Research on Planting Technology of *Dysosma versipellis*

Mengyao ZHOU[1#], Zishu CHAI[1#], Mengsi LING[1], Dongye YANG[1], Yiyuan LONG[1], Peng FU[1,2,3,4], Xuezheng HUANG[1*], Ruzhi TAN[1*]

1. Faculty of Chinese Medicine Science of Guangxi University of Chinese Medicine, Nanning 530200, China; 2. Guangxi Key Laboratory of Zhuang and Yao Ethnic Medicine, Nanning 530200, China; 3. Guangxi Medical College, Nanning 530000, Guangxi; 4. Collaborative Innovation Center of Zhuang and Yao Ethnic Medicine, Nanning 530200, China

Abstract [**Objectives**] This study was conducted to obtain the best planting technology system of *Dysosma versipellis*. [**Methods**] The rhizomes of *D. versipellis* were selected as the propagation material. Experiments were conducted on one-year-old, two-year-old and three-year-old rhizomes to investigate the effects of hormone formula, soaking time, and growth years on the planting technology. [**Results**] The effects of various factors on the growth rate of *D. versipellis* ranked as hormone formula > rhizome age > soaking time (h). The optimal combination was $A_2B_2C_3$, which corresponded to three-year-old rhizomes soaked for 12 h in a hormone solution containing BA 2 mg/L + NAA 0.2 mg/L. Adventitious roots of *D. versipellis* (including isolated adventitious roots and adventitious roots attached to two-year-old rhizomes) were also used for propagation, while also considering whether to add Shuangjier (GGR) solution, with soaking times in the GGR solution set at 4, 12, and 24 h, respectively. The results indicated that soaking the roots attached to rhizomes in GGR solution for 12 h yielded the highest growth rate. [**Conclusions**] This study not only provides technical support for the cultivation of *D. versipellis*, but also offers a reference for formulating corresponding *Technical Operating Procedures* (SOP) and establishing demonstration bases.

Key words *Dysosma versipellis*; Adventitious root; Rhizome

DOI:10.19759/j.cnki.2164-4993.2025.05.001

Dysosma versipellis (Hance) M. Cheng ex Ying, a rare and endangered medicinal plant endemic to China, is a perennial herb belonging to the genus Dysosma in the family Berberidaceae[1-3]. It is distributed in Guangdong, Guangxi, Yunnan, Guizhou, Sichuan, and other regions, typically growing in shady and moist environments, under bamboo forests, or in evergreen forests on limestone mountains, at elevations ranging from 300 to 2 400 m. Its rhizomes are used medicinally for treating injuries from falls, bruises, and fractures, hemiplegia, joint pain, and snake bites[4-7]. *D. versipellis* has been documented in ancient Chinese medical texts such as *Shen Nong's Herbal Classic* and *Compendium of Materia Medica*. The roots and rhizomes are used in traditional medicine for their effects in clearing heat and toxins, resolving phlegm and masses, and dispersing blood stasis and swelling. They are indicated for conditions including boils, carbuncles, furuncles, traumatic injuries, venomous snake bites, hemiplegia, bronchitis, hepatitis B, infantile convulsions, and also serve as an insecticide[8-9]. The active components in *D. versipellis* are lignan compounds, such as podophyllotoxin and its derivatives, which have been found in studies to possess antitumor, antibacterial, and antiviral effects[10-14].

In this study, with *D. versipellis* as the research subject, its cultivation technology (such as rhizome propagation and adventitious root reproduction) was investigated, aiming to provide a reference for formulating corresponding *Technical Operating Procedures* (SOP) and establishing demonstration bases.

Materials and Methods

Experimental materials

D. versipellis was collected from Jinxiu County, Laibin City, Guangxi Zhuang Autonomous Region (24.147136N, 110.204170E). The plant was identified as *D. versipellis* (Hance) M. Cheng ex Ying by associate professor Dai Zhonghua from Guangxi University of Chinese Medicine.

Experimental methods

Experimental design In spring, healthy rhizomes of *D. versipellis* showing no obvious signs of pests or diseases were selected as experimental materials. Rhizome samples from one-year-old, two-year-old, and three-year-old plants (all with fibrous roots attached) were chosen, and 20-30 samples were collected for each age. The rhizomes were rinsed with tap water to remove surface soil. Following an $L_9(3^3)$ orthogonal array, the rhizomes were soaked in hormone solutions with varying ratios. A blank control group was cultivated in tap water without hormones.

Sowing method Before sowing, the cut surfaces were coated with tung oil to prevent pests and diseases. Sowing was conducted

Received: May 6, 2025 Accepted: July 17, 2025

Supported by National Undergraduate Innovation and Entrepreneurship Training Program of Faculty of Chinese Medicine Science of Guangxi University of Chinese Medicine (202113643016); Univeristy-level Scientific Research Project of Faculty of Chinese Medicine Science of Guangxi University of Chinese Medicine in 2022 (2022MS017); National Key Research and Development Program of China (2019YFC171230).

Mengyao ZHOU (2000-), female, P. R. China, devoted to research about quality control of traditional Chinese medicine and development of traditional Chinese medicine resources.

Zishu CHAI (1994-), female, P. R. China, lecturer, devoted to research about quality control of traditional Chinese medicine and development of traditional Chinese medicine resources.

# These authors contributed equally to this work.

* Corresponding author. Xuezheng HUANG, male, associate professor, devoted to research about the management of college students and the development of traditional chinese medicine resources. Ruzhi TAN, male, associate professor, devoted to research about the management of college students and teaching of basic theories of traditional Chinese medicine.

in marked rows with a row spacing of 20 cm. Furrows were dug to a depth of 3 – 4 cm, and one cut piece was planted every 10 cm along the furrow. The cut pieces were covered with fine soil and watered thoroughly.

Results and Analysis

Experimental design and results of rhizome propagation in *D. versipellis*

An $L_9(3^3)$ orthogonal array was employed to evaluate three factors at three levels each: hormone formula, soaking time, and rhizome age. The objective was to identify the optimal experimental protocol for rhizome propagation.

The hormone formulations were as follows: ① BA 3 mg/L + GA_3 0.2 mg/L, ② BA 2 mg/L + NAA 0.2 mg/L, and ③ BA 1 mg/L + TDZ 0.2 mg/L. The soaking durations were 8 , 12 and 24 h.

The rhizome ages included one year old, two yeas old, and three years old. Factor levels are shown in Table 1, and the orthogonal experimental design is presented in Table 2. The blank control group was cultivated in tap water without hormones. Growth conditions were regularly observed, and the sprouting of adventitious buds was recorded at 3, 6, and 9 months after planting. The sprouting rate was calculated at 6 months as follows: Sprouting rate (%) = (Total number of buds after planting – Total number of buds before planting)/Number of parallel replicates × 100%.

The same calculation method was applied to the control group.

Table 1 Factor level table for rhizome reproduction

Level	A Hormone formula	B Soaking time//h	C Age
1	① BA 3 mg/L + GA3 0.2 mg/L	8	One year old
2	② BA 2 mg/L + NAA 0.2 mg/L	12	Two years old
3	③ BA 1mg/L + TDZ 0.2 mg/L	24	Three years old

As shown in Table 2, the effects of various factors on the growth rate of *D. versipellis* ranked as hormone formula > rhizome age > soaking time (h) (A > C > B). The optimal combination was $A_2B_2C_3$, which corresponded to three-year-old rhizomes soaked for 12 h in a hormone solution containing BA 2 mg/L + NAA 0.2 mg/L. The sprouting rate obtained using water soaking alone was 133.33%. The results of the rhizome propagation experiment are shown in Fig. 1.

Adventitious root propagation of *D. versipellis*

D. versipellis possesses a well-developed underground root system. A typical three-year-old plant generally has over 30 roots, each measuring 50 – 60 cm in length. Accordingly, the fibrous roots excised from the rhizomes were cut into segments of 10 – 30 cm, which were horizontally buried in soil, covered with 4 – 5 cm of fine soil, and thoroughly watered. The sprouting rate was subsequently observed.

Table 2 Orthogonal experimental design and result table for rhizome propagation

No.	Factor			Sprouting rate//%
	A	B	C	
1	3.00	3.00	1.00	100.00
2	1.00	2.00	3.00	200.00
3	3.00	1.00	3.00	166.67
4	1.00	3.00	2.00	150.00
5	2.00	3.00	3.00	166.67
6	3.00	2.00	2.00	100.00
7	2.00	2.00	1.00	200.00
8	2.00	1.00	2.00	150.00
9	1.00	1.00	1.00	100.00
K_1	450	416.67	400	
K_2	516.67	500	400	
K_3	366.67	416.67	533.34	
R	150	83.33	133.34	

Fig. 1 Rhizome propagation experiment of *D. versipellis* (left: before planting, right: after 9 months)

Fig. 2 Growth of *D. versipellis* during adventitious root propagation

The adventitious root propagation experiment utilized cut peices from two-year-old *D. versipellis* plants. Two types of materials were used: one consisted of isolated adventitious roots (approximately 10 cm in length), and the other consisted of adventitious roots attached to two-year-old rhizomes (cut with buds). For both types, approximately 20 – 30 replicates were designed per sample. The experimental design also included treatments with or

without addition of Shuangjier (GGR) solution, as well as soaking durations in GGR solution of 4, 12, and 24 h. The experimental design is detailed in Table 3, and growth images are shown in Fig. 2.

The effects of rhizome age (one year old, two years old, and three years old) on the experiment was also investigated. The specific design is detailed in Table 3 below. Growth conditions were regularly observed, and the sprouting of adventitious buds was recorded at 3, 6, and 9 months after planting. The sprouting rate was calculated at 6 months as follows: Sprouting rate (%) = (Total number of buds after planting – Total number of buds before planting)/Number of parallel replicates × 100%. The specific experimental design for investigating the effects of different root ages (one year old, two years old, and three years old) is shown in Table 4 below.

Based on the experimental design for adventitious root propagation, the optimal propagation method was determined to be: soaking rhizome-attached roots in GGR solution for 12 h. Regarding the influence of different ages on adventitious root propagation, the three-year-old adventitious roots yielded the best results.

Table 3 Experimental design of adventitious root propagation

No.	Treatment method	Sprouting rate//%
A	Adventitious roots alone, soaked in GGR solution for 4 h	8
B	Adventitious roots alone, soaked in GGR solution for 12 h	20
C	Adventitious roots alone, soaked in GGR solution for 24 h	17
D	Adventitious roots alone, planted directly in tap water	4
E	Adventitious roots with rhizomes, soaked in GGR solution for 4 h	35
F	Adventitious roots with rhizomes, soaked in GGR solution for 12 h	49
G	Adventitious roots with rhizomes, soaked in GGR solution for 24 h	43
H	Adventitious roots with rhizomes, planted directly in tap water	32

Table 4 Experimental design for different rhizome ages

No.	Treatment method	Sprouting rate//%
I	One-year-old adventitious roots alone, soaked in GGR solution for 12 h	4
B	Two-year-old adventitious roots alone, soaked in GGR solution for 12 h	20
J	Three-year-old adventitious roots alone, soaked in GGR solution for 12 h	23
K	One-year-old adventitious roots attached to rhizomes, soaked in GGR solution for 12 h	16
L	Two-year-old adventitious roots attached to rhizomes, soaked in GGR solution for 12 h	49
M	Three-year-old adventitious roots attached to rhizomes, soaked in GGR solution for 12 h	54

Conclusions and Discussion

D. versipellis is a precious plant endemic to China with significant medicinal value. This study employed an orthogonal design to explore cultivation methods for its rhizomes. The optimal protocol was determined to be soaking three-year-old rhizomes in a solution of BA 1 mg/L + TDZ 0.2 mg/L for 24 h, achieving a sprouting rate of 167%. The control group without hormone treatment exhibited a sprouting rate of 100%, indicating that *D. versipellis* can sprout naturally without hormonal intervention, but hormone soaking significantly enhances the sprouting rate.

D. versipellis possesses a well-developed underground root system. Through experimental design for adventitious root propagation, the optimal propagation method was determined as: soaking rhizome-attached roots in GGR solution for 12 h. The control group treated with tap water also showed sprouting capability, but demonstrated a lower sprouting rate compared with the GGR-treated group. The study also revealed that isolated roots alone could develop buds, achieving a rate of 8%, though the sprouting rate remained low. These results indicate that rhizome-attached roots exhibit higher survival rates during propagation.

When comparing the effects of different rhizome ages (one-year-old, two-year-old, and three-year-old), it was found that three-year-old rhizomes exhibited a higher sprouting rate of 154%, surpassing that of one-year-old and two-year-old rhizomes.

The artificial cultivation models of *D. versipellis* were systematically investigated in this study. Exploring the rhizome propagation and adventitious root propagation of *D. versipellis* is of great significance, as it not only provides technical support for the cultivation of *D. versipellis* but also offers a reference for formulating corresponding *Technical Operating Procedures* (SOP) and establishing demonstration bases, thereby demonstrating considerable potential for broader adoption.

References

[1] Editorial Board of Flora of China, Chinese Academy of Sciences. Flora of China[M]. Beijing: Science Press, 1993. (in Chinese).

[2] TAN XM, ZHOU YQ, LU ML, *et al.* Ecological occurrence and plant regeneration of embryoid of the endangered and endemic plant *Dysosma versipellis* in China[J]. Northern Horticulture, 2021(19): 121 – 127. (in Chinese).

[3] MA J, JIANG L, CHEN H, *et al.* Research progress of *Dysosma versipellis*[J]. Journal of Hubei University of Medicine, 2020, 39(1): 96 – 100. (in Chinese).

[4] QIN XB. Advances in research on plant of *Dysosma* in China[J]. Resource Development & Market, 2012, 28(11): 1018 – 1019, 1043. (in Chinese).

[5] ZHANG Y, LI B, LI SF. Research advances of conservation biology on *Dysosma versipellis*[J]. Subtropical Plant Science, 2011, 40(4): 89 – 92. (in Chinese).

[6] XIATIGULI · ABULIZI, JIA XG, XIONG YJ, *et al.* Research progress of *Dysosma versipellis*[J]. Xinjiang Journal of Traditional Chinese Medicine, 2010, 28(3): 69 – 72. (in Chinese).

[7] ZHANG J, LI JT, LI XJ, *et al.* Research on the idioplasm resources of *Dysosma* Woodson[J]. Journal of Mianyang Teachers' College, 2008 (11): 78 – 80. (in Chinese).

[8] LYU M, SU YF, GUO ZJ, *et al.* General situation of chemical constituents and biological activities of *Dysosma*[J]. Northwest Pharmaceutical Journal, 2007, 22(3): 152 – 153. (in Chinese).

(Continued on page 7)

Packaging, Storage and Transportation

Packaging

The packaging and labeling must comply with the requirements of NY/T 1655.

Storage and transportation

During storage, products should be stored separately by variety, grade, and specification. Stacking should ensure uniform air circulation. The suitable storage temperature is 11 to 13 ℃, and the suitable relative humidity is around 80%. The storage room should be cleaned and disinfected before use, and its temperature should be reduced to the suitable range. Storing together with toxic or hazardous substances is prohibited. Pre-cooling is required before transportation. The suitable transport temperature is 10 to 13 ℃, and the suitable relative humidity is around 80%.

Management of Production Waste

Residual branches, diseased leaves, senescent leaves and weeds in the field are promptly cleared away and centrally subjected to harmless treatment to maintain clean field conditions. Empty pesticide bottles or bags are collected and processed according to their type.

Production Records

Detailed records are maintained, including information on the production site's environmental conditions, production inputs, production management, pest and disease control, product quality testing, and relevant traceability data. These records are kept for a period of no less than three years.

References

[1] XU ZF, WEI SL. High-yield and high-efficiency cultivation techniques of greenhouse netted melon[J]. Modern Horticulture, 2022, 16: 33 – 37. (in Chinese).

[2] LI XH, CHANG GZ, KANG LY, *et al.* Technical specification for facility production of netted melon[J]. Zhongguo Guacai, 2018, 31(9): 54 – 56. (in Chinese).

[3] HUANG KD, JIANG CS. Cultivation techniques of netted melon in solar greenhouse after winter and spring in Haiyang City[J]. Modern Agricultural Science and Technology, 2008(23): 40 – 41. (in Chinese).

[4] DONG YM, JIAO ZG, WANG CQ, *et al.* Efficient cultivation model of netted melon Luhoutian 1 in Haiyang City[J]. Zhongguo Guacai, 2008 (2): 48 – 49. (in Chinese).

[5] JIAO ZG, WANG CQ, DONG YM, *et al.* How to improve the beauty of netted melon[J]. New Rural Technologies, 2017(9): 15. (in Chinese).

[6] BAI YQ. Pollution-free and high-yield cultivation techniques of netted melon in protected field[J]. Shanghai Agricultural Science and Technology, 2006 (2): 75 – 76. (in Chinese).

[7] JIANG H, GAO S, XU T. Protected cultivation techniques of netted melon in early spring[J]. China Vegetables, 2024(2): 131 – 134.

Editor: Yingzhi GUANG Proofreader: Xinxiu ZHU

(Continued from page 3)

[9] XU Y, QIU B, XIONG YX, *et al.* Determination of three active components in *Dysosma versipellis* by HPLC[J]. Yunnan Journal of Traditional Chinese Medicine and Materia Medica, 2017, 38(7): 65 – 67. (in Chinese).

[10] ZHANG YJ, FENG C. The identification of the active component of *Dysosma versipellis* and its effect on anticancer activity[J]. Journal of Jilin Medical College, 2013, 34(4): 241. (in Chinese).

[11] JIANG F, TIAN HY, ZHANG JL, *et al.* Studies on chemical constituents of *Dysosma versipellis*[J]. Chinese Traditional and Herbal Drugs, 2011, 42(4): 634. (in Chinese).

[12] ZHANG PN, LI CF, ZHAO CQ. Podophyllotoxin and its derivatives [J]. Natural Product Research and Development, 2004, 16(1): 80. (in Chinese).

[13] LEI Z, YANG GY, YE F, *et al.* Determination of podophllotoxin in *Dysosma versipellis* by UPLC[J]. China Pharmacist, 2013, 16(4): 548. (in Chinese).

Editor: Yingzhi GUANG Proofreader: Xinxiu ZHU