension of the tertiary veins has no fixed direction, and most of them are connected with the primary to quaternary veins to form meshes of different sizes and shapes. The included angle of the quaternary veins is obviously larger, nearly right angle, and they also form meshes like tertiary veins. The quinary veins are unclear.



NOTE 1. primary vein; 2. secondary vein.

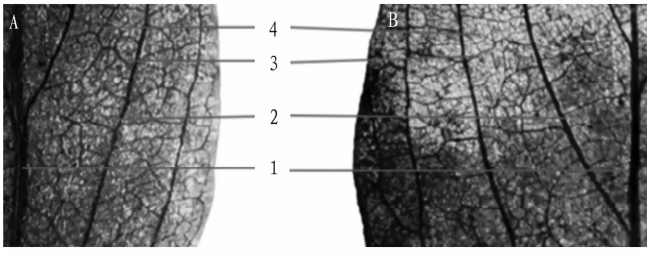
Fig. 5 Leaf morphology and primary and secondary leaf venation pattern of *Spermacoce alata* Aubl.

3.4 Leaf morphology-venation pattern of *Spermacoce alata* Aubl.

3.4.1 Leaf morphology. The leaves are simple, with two opposite, elliptical or ovate-round; the length is 2.0 – 6.3 cm, the width is 1.1 – 3.1 cm, the upper and lower surfaces have slight down, the upper surface is green, and the lower surface is light green; the leaf base is mostly crooked, the apex is sharp or obtuse, and the margin is entire; herbaceous.

3.4.2 Leaf venation pattern. It can be seen from Fig. 6 that the leaf venation of *S. alata* Aubl. is circular knotted-curved and pinnate. The primary veins of fresh leaves are thick and straight, and there are no redundant branches. There are 4 – 6 pairs of upward curved secondary veins, all of which are only alternate. Compared with the primary veins, they are smaller in diameter. They are connected with the upper adjacent secondary veins, but they do not reach the leaf margin. The angle between the secondary veins and the primary veins is mostly medium acute angle, and the angle at the top has not changed significantly. The angle between the tertiary veins and the secondary veins is nearly right angle. Tertiary veins are mostly extended horizontally, and at the same time, there is also extension without fixed direction and they connect with the primary to quaternary veins to form meshes of different sizes and shapes. The included angle of the quaternary veins is

mostly acute angle, and and they also form meshes like tertiary veins. The quinary veins are unclear.



NOTE 1. primary vein; 2. secondary vein; 3. tertiary vein; 4. quaternary vein.

Fig. 6 Partial leaf venation pattern of *Spermacoce pusilla* Wall. (A) and *Spermacoce alata* Aubl. (B)

4 Conclusions

(i) *H. auricularia* L.: The single leaves are opposite, broadly elliptical, with acuminate leaf apex, wedge-shaped base, short petiole; it is circular knotted-curved pinnate leaf venation that does not reach the margin. There is only one primary vein, straight without branches; the secondary veins curve upward and connect with each other at the tail to form an obvious vein ring, which connects the adjacent secondary veins above at an acute angle; the angle of tertiary veins is mostly near right angle or obtuse angle.

(ii) *M. hirtus* (L.) DC.: The single leaves are opposite, oblong, leaf tip is short and pointed, leaf bases are tapering, leaves are sessile; it is curved pinnate leaf venation that does not reach the margin. The primary veins run straight with no obvious change; the secondary veins curve upward, gradually tapering on the inner side of the leaf margin towards the leaf apex without forming an obvious vein ring; the tertiary veins are slender, and the included angles are mostly acute.

(iii) *S. pusilla* Wall.: Two groups of adjacent leaves at the top and bottom are diagonally distributed, and the leaves are fusiform or lanceolate, narrow and long, with the apex acuminate, and the base tapering; there are 4 to 5 pairs of secondary veins, mostly opposite and occasionally alternate; the angle between the secondary veins and the primary veins in the middle and near the petiole is mostly a medium acute angle, and the angle at the top is a small acute angle; there is no fixed direction for tertiary vein extension; the included angle of the quaternary veins is significantly larger.

(iv) *S. alata* Aubl.: The leaves are elliptical or ovate-round, with slight hairs on the upper and lower surfaces, the leaf base is mostly crooked, and the apex is sharp or obtuse; the primary veins are raised straight without branches, and there are 4 to 6 pairs of secondary veins, only alternating; the angle between the secondary veins and the primary veins is mostly medium acute angle, and the angle at the top has not changed obviously; the angle between the tertiary veins and the secondary veins is nearly right angle; tertiary veins are more commonly extended laterally.

5 Discussion

Traditional pharmacognosy identification usually includes basal identification, trait identification, and microscopic identification. The identification of leaf morphology-venation pattern in this experiment is innovative to some extent. The morphological characteristics of plants in the same family are similar. Besides the traditional pharmacognosy identification methods, it is also a reliable identification method to distinguish different plants from the perspective of leaf morphology-venation pattern. However, the leaves of plants may change with the environment, or the leaf venation patterns of different seasons are different, which also has a certain impact on the identification of plants. Therefore, the study of leaf veins should focus on leaves in different environments and seasons.

The experimental results show that this method can provide basic research data for the identification basis and quality evaluation of *H. auricularia* L. and its adulterants—*M. hirtus* (L.) DC., *S. pusilla* Wall., *S. alata* Aubl. in Guangxi, provide scientific basis for development and utilization, and provide convenience for reasonable and standardized use, and ensure the safety of medication.

References

[1] Editorial Committee of Flora of China, Chinese Academy of Sciences. Flora of China (vol. 71)[M]. Beijing: Science Press, 1999: 37. (in Chinese).

[2] CHANG Y. A taxonomic study on the genus *Hedyotis* in Guangdong province[D]. Zhengzhou: Henan Agricultural University, 2013: 32. (in Chinese).

[3] LIU Y. *Hedyotis auricularia* L.[J]. Chinese Journal of Ethnomedicine and Ethnopharmacy, 2020, 29(15): 119. (in Chinese).

[4] National Compendium of Chinese Herbal Medicines Preparation Group. National Compendium of Chinese Herbal Medicine (The Second Books)[M]. Publisher: People's Health Publishing House, 1996: 233 - 234. (in Chinese).

[5] WANG FG, YE HG. Resources of medicinal plants of the genus *Hedyotis* in Guangdong Province[J]. Journal of Chinese Medicinal Materials, 2003, 8(26): 547 - 548. (in Chinese).

[6] ZHENG XL, CHEN HF, XING FW. Resources of medicinal plants of the genus *Hedyotis* in Hainan[J]. Journal of Chinese Medicinal Materials, 2009, 11(32): 1667 - 1670. (in Chinese).

[7] YUAN QM, ZHANG FG, WANG X, *et al*. Species and distribution of plants of *Hedyotis* in China[J]. Journal of Yunnan University (Natural Sciences Edition), 2004(S1): 166 - 170. (in Chinese).

[8] WANG YJ, HUANG JM, WEN CH, *et al*. Chemical constituents from whole herb of *Hedyotis* scandens[J]. China Journal of Chinese Materia Medica, 2023, 48(22): 6082 - 6087. (in Chinese).

[9] JIN XW, HE YF. Optimization of extraction process and determination of active ingredient of total flavonoids from *Hedyotis chrysotricha*[J]. Drug Evaluation, 2023, 20(9): 1060 - 1063. (in Chinese).

[10] SU JT. Study on the chemical constituents of *Oldenlandia diffusa* (Willd.) Roxb[D]. Kunming: Yunnan University, 2021: 1. (in Chinese).

[11] ZHANG YK, LI L. Clinical observation on 36 cases of intrahepatic cholestasis treated by dissolution method[J]. Zhejiang Journal of Integrated Traditional Chinese and Western Medicine, 2006(10): 610 - 611. (in Chinese).

[12] WANG JQ. Detoxification, removing blood stasis and purgation therapy in treatment of chronic severe hepatitis[J]. Zhejiang Journal of Integrated Traditional Chinese and Western Medicine, 2007(1): 47 - 48. (in Chinese).

(To page 54)

Central South Pharmacy, 1 – 10[2024 – 09 – 10]. (in Chinese).
[7] SU R, PEI HL, TIAN J, *et al*. Study on the therapeutic effects and mechanism of *Orychophragmus violaceus* (L.) O. E. Schulz seeds in non-alcoholic steatohepatitis rats based on network pharmacology and experimental verification[J/OL]. Natural Product Research and Development, 1 – 23[2024 – 09 – 10]. (in Chinese).
[8] LIU YY, SU GF, ZHENG H, *et al*. Exploration on action mechanism of Fritillariae Thunbergii Bulbus-Sepiae Endocon cha Drug Pair for Gastroesophageal Reflux disease based on network pharmacology[J]. New Chinese Medicine, 2024, 56(13): 214 – 222. (in Chinese).
[9] WANG MF, LI QH. Exploring the mechanism of action of the tiger nut-money herb pair in the treatment of hepatocellular carcinoma based on network pharmacology and molecular docking[J]. Shanxi Journal of Traditional Chinese Medicine, 2024, 40(4): 60 – 65. (in Chinese).
[10] LIU JQ, LI WJ, XU MP, *et al*. Network pharmacology-based research on the mechanism of action of Baishao in the treatment of chronic atrophic gastritis[J]. Clinical Journal of Chinese Medicine, 2024, 16(7): 8 – 14. (in Chinese).
[11] NIE XY, WU XH, XU D, *et al*. Study on the Mechanism of *Plantago asiatica* L. in the treatment of liver cancer based on network pharmacology, molecular docking and *in vitro* experiments[J]. Journal of Guangdong Pharmaceutical University, 2024, 40(4): 18 – 26. (in Chinese).
[12] HANG YX, YU JQ, CAO YF, *et al*. Exploring the mechanism of Mongolian medicine of Fanbaicao in treatment of type 2 Diabetes Mellitus based on network pharmacology[J]. Journal of Shandong First Medical University & Shandong Academy of Medical Sciences, 2023, 44(3): 191 – 196. (in Chinese).
[13] HAN ML, TIAN D, CHE XY, *et al*. Mechanism of *Lonicerae japonicae* Flos in the treatment of diabetes based on netwwork pharmacology[J]. Journal of Shandong First Medical University & Shandong Academy of Medical Sciences, 2022, 43(3): 172 – 177. (in Chinese).
[14] FANG SS, DONG L, LIU L, *et al*. HERB: A high-throughput ex-periment-and reference-guided database of traditional Chinese medicine[J]. Nucleie Acids Research, 2021, 49(D1): 1197 – 1206.
[15] THIES P. Über die wirkstoffe des baldrians : 2. Mitteilung Zur konstitution der isovalerians ureester valepotriat, acetoxyvalepotriat und dihydrovalepotriatt[J]. Tetrahedron Letters, 7 (1966): 1163 – 1170.
[16] HAO L, XIA YQ, LIU J. Research of prescription rules of professor Xia Yuqing for lung cancer based on data mining and network pharmacology [J]. Traditional Chinese Medicinal Research, 2024, 37(7): 59 – 64. (in Chinese).
[17] ZHANG B, ZHONG D, WANG QW, *et al*. Study on correlation of JAK/STAT signal pathway with progression and prognosis in hepatocellular carcinoma[J]. Chinese Journal of Cellular and Molecular Immunology, 2010, 26(4): 368 – 370, 373. (in Chinese).
[18] WANG HQ, MAN QW, HUO FY, *et al*. STAT3 pathway in cancers: Past, present, and future[J]. MedComm, 2022, 3(2): e124.
[19] WANG RJ, HUANG Q, YONG Y, *et al*. Studies on chemical constituents of *Valeriana* plants and their biological activities[J]. China Journal of Chinese Materia Medica, 2016, 41(8): 1405 – 1414. (in Chinese).
[20] XUE XC, HU JH. Research methods and applications in network pharmacology[J]. Journal of Pharmaceutical Practice, 2015, 33(5): 401 – 405. (in Chinese).
[21] MENG FC, TANG LD. Challenges and prospect in research of Chinese materia medica network pharmacology [J]. Central South Pharmacy, 2020, 51(8): 2232 – 2237. (in Chinese).
[22] GUO Q, TIAN CW, REN T, *et al*. Study Progress on pharmacodynamic material basis of Chinese materia medica[J]. Modernization of Traditional Chinese Medicine and Materia Medica-World Science and Technology, 2015, 17(3): 648 – 654. (in Chinese).

(From page 38)

[13] ZHENG CG, JIN C, YE LC. Clinical observation on Ge Xian Tang in the treatment of ulcerative colitis with internalised damp-heat syndrome [J]. Zhejiang Journal of Integrated Traditional Chinese and Western Medicine, 2010, 20(12): 757 – 758. (in Chinese).
[14] ZHU JL, XI JY, CAO YM. Introduction to Professor Xi Jiuyi's experience in treating allergic cutaneous vasculitis[J]. Shanghai Journal of Traditional Chinese Medicine, 2010, 44(12): 9 – 10. (in Chinese).
[15] MEI QX, LIN H. Progress of research on anti-tumour pharmacology and its clinical application of *Scleromitrion diffusum*[J]. China Pharmacy, 2010, 21(47): 4508 – 4510. (in Chinese).
[16] SHANG JW, ZHANG YS. Diagnosis and treatment of prostate cancer [J]. Chinese Community Doctors, 2010, 12(36): 4. (in Chinese).
[17] ZHAGN QY, ZHANG FP. Investigation on medical plant resources of rubiaceae in the eastern region of Guangdong[J]. Clinical Journal of Traditional Chinese Medicine, 2015, 27(6): 2015: 0328. (in Chinese).
[18] ZENG XF, QIU HY. Two species of new record naturalized plants in Fujian Province[J]. Journal of Anhui Agricultural Sciences, 2012, 40 (4): 1941. (in Chinese).
[19] GAO YZ. The genus *Mitracarpus*: A new genus in the family Rubiaceae in China[J]. Guihaia, 1986(4): 261 – 262. (in Chinese).
[20] LIN CR, SHEN Xl, HUANG YS, *et al*. New records of the exotic seed plants discovered in Guangxi, China[J]. Guihaia, 2012, 32(4): 446 – 449. (in Chinese).
[21] LIU QR, CHE JD, GUAN LS, *et al*. Ome newly recorded plants from Beijing and Hebei[J]. Journal of Beijing Normal University (Natural Science), 2005(5): 510 – 512. (in Chinese).
[22] ZENG XF, QIU HY. Two newly recorded invasive plants of Rubiaceae in Jiangxi Province[J]. Guizhou Agricultural Sciences, 2013, 41(4): 101 – 102. (in Chinese).
[23] Editorial Board of "Chinese Materia Medica", State Administration of Traditional Chinese Medicit. Chinese Materia Medica (Vol. 18)[M]. Shanghai: Shanghai Science and Technology Press. , 1999: 430 – 431. (in Chinese).
[24] MA YL, QIN JL, MA YF, *et al*. *Spermacoce latifolia* Aubl. Chemical Control Techniques in Caneplanting area of Guangxi[C]. Agricultural weeds and their control. Weed Branch of the Chinese Plant Protection Society, 2011: 387 – 390. (in Chinese).
[25] PEDRO PFG, EMILIO LL, ROBERTO RG. *Spermacoce latifolia* Aubl. (Rubiaceae), una especie alóctona nueva en la flora europea[J]. Orsis,2012: 193 – 199.
[26] HE BZ, WEI H, LIANG H, *et al*. Distinguishing features of the morphology and venation profiles of *Mangifera indica* leaves and spurious *Mangifera persiciformis* leaves[J]. Journal of Guangxi Traditional Chinese Medical University, 2005(3): 90 – 94. (in Chinese).
[27] GUO M. Teaching discussion on leaf veins and venation pattems in medicinal botany[J]. Chinese Journal of Ethnomedicine and Ethnopharmacy, 2013, 22(21): 116. (in Chinese).
[28] National Pharmacopoeia Commission. Pharmacopoeia of the People's Republic of China (Four parts)[M]. Beijing: China Pharmaceutical Science and Technology Press, 2020: 29. (in Chinese).
[29] HE BZ, WEI H, ZENG J, *et al*. Leaf vein mapping identification of traditional Chinese medicine[M]. Beijing: People's Health Publishing House, 2010: 32 – 33. (in Chinese).