Microscopic and Ultraviolet Spectroscopic Identification of *Pyrostegia venusta* (Ker-Gawler.) Miers

Hailin LU△, Bin LI△, Zishu CHAI, Zhiying WEI, Wencheng WEN*, Jianning TAN*

Guangxi University of Chinese Medicine, Nanning 530200, China

Abstract [**Objectives**] To identify *Pyrostegia venusta* (Ker-Gawler.) Miers by microscope and ultraviolet spectrum. [**Methods**] The paraffin section, slide section and freehand section were used to make the cross section of the stem and leaf, and the surface of the leaf and the powder of the root, stem and leaf were made by the conventional method, which were observed under the optical microscope. Ultraviolet-visible spectrum identification was carried out according to a conventional method. [**Results**] The microscopic identification and ultraviolet-visible absorption characteristics of *P. venusta* (Ker-Gawler) Miers were described in detail. [**Conclusions**] This study is expected to provide a reference for the identification of *P. venusta* (Ker-Gawler) Miers and the establishment of the related quality standard.

Key words Microscopic identification, Ultraviolet spectroscopic identification, *Pyrostegia venusta* (Ker-Gawler.) Miers, Quality standard

1 Introduction

Pyrostegia venusta (Ker-Gawler.) Miers is large evergreen vine of the genus *Pterospermum* in family Bignoniaceae. It is native to Brazil, South America, it has been widely cultivated as an ornamental pergola in tropical Asia. It is cultivated in Guangdong (Guangzhou), Hainan, Guangxi, Fujian, China Taiwan, Yunnan (Kunming, Xishuangbanna) and other places in China[1]. It is neutral in nature, bitter in taste and slightly astringent. It has the effects of moistening lung and relieving cough, clearing heat and relieving sore throat. It is used for pulmonary tuberculosis, chronic cough, sore throat and other symptoms[2].

It is reported that an orange-yellow pigment was extracted from *P. venusta* and can be used as a food additive. The extraction method, extraction agent selection, physical and chemical properties and stability of *P. venusta* pigment were studied[3-4]. Through literature search, it is known that the research on *P. venusta* in China focuses on cultivation, greening environment and pigment extraction, while the research on anti-cancer activity[5], antiandrogen and antioxidant activity[6], antibacterial activity and wound healing activity[7], and reducing lipopolysaccharide-induced disease behavior in mice[8] has been carried out abroad. However, there is no report on the pharmacognosy study of them, so the microscopic and ultraviolet spectral identification of them can provide a reference for the formulation of quality standards and further research.

2 Materials and methods

2.1 Materials DMB-1223 optical microscope, Agilent 8453 ultraviolet-visible spectrophotometer, HM355S automatic paraffin microtome (Microm, Germany), 860 microtome (USA); solvents are 95% ethanol, ethyl acetate, petroleum ether, acetone, methanol and chloroform, all of which are analytically pure. The materials were collected from the suburbs of Nanning, Guangxi, and were identified as the stems and leaves of *P. venusta* (Ker-Gawler.) Miers by Yin Shenggao, an associate professor from Guangxi University of Chinese Medicine.

2.2 Methods

2.2.1 Microscopic identification. The paraffin section, slide section and freehand section were used to make the cross section of the stem and leaf, and the surface of the leaf and the powder of the root, stem and leaf were made according to the conventional method, and the microscopic observation was carried out under the optical microscope, and the text description and drawing of each part were completed.

2.2.2 Ultraviolet spectrum identification. We separately weighed six portions of coarse powder of *P. venusta*, 1.0 g for each portion, put into a conical flask, added 20 mL of 95% ethanol, ethyl acetate, petroleum ether, acetone, methanol and chloroform solution, soaked for 24 h, filtered, diluted appropriately, took the corresponding solvent as a blank control, and scanned at the wavelength range of 200 - 800 nm.

3 Results and analysis

3.1 Microscopic characteristics

3.1.1 Cross section of stem. The cross section of the stem is round-like, with 8 fine ridges on the edge. Epidermal cells are round-like or oval, with slightly thick cell walls, covered with cuticle, with glandular phosphorus, and with non-glandular hairs on young stems. At the ridge, there are 3 - 5 rows of collenchyma inside the epidermal cells, and there are many fibers below the collenchyma, forming large fiber bundles, which are located below the collenchyma. For the old stem, there are 2 to 4 rows of cork cells in the inner side of the fiber bundle, and 1 to 4 layers of fi-

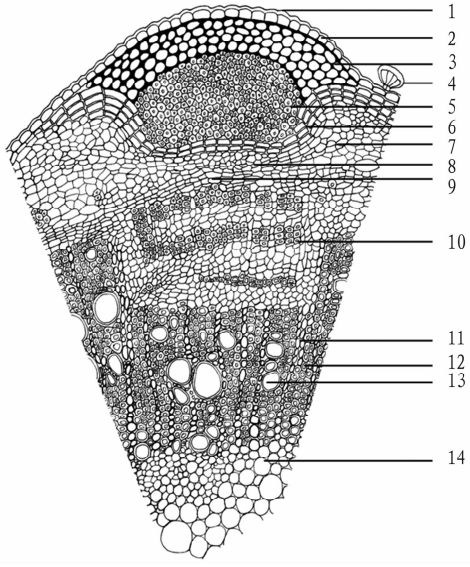
Received: January 12, 2025 Accepted: March 3, 2025

Supported by Scientific Research Program of Guangxi University of Chinese Medicine (P200246).

△These authors contributed equally to this work.

Hailin LU, bachelor's degree, senior experimenter; Bin LI, master's degree, associate professor. * Corresponding author. Wencheng WEN, professor; Jianning TAN, master's degree, professor-level senior experimenter.

ber cells in the middle of the cambium and xylem, which are arranged alternately with the parenchyma cells. The whole stem is almost rectangular. When sliced, the parenchyma cells connected with the xylem are easy to fall off and form fissures. Cortical cells are round-like or ellipse-like. The phloem is narrow, and the fibers are scattered singly or in groups. Cambium is obvious, with 3 to 5 layers of cells. The xylem is wide and evenly lignified. The vessels are sparse, scattered singly or in groups of 2 to 4. There are wood rays beside the vessels, and the wood rays are arranged radially in 1 to 2 rows of cells. The pith is wide, accounting for about a half of the radius of the transverse section, and the parenchyma cells are not lignified (Fig. 1).

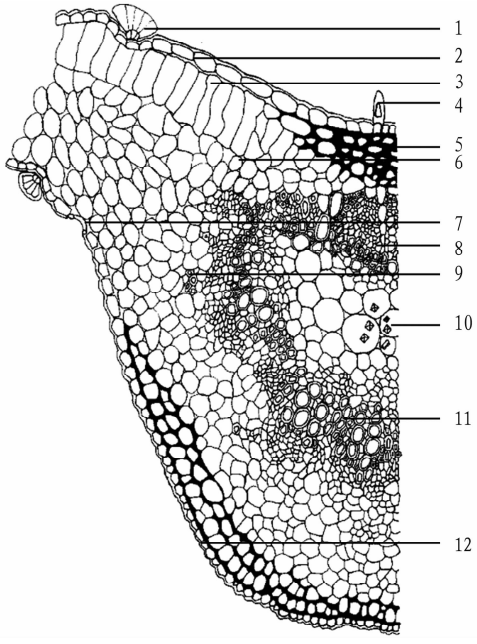


NOTE 1. Cuticle, 2. Epidermis, 3. Collenchyma, 4. Adenine, 5. Fiber bundle, 6. Cork cell, 7. Cortex, 8. Phloem, 9. Cambium, 10. Fiber, 11. Ray, 12. Xylem, 13. Vessel, 14. Pith.

Fig. 1 Detail of stem cross section of *Pyrostegia venusta* (Ker-Gawler.) Mier (×400)

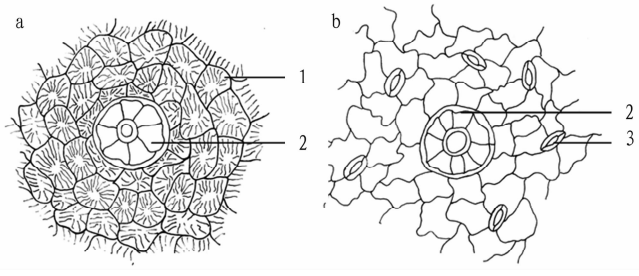
3.1.2 Cross section of leaf. The upper and lower epidermal cells have one row each. The upper epidermal cells are oblong and non-glandular hairs can be seen. The lower epidermal cells are polygonal and stomata can be seen. There are large flat spherical glandular phosphorus in the depression of the upper and lower epidermal cells. The palisade tissue has one row of cells, the cells are long column-like and do not pass through the main vein; the spongy tissue has several layers, and the cells are round-like or ellipse-like. The vascular bundle of the main vein is of the outer phloem type, almost in the shape of a vascular column, the xylem vessels are often 1 to 4 in a row, the phloem is narrow, and there are collenchyma tissues on the inner side of the upper and lower epidermis. The parenchyma cells contain prismatic crystals and a few prismatic crystals, as shown in Fig. 2.

3.1.3 Leaf surface characteristics. The cells of the upper epidermis are polygonal, with slightly curved anticlinal walls, and the cuticle texture can be seen, and adenophosphorus can often be seen; the cells of the lower epidermis are polygonal, with wavy and curved anticlinal walls, and the stomata are indefinite, and adenophosphorus can also be seen (Fig. 3).



NOTE 1. Glandular scale, 2. Epithelium, 3. Palisade tissue, 4. Non-glandular hair, 5. Collenchyma, 6. Spongy tissue, 7. Stoma, 8. Phloem, 9. Fiber, 10. Crystal, 11. Xylem, 12. Lower epidermis.

Fig. 2 Detail of cross section of leaf of *Pyrostegia venusta* (Ker-Gawler.) Miers (×400)



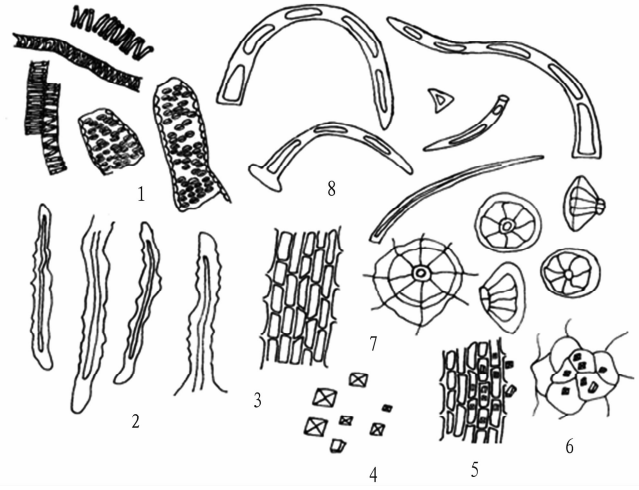
NOTE a. Upper epidermis, b. Lower epidermis. 1. Stratum corneum texture, 2. Glandular scale, 3. Stomata.

Fig. 3 Leaf surface section of *Pyrostegia venusta* (Ker-Gawler.) Miers (×400)

3.1.4 Characteristics of stem and leaf powder. The stems and leaves are gray-brown, slightly fragrant and light in taste. The cork cells are colorless or pink, the surface is oblong, a few cells are polygonal, some walls are slightly thick, and occasionally cork cells containing square crystals are seen. Adenine is composed of a head and a stalk. The head is spherical in apical view and fan-shaped in lateral view, with a diameter of 153.7 – 211.9 μm. It is composed of 6 – 9 secretory cells. The stalk is very short, composed of 1 – 3 cells. Spiral vessels with diameter of 16.0 – 41.0 μm and bordered pit vessels are common. The intact non-glandular hairs are composed of 1 – 6 cells, straight or curved, and the

wall thickness is 5 – 12 μm.

Calcium oxalate crystals are mostly observed in the cork cells and parenchyma cells, and prismatic crystals are occasionally observed. The fibers are single and scattered, or connected with vessels, long fusiform, with microwavy edges, 10.0 – 46.2 μm in diameter, thickened walls, and wide cavities, as shown in Fig. 4.



NOTE 1. Vessel, 2. Fiber, 3. Cork cell, 4. Crystal, 5. Crystal-containing cork cell, 6. Crystal-containing parenchyma cell, 7. Adenine, 8. Non-glandular hair.

Fig. 4 Powder picture of whole plant of *Pyrostegia venusta* (Ker-Gawler.) Miers (×400)

3.2 UV-Vis spectral characteristics It can be seen from Table 1 that the petroleum ether extract has 5 absorption peaks, the acetone extract has 5 absorption peaks, the ethanol extract has 3 absorption peaks, the chloroform extract has 5 absorption peaks, the ethyl acetate extract has 6 absorption peaks, and the methanol extract has 4 absorption peaks.

Table 1 UV absorption spectrum results of *Pyrostegia venusta* (Ker-Gawler.) Miers

Solvent	Absorption peak//nm
95% ethanol	209.0, 412.0, 664.0
Ethyl acetate	271.0, 318.0, 410.0, 534.0, 607.0, 666.0
Petroleum ether (60 – 90 ℃)	267.0, 420.0, 444.0, 473.0, 669.0
Acetone	208.0, 410.0, 534.0, 608.0, 665.0
Methanol	208.0, 269.0, 408.0, 664.0
Chloroform	247.0, 415.0, 538.0, 609.0, 668.0

4 Conclusions

The above experimental results show that the main microscopic characteristics of *P. venusta* include: (i) there are fine ridges on the edge of the stem cross section, and glandular scales are often seen on the epidermal cells. At the ridges, there are 3 – 5 rows of collenchyma on the inner side of the epidermal cells, and there are many fibers below the collenchyma, which are located below the collenchyma. For the old stem, there are 2 to 4 rows of cork cells in the inner side of the fiber bundle, and there are 1 to 4 layers of fiber cells in the middle of the cambium and the xylem, which are arranged alternately with the parenchyma cells. The whole stem is almost rectangular. When sliced, the parenchyma cells connected with the xylem are easy to fall off and form fissures. The cambium is obvious, and the xylem cells are lignified. (ii) The vascular bundle of the main vein of the leaf is of the outer phloem type, almost columnar, and the phloem is narrow, with collenchyma on the inner side of the upper and lower epidermis. (iii) Glandular scales, non-glandular hairs and vessels are common in stem and leaf powder. Fibers and prismatic crystals can be seen, and prismatic crystals can be seen occasionally. The ultraviolet-visible spectrum characteristic is that the petroleum ether extract has 5 absorption peaks, the acetone extract has 5 absorption peaks, the ethanol extract has 3 absorption peaks, the chloroform extract has 5 absorption peaks, the ethyl acetate extract has 6 absorption peaks, and the methanol extract has 4 absorption peaks. The above experimental results have pharmacognosy characteristics and can provide a reference for the identification of *P. venusta* and the formulation of related quality standards.

References

[1] Editorial Board of Flora of China. Flora of China: Volume 69[M]. Beijing: Science Press, 1990: 3. (in Chinese).

[2] Editorial Board of Chinese Materia Medica. Chinese Materia Medica: Volume 7[M]. Shanghai: Shanghai Scientific & Technical Publishers, 1999: 432. (in Chinese).

[3] YIN MH, YAO RL. Extraction of the pigment of fire-cracker vine and its physical and chemical properties[J]. Journal of Dali University, 2009, 38(4): 49 – 51, 73. (in Chinese).

[4] LIN QH, LIN CW, ZHANG N, *et al.* Content determination of carotenoid in *Pyrostegia venusta* and its anti-inflammatory activity[J]. Chemistry & Bioengineering, 2020, 37(3): 42 – 47.

[5] BHAT MP, KUMAR RS, ALMANSOUR AI, *et al.* Characterization, antimicrobial activity and anticancer activity of *Pyrostegia venusta* leaf extract-synthesized silver nanoparticles against COS-7 cell line[J]. Applied Nanoscience, 2022, 13(3): 1 – 12.

[6] PEREIRA AM, HERNANDES C, PEREIRA SI, *et al.* Evaluation of anticandidal and antioxidant activities of phenolic compounds from *Pyrostegia venusta* (Ker Gawl.)[J]. Chemico-Biological Interactions, 2014, 224: 136 – 141.

[7] ROY P, AMDEKAR S, KUMAR A, *et al.* In vivo antioxidative property, antimicrobial and wound healing activity of flower extracts of *Pyrostegia venusta* (Ker Gawl) Miers[J]. Journal of Ethnopharmacology, 2012, 140(1): 186 – 192.

[8] VELOSO CC, BITENCOURT AD, CABRAL LDM, *et al.* *Pyrostegia venusta* attenuate the sickness behavior induced by lipopolysaccharide in mice[J]. Journal of Ethnopharmacology, 2010, 132(1): 355 – 358.