A Study of Zibeitiankui [*Semiaquilegia adoxoides* (DC.) Makino] in *Leigong Paozhilun*

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Abstract Zibeitiankui [*Semiaquilegia adoxoides* (DC.) Makino] was first documented in *Leigong Paozhilun* (*Lei Gong's Treatise on Preparation and Broiling of Materia Medica*). Due to the succinct description in the original text, its nomenclature and identification became confused in subsequent generations. This study investigates the issue by reviewing ancient materia medica literature and integrating analyses of plant morphology, origin, and alchemical functions. The findings indicate that Zibeitiankui in *Leigong Paozhilun* corresponds to *Semiaquilegia adoxoides* (DC.) Makino, a species within the Ranunculaceae family, which began to be utilized during the late Sui Dynasty and early Tang Dynasty. The term "Tiankui" was initially used interchangeably with "Tukui"; it was not until the Qing Dynasty that *Zhiwu Mingshi Tukao* (*An Illustrated Book of Plants*) and *Bencao Gangmu Shiyi* (*Supplement to the Compendium of Materia Medica*) distinguished between the two. In Taoist practice, Tiankui often refers to substances used in the refinement of external elixirs. The name Zibeitiankui derives from the purple coloration on the underside of its leaves. In *Diannan Bencao* (*Materia Medica of Southern Yunnan*), Zibeitiankui refers to *Gynura bicolor* (Roxb. ex Willd.) DC. of the Compositae family, whereas in botanical terms, it denotes *Begonia fimbristipula* Hance of the Begoniaceae family. Although these three plants share the same name, they are distinct species.

Key words *Leigong Paozhilun*, *Semiaquilegia adoxoides* (DC.), Herbal textual research

1 Introduction

Zibeitiankui [*Semiaquilegia adoxoides* (DC.) Makino] was first documented in *Leigong Paozhilun* (*Lei Gong's Treatise on Preparation and Broiling of Materia Medica*). In the preface, it is stated that there exists a variety of Zibeitiankui, commonly resembling the curled mallow consumed daily; its leaves exhibit a purple coloration on the dorsal side and green on the ventral side, and it is purported to consolidate the lead form in alchemical practice[1]. This description is overly simplistic. Subsequent records of Zibeitiankui in later materia medica literature remain ambiguous, and there is a lack of comprehensive academic investigation regarding its precise identity. Zibeitiankui, commonly utilized in Taoist alchemical practices, has also been documented in medical literature owing to its properties of ulcer treatment, pus discharge, and analgesic effects. Therefore, it is imperative to investigate its varietal sources to guarantee its medicinal efficacy.

2 Zibeitiankui shares the same name but is an anomaly in *Diannan Bencao* (*Materia Medica of Southern Yunnan*) and *Leigong Paozhilun*

As the earliest known processing monograph in history, the compilation date of *Leigong Paozhilun* remains a subject of scholarly debate. The primary perspectives place its origin in various periods, including the Liu Song period of the Northern and Southern Dynasties[2], the Sui Dynasty[3], the late Tang and Five Dynasties[4], the Zhao Song period[5], and the late Sui and early Tang Dynasties[6]. With the advancement of research, the evidence supporting the concept pertaining to the late Sui and early Tang Dynasties has become increasingly substantial. Accordingly, this article posits that *Leigong Paozhilun* was originally authored by Lei Xiao, a local regime that held dominance over Jiangdong during the late Sui and early Tang Dynasties, and was subsequently revised by Hu Qia during the late Tang and Five Dynasties. Although *Leigong Paozhilun* documents Zibeitiankui, a comprehensive review of ancient literature reveals that, aside from *Leigong Paozhilun*, only the local materia medica *Diannan Bencao*, authored by Lan Mao during the Ming Dynasty, references the herb Zibeitiankui. It is described as having a pungent taste and slight toxicity, resembling a dandelion with green leaves and a purple underside. The herb can be sun-dried, ground into powder, and applied to large sores, yielding remarkable therapeutic effects. However, accidental ingestion induces profuse sweating and loss of consciousness[7]. Based on the description of the plant resembling a dandelion, characterized by green leaves and a purple underside, and considering its origin in Yunnan, the species is likely *Gynura bicolor* (Roxb. ex Willd.) DC. of the Asteraceae family. According to *Leigong Paozhilun*, Zibeitiankui resembles curled mallow, which is commonly consumed. Curled mallow, commonly referred to as "Dongkui", denotes to *Malva verticillata* L. var. *crispa* L. of the Malvaceae family. This plant was cultivated as a vegetable prior to the Han Dynasty, and its fruit, known as Fructus Malvae Verticillatae, has been used in traditional Chinese medicine. *M. verticillata* is a species within the Malvaceae family. Its leaves are round and exhibit 5 – 7 lobes. The flowers are small, white, and develop either singly or in clusters in the leaf axils. This morphological characteristic markedly differs from that of *G. bicolor* (Roxb. ex Willd.) DC. Evidently, the plant referred to as Zibeitiankui in *Diannan Bencao* is distinct from the Zibeitiankui described in *Leigong Paozhilun*.

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3 Luokui is distinct from Zibeitiankui as characterized in *Leigong Paozhilun*

Beginning with the name "Tiankui" to seek relevant information, it is noted that the term "Tiankui" in materia medica first appeared in the *Mingyi Bielu* (*Miscellaneous Records of Famous Physicians*), where it is identified as an alternative name for Luokui. *Mingyi Bielu* states, "Luokui, also known as Tiankui and Fanlu …"[8]. *Shu Ben Cao* offers a comprehensive description of the plant morphology of Luokui, noting that it is also referred to as "Tengkui". The plant exhibits a sprawling growth habit and possesses round leaves comparable in thickness to those of the apricot tree. Its seeds resemble those of *Schisandra chinensis*, appearing green when raw and turning black upon cooking, and the plant is widely distributed[9]. Li Shizhen's *Bencao Gangmu* (*Compendium of Materia Medica*) describes the plant as spreading in May, with leaves resembling those of the apricot tree, though thicker, softer, and smoother[2]. It is suitable for use as both a vegetable and a meat source. During August and September, the plant produces delicate purple flowers and abundant fruit, comparable in size to *S. chinensis*, which turn purple-black upon ripening. The juice, noted for its rouge-like red color, is traditionally kneaded and utilized by women for facial adornment, as lipstick, and for dyeing fabrics. This substance is referred to as "Hu Yanzhi" or "Ran Jiangzi", but the color may alter over time. The characteristics of the original Luokui plant described in the aforementioned materia medica correspond closely to those of *Basella alba* L. from the Basella family. *B. alba* L. is a vine species whose leaves are round and resemble those of Dongkui; however, they are not lobed and lack the distinctive "purple underside and green upper surface". Therefore, it is evident that this plant is not the Zibeitiankui referenced in *Leigong Paozhilun* (Figs. 1 – 3).



Fig. 1 Luokui in *Illustrated Atlas for Identifying Original Plants of Chinese Herbal Medicine*

4 Tuikui is not the same as Zibeitiankui, as described in *Leigong Paozhilun*

In addition to Luokui, Tiankui is also documented as an alternative name for Tuikui in traditional materia medica. The term "Tuikui" first appeared in the Tang Dynasty text *Xinxiu Bencao* (*Newly Revised Materia Medica*), which describes it as follows: the seedlings resemble those of *Ranunculus sceleratus*; the leaves are



Fig. 2 Luokui in *Flora of Medicinal Plants in Xiantao, Hubei*



Fig. 3 Line diagram of Luokui in *Zhiwu Mingshi Tukao*

glossy; the flowers are white, resembling plum blossoms; the stems are purple; and the juice is exceptionally smooth and palatable when cooked[10]. These characteristics correspond to those of the genus *Malva* within the Malvaceae family. According to the research conducted by Wu Jialin[11], Tuikui is identified as *Malva verticillata* L., a species belonging to the Malvaceae family.

Since the Song Dynasty, the terms Tukui and Tiankui have frequently been conflated in the literature. The *Bencao Tujing* (*Illustrated Classic of Materia Medica*) states that the term xi (菥) in the *Erya* corresponds to Tukui, which is alternatively known as Tiankui[12]. Similarly, Zheng Qiao's *Tongzhi* from the Southern Song Dynasty states, Tukui, also known as Tiankui. Li Shizhen's *Bencao Gangmu* of the Ming Dynasty also merged the two terms. This conflation persisted until it was rectified during the Qing Dynasty. In the Corrections and Errors section of *Bencao Gangmu Shiyi* (*Supplement to the Compendium of Materia Medica*) authored by Zhao Xuemin during the Qing Dynasty, it is explicitly noted that Li Shizhen (Binhu) cited a statement from *Tujing* (*Illustrated Classic*), asserting that Tukui is synonymous with Tiankui. However, in the Collected Explanations, the morphological description found in *Tujing* is omitted; instead, the text relies

solely on Zheng Qiao's *Tongzhi*, which states that Tukui is precisely Tiankui. According to this account, the plant resembles curled mallow, with leaves as large as coins and notably thick. The surface is green, while the underside is purple, and it typically grows on cliff rocks. Zhao explicitly identified that Li Shizhen's error in conflating Tuikui with Tiankui was influenced by *Bencao Tujing* and Zheng Qiao's *Tongzhi*[13], overlooking the morphological differences between the two plants, which are distinct species.

In the *Zhiwu Mingshi Tukao* (*An Illustrated Book of Plants*) by Wu Qijun of the Qing Dynasty, it is documented that Tukui, also referred to as Yekui, is smaller than Jiakui[14]. The text further clarifies that Tukui is distinct from Tiankui, with the latter being inedible. Zheng Qiao's erroneous identification of Tiankui as Tukui is a significant mistake; to rectify this, he included an illustration of Tukui (Fig. 4) as evidence.



Fig. 4 Line diagram of Tukui in *Zhiwu Mingshi Tukao*

Since Tukui corresponds to *Malva verticillata* L. of the Malvaceae family, it differs from Zheng Qiao's description of Tiankui in *Tongzhi*. Although Yekui resembles Dongkui (curled mallow) in shape, its leaves measure 5 – 11 cm in diameter, which is significantly larger than the size of ancient coins (generally 2 – 3 cm). Furthermore, Yekui does not exhibit the characteristic coloration of green on the upper leaf surface and purple on the underside. Therefore, Tukui cannot be identified as Zibeitiankui.

5 Zibeitiankui referenced in *Leigong Paozhilun* corresponds to Tiankui

Tiankui, identified as a novel plant species, was documented in historical literature during the Tang and Song Dynasties. Zheng Qiao preserved the morphological description of Tiankui in his work *Tongzhi*, noting that it resembles a curled mallow, with leaves as large as coins and thick in texture, exhibiting a green adaxial surface and a purple abaxial surface, and typically growing on cliff rocks. This account aligns closely with the description of Zibeitiankui in *Leigong Paozhilun*, which characterizes the plant as similar to the commonly consumed curled mallow, with leaves displaying purple coloration on the dorsal side and green on the ventral side.

Comprehensive records of the morphology of Tiankui have been documented since the Qing Dynasty. In Zhao Xuemin's *Bencao Gangmu Shiyi*, it is stated that thousand-year-old rat droppings (Radix Semiaquilegiae) is the root of Zibeitiankui. The original plant is described as follows: it sprouts in February, with leaves resembling *Oxalis corniculata*. The purple underside is most prominent when the plant is shaded. Its root resembles rat droppings, being black externally and white internally. The plant produces delicate white flowers in March, characterized by slender horns, and withers in April[13]. *Zhiwu Mingshi Tukao* documents that Tiankui, also referred to as Xia Wuzong, possesses a primary stem and a single leaf each approximately the size of a coin, slightly larger than that of *O. corniculata*. The leaf exhibits a green upper surface and a purple underside. The stem is as slender as silk, while the root is comparable in size to that of *Pinellia ternata*. In spring, the branches emerge delicately, with each branch bearing three leaves, and each leaf dividing into three segments, exhibiting a swaying and drooping posture. Small white flowers appear at the tips but wither by early summer. According to the *Annals of Nancheng County*, Xia Wuzong was named Tiankui. This plant is found in the mountainous regions near Fuzhou and Jiujiang in Jiangxi Province, and Zheng Qiao referred to it as Tukui or Zibeitiankui. In spring, it produces stems and flowers but withers at the onset of summer. The plant has a delicate texture and very fine roots, rendering it extremely difficult to locate. It regrows in autumn and remains viable throughout the winter. Local physicians commonly refer to it as Tiankui. Nancheng borders Fujian Province, and the fishermen there are well acquainted with this fact. The grass, which grows to less than a foot in height, thrives in the shaded crevices of stones. It is unlikely for such grass to sway in the spring breeze as oats do. In Jianchang, traditional folk physicians utilized this method as a treatment for milk poisoning, which proved to be highly effective[14]. Additionally, a depiction of Tiankui is provided, as illustrated in Fig. 5. Tiankui is primarily produced in Fuzhou and Jiujiang, Jiangxi Province. Locally, it is referred to as "thousand-year-old rat droppings" due to the resemblance of its roots to rat droppings. Additionally, because it withers in April, it is also known as Xia Wuzong. The entire plant is relatively small, with a height of less than one foot, and predominantly grows in shaded environments, such as beneath stone crevices. It begins to sprout in February, producing leaves that resemble those of *O. corniculata*, characterized by trifoliate compound leaves approximately 3 cm in size, comparable to the diameter of coins. The leaf lobes are deeply divided, with each branch bearing three leaves and each

leaf exhibiting three distinct lobes. Flowering occurs in March, presenting small white flowers. Based on these morphological characteristics, the plant has been identified as *Semiaquilegia adoxoides* (DC.) Makino, a member of the Ranunculaceae family. This species corresponds to Zibeitiankui, as referenced in *Leigong Paozhilun*. The supporting evidence is as follows.



Fig. 5 Line diagram of Tiankui in *Zhiwu Mingshi Tukao*

(i) The descriptions of the plant morphology of Tiankui found in the literature are consistent with the account recorded in *Leigong Paozhilun*: Zibeitiankui commonly resembles the curled mallow consumed daily, with its leaves displaying a purple coloration on the dorsal side and green on the ventral side. Notably, the leaves of *S. adoxoides*, a member of the Ranunculaceae family, are trifoliate compound leaves, whereas its simple leaves are ovate in shape. The ancients did not distinguish between simple and compound leaves. From a general sensory perspective, the leaves of Tiankui closely resemble those of Dongkui, albeit with a smaller diameter. Specifically, the ancients described Tiankui leaves as "similar to mallow but small" or "as big as a coin", with diameters ranging from 1.2 to 3 cm, whereas Dongkui leaves measure between 5 and 8 cm in diameter. In the phrase "the leaves are as big as coins and thick", the term "thick" likely refers to *M. verticillata* L. var. *crispa* L. of the Malvaceae family. Empirical observations indicate that Tiankui leaves are slightly thicker than those of Dongkui. Additionally, the adaxial (upper) surface of Tiankui leaves is green, while the abaxial (lower) surface exhibits a slightly purplish-green hue, consistent with the description of green dorsal side and purple ventral side.

(ii) From the perspective of the efficacy of Tiankui, the text *Leigong Paozhilun* asserts that Zibeitiankui can solidify the form of a lead, a concept that is not easily comprehended. The work *Leigong Paozhilun* is significantly influenced by Taoist philosophy. In this context, the phrase "can solidify the form of a lead" likely refers to a term used within Taoist alchemical practices. Lead is a substance frequently utilized in Taoist alchemy. The expression "it can solidify the form of a lead" aligns with the description of Tiankui in Zheng Qiao's *Tongzhi*, which states that all types of elixirs and stones require the acquisition of Tiankui to achieve divinity. Additionally, *Goulou Shenshu* records that when the natural juice of Tiankui is boiled with mercury, it becomes firm and is also capable of decocting eight mineral substances to resist fire. The aforementioned evidence suggests that Tiankui is frequently utilized in the preparation of Taoist external elixirs and contributes positively to their refinement. According to *Bai Cao Jing*, a Qing Dynasty Chinese materia medica classic, the root of Zibeitiankui possesses a cooling nature and is effective in clearing heat, treating ulcers, swelling, toxins, furuncles, and carbuncles, as well as injuries resulting from falls, wind, and fire. Additionally, it is used to address seven types of hernias, hemorrhoids, and injuries caused by overexertion.

(iii) Tiankui is distributed across several regions in China, including Sichuan, Guizhou, Hubei, Hunan, northern Guangxi, Jiangxi, Fujian, Zhejiang, Jiangsu, Anhui, and southern Shaanxi. This distribution aligns with the habitat of the author of *Leigong Paozhilun*.

6 Zibeitiankui in botany differs in meaning from its usage in *Leigong Paozhilun*

In botany, there is a plant known as Zibeitiankui, scientifically named *Begonia fimbristipula* Hance, which belongs to the Begoniaceae family. Its leaves are characterized by a green coloration on the upper surface and a purple hue on the underside. The *Flora of China* describes the leaves as slightly asymmetrical, with a broadly ovate shape, measuring 6 – 13 cm in length and 4.8 – 8.5 cm in width[15]. This description does not correspond with historical accounts that characterize the leaves as "like a mallow with small leaves" or "shaped like a coin". Furthermore, Lei Xiao, the author of *Leigong Paozhilun* was a local regime that held dominance over Jiangdong during the late Sui and early Tang Dynasties, and Fu Song's capital was established in Danyang (present-day Nanjing City, Jiangsu Province). In contrast, the primary distribution areas of *B. fimbristipula*, a species within the Begoniaceae family, are located in Zhejiang, Jiangxi, Hunan, Fujian, Guangxi, Guangdong, Hainan, and Hong Kong[15], which differ from the original production regions mentioned in historical records. Therefore, *B. fimbristipula* of the Begoniaceae family should not be identified as Zibeitiankui described in *Leigong Paozhilun*.

7 Conclusions

In summary, Zibeitiankui, as referenced in *Leigong Paozhilun*, corresponds to *S. adoxoides* (DC.) Makino, a species within the Ranunculaceae family. This plant began to be utilized approximately at the transition from the Sui Dynasty to the early Tang Dy-

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nasty. The term Zibeitiankui was originally used interchangeably with Tukui. During the Qing Dynasty, works such as *Zhiwu Mingshi Tukao* and *Bencao Gangmu Buyi* sought to address this confusion by distinguishing Tukui from Tiankui, thereby clarifying both the nomenclature and the actual identity of Tiankui. Taoism frequently employs Tiankui in the preparation of external elixirs. Due to the purple coloration on the underside of its leaves, it is referred to as Zibeitiankui. In the *Diannan Bencao*, Zibeitiankui corresponds to *G. bicolor* (Roxb. ex Willd.) DC., a species within the Compositae family, whereas in botanical taxonomy, Zibeitiankui denotes *B. fimbristipula* Hance of the Begoniaceae family. Although both plants share the name Zibeitiankui as used in *Leigong Paozhilun*, they represent distinct species.

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