

Ethnobotany of *Camptotheca* Decaisne: New Discoveries of Old Medicinal Uses

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Abstract: *Camptotheca* trees had been used as fuelwood and an ornamental species in its native China. There were no reports on medicinal uses of *Camptotheca* in China and thus it was believed the trees had no medicinal before its antitumor activity discovered in 1957. We conducted national surveys of *Camptotheca* in China from 1994 to 1999. We found that *Camptotheca* acuminata is commonly known as happytree (xi shu) because the trees can be used as folk medicine to cure stubborn phlegm as well as other diseases, thus making patients "happy". There are three local names to refer the uses of *C. acuminata* in China. In addition, there are at least 25 other local names for tree morphology and habitat of the species by 35 ethnic groups. There are two local names for *C. lowreyana*. The Dong people made paste from fresh leaves or fruits and powder from dry materials from any part of this tree species and mixed some or all with rice wine to cure many stubborn diseases including furunculosis, skin diseases, and even a liu (probably a kind of cancer). Medicinal and other ethnic uses of *Camptotheca* trees in China were reported in this study.

Keywords: *Camptotheca*, cancer, ethnobotany, etymology, happytree, medicinal uses, wood uses.

INTRODUCTION

The current value of plant-based drugs worldwide is estimated to be more than \$200 billion a year [1]. According to Balick and Cox, nearly one out of every four pharmaceutical drugs in use today was discovered from studying plants used by indigenous peoples for healing. Undoubtedly, the ethnobotanical approach to drug discovery is important in the identification of potentially therapeutic drugs [1]. Ethnic use of happytrees for medicine in China is still a puzzle although it has drawn the attention of many medical doctors, chemists, botanists, and cancer patients for decades. Previously, it was commonly thought that the Chinese happytree was largely a fuelwood and an ornamental species [2-7]. In fact, there were no reports on medicinal uses of *Camptotheca* in China until 1957 when its anti-cancer activity was discovered [8, 9]. As a member of one of the first delegations of American scientists to enjoy academic exchanges with China, Dr. Monroe E. Wall, the discoverer of CPT and taxol, made a special three-week trip to China in 1976 to investigate medical uses of *Camptotheca* in southern China. Dr. Wall could not document any instances and thus concluded that no medical uses existed in China before the 1960s [6, 7]. These conclusions have not been questioned by scientists until now. As Li and Adair stated in 1994, however, 35 ethnic groups of people live in the native range of *Camptotheca* and use dozens of local names for the tree. Cultural and geographical isolations are the two major barriers to documentation of long traditions of ethnic uses of *Camptotheca* by minority Chinese [9].

To wit, the label of a specimen (F. A. McClure 6546) at Harvard University Herbaria collected from Guangdong, China in 1921 indicates "drug plant" although no detailed information on its medicinal uses is provided [9].

One of the purposes of our study has been to document the ethnic uses of *Camptotheca* in selected remote minority regions in China.

Based on our national survey in China in 1994-1999, we found that Chinese minority people of the Dong nationality have been using *Camptotheca* for traditional drug purposes for hundreds and possibly thousands of years. Until now, however, there has been no scientific evidence of its use for medicinal purposes either within or outside of China. Our new findings of certain ethnic use may lead to new directions for medicinal studies of the species. In addition, these findings validate the importance of ethnobotanical studies in the general utilization of plant resources [1].

MATERIALS AND METHODS

A comprehensive literature review was conducted in China and the United States between March 1994 and December 1995. During this period, a non-structured field survey was conducted in the southern Chinese provinces of Sichuan, Hunan, Guangdong and Yunnan with emphasis on the more remote minority regions. Over 250 individuals including medical doctors, folk doctors (rural bare-foot doctors), chemists, biologists, professors, foresters, farmers, enterprise managers and government officials were interviewed or participated in our field surveys. Ethnic groups interviewed included the minority nationalities Dong, Bai, Hui and Dai and majority Han in the southern Chinese provinces. All available specimens of *Camptotheca* deposited at the following herbaria worldwide (A, CDBI, HNNU, IBSC, KUN, MO, P,

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PE, SZ and US) were examined. Location, habitat, local name, and other information were recorded for each specimen examined. These activities have produced the largest single collection of happytree genetic stock available in the world today.

ETYMOLOGY

The genus *Camptotheca* was established by Joseph Decaisne, Director of the Jardin Des Plantes in Paris in 1873. The type *Camptotheca acuminata* Decaisne was described based on specimens collected by Father Armand David in Lushan, Jiangxi Province during his 1868-1870 plant exploration trip in China. The genus name *Camptotheca* is from the Greek "*campto*," meaning bent or curved and "*theca*," a case. The name refers to the anthers which are bent inward in a distinctive manner. The species name, *acuminata*, refers to acuminate tips of leaves.

The first appearance of the Chinese happytree (*C. acuminata* var. *acuminata*) in Chinese literature was as early as in 1848. In the book *Zhi Wu Ming Shi Tu Kao* [Illustrated Investigation of the Names and Natures of Plants] published in 1848, the happytree is identified under the name of Han Lian [10]. This Chinese herbal book briefly describes morphology and habitat, but no uses of the tree (Fig. 1). It recorded that Han Lian grew in the western mountains in Nanchang (Jiangxi), had reddish brown bark, green stems, leaves similar to those on vegetative shoots of paper mulberry, fruited in the fall with tens of individual fruits about the same size as the water bean assembled together in a ball which resembled qiu (a fur ball for a traditional Chinese game), or a cluster of small bananas.



Fig. (1). Description and illustration of the Chinese happytree (*C. acuminata*) in *Zhi Wu Ming Shi Tu Kao* (植物名实图考) by Wu in 1848.

Today in China, however, the most popular common name for *C. acuminata* var. *acuminata* is Xi Shu (喜树). It is not clear when the name came into use. However, it is named as such because the tree can be used as folk medicine to cure stubborn phlegm as well as other diseases, thus making pa-

tients "happy" [11]. Here, the stubborn phlegm refers to the phlegm syndrome which is difficult to cure, and which is the cause or manifestation of stubborn diseases such as recurrent asthma and headache. Xi Shu was first translated into English as "happytree" and *C. acuminata* var. *acuminata* was called Chinese happytree by the senior authors in 1994 [9]. The name happytree has been widely used in the English-speaking world, although it is also known as "Tree of Joy" sometimes. From the original Chinese meaning mentioned above, however, the English name "happytree" is the more appropriate translation.

Local names for the Chinese happytree differ from region to region in China, most referring to tree morphology, habitat, and uses. For example, Chinese names for the description of fruit morphology include Ba Jiao Su (八角树, anise tree, in Guizhou), Ling Shu (菱树, aris tree, in Jiangxi), Tu Ba Jiao (土八角, wild anise, in Guizhou) and Ye Ba Jiao (野芭蕉, wild banana, in Guizhou) (Fig. 2). The names for indicating the habitat of the tree include Chao Yang Zi (朝阳子, sunny seed, in Guangxi), Han Lian (旱莲) or Han Lian Mu (旱莲木) or Han Lian Zi (旱莲子, dry lotus tree, in Jiangsu, Jiangxi and Sichuan), Shui Bai Za (water baiza, in Hunan), Shui Dong Gua (水冬瓜, water white gourd, in Sichuan), Shui Li Zi (水栗子, water chestnut, in Sichuan), Shui Mo Zi (水沫子, water foam, in Yunnan), Shui Ting Mu (水挺木, tree along river, in Sichuan), Shui Tong Shu (水桐树, water tung tree, in Guangdong and Guangxi) and Shui Zong Shu (水棕树, water palm, in Guangdong).



Fig. (2). Fruit of the *Camptotheca acuminata* is often known as wild anise or wild banana.

Chinese names for indicating the uses of the Chinese happytree include Hua Gan Zi Shu (滑杆子树, tree for a kind of litter, in Yunnan), Jia Shu (佳树, fine tree, in Fujian) and Long Shu (龙树, dragon tree, in Yunnan). Names for describing the size and trunk morphology of the tree are Qian Zhang Shu (千张树, thousand-sheet tree, in Sichuan), Qian Zhang Shu (千丈树, thousand-zhang tree, in Sichuan), Tian Zi Shu (天梓树, heavenwood tree, in Hunan), Wan Zhang Shen (万丈深, thousand feet tree, in Sichuan), Nanjing Wu Tong (南京梧桐, Nanjing Chinese parasol tree, in Yunnan), Yang Qing Shu (秧青树, green tree, in Sichuan) and Yuan Mu (圆木, roundwood, in Guizhou). Another name Ji Zi Shu (鸡子树, chicken tree, in Guangxi) is not clear to the authors.

Camptotheca acuminata var. *rotundifolia* is known only as Yuan Ye Xi Shu (圆叶喜树, round leaf happytree) in China and *C. acuminata* var. *tenuifolia* is called only as Bao Ye Xi Shu (薄叶喜树, tenuous leaf happytree).

Camptotheca lowreyana is named in honor of Mr. Lynn R. Lowrey, a horticulturist in Houston, Texas, USA, for his contributions to *Camptotheca* research [12]. The Chinese name of this species is Lowrey Xi Shu (洛氏喜树, Lowrey happytree). The species is also known as Lang Dong Shu (浪洞树, wave-cave tree, in Huaiji of Guangdong) and Qing Yang Hua (青杨花, cathay poplar flower, in Lian Xian of Sichuan).

The common name for *C. yunnanensis* is known only as Xi Shu (喜树). In fact, this species had never received recognition as a species separated from *C. acuminata* since it was first described in 1908 [12]. Until recently, when the senior author proposed the Chinese name of the species as Yunnan Xi Shu (云南喜树, Yunnan happytree) based on the scientific name.

ETHNOBOTANY

Medicinal Uses

The study began with anecdotal evidence on medicinal uses by native peoples in China. The field record of one specimen (McClure 6546, A) collected from Guangdong in 1921 referred to the Chinese happytree as a "drug plant," but there was no further explanation. *Camptotheca* is largely distributed in southwestern and southern China, which is home to some 40 Chinese minority ethnic populations. The real meaning of many local names of *Camptotheca*, including Xi Shu, remains unknown. Fortunately, through numerous interviews with the assistance of local translators, we have documented several traditional medical uses of the plant.

In Huaiji, the most important forestry county of Guangdong Province, people of the Dong nationality confirmed traditional folk uses of *Camptotheca*. According to two rural doctors, Dongda Lu and Zhiming Yang, the Lowrey happytree (*C. lowreyana*) locally known locally as Lang Dong Shu (浪洞树), was commonly present some decades ago and has been used for medicinal purposes by local people for as long as memory serves. At present, however, only a few trees remain in the wild and no plantations have been developed. Mr. Lu, a 79 year old man of the Dong nationality (侗族) knew the medical uses of the tree from his father (Fig. 3). The people in his community made paste from fresh leaves or fruits and powder from dry materials from any part of the tree and mixed some or all with rice wine to cure many stubborn diseases including furunculosis, skin diseases and even a liu (probably a kind of cancer). Applying the paste or powder mixture with liquor or wine once a day for three consecutive days constitutes one treatment cycle which is usually sufficient. Later, we found the same uses for extracts of *Camptotheca* in other Dong villages. From our understanding today, liquor or wine is actually necessary to make the drugs effective because most drugs from the tree including camptothecin, 10-hydroxycamptothecin, and 9-aminocamptothecin are water insoluble, but are alcohol-soluble.



Fig. (3). Mr. Dongda Lu, a 79-years-old bare-foot doctor in Shiyang, Huaiji, Guangdong, China is identifying *Camptotheca lowreyana* as Lang Dong Shu, a traditional folk medicinal plant used for many stubborn diseases (photo by S.Y. Li, 1995).

In Sichuan, Hunan, and Yunnan, hundreds of people, including doctors, farmers, foresters, and scientists were interviewed and none could describe ethnobotanical uses of *Camptotheca* (Fig. 4). We should caution, however, that this does not necessarily exclude historical ethnobotanical uses of *Camptotheca* in these provinces. The forest in the survey region had been clear cut for agricultural use early in this century. The *Camptotheca* developed in these provinces since 1950 has largely been for other purposes. In addition, the seed source for these plantations came primarily from other provinces as none was available locally. Obviously, the gap (at least 40-50 years) between the disappearance of wild populations and the establishment of plantations in these regions resulted in a loss of knowledge about traditional uses of the species. As we know, however, many traditional medicinal uses and recipes in China are handed down orally from parents to their children. In many cases there is no written record. More likely, with the obscurity of *Camptotheca* populations over a long period of time, folk recipes probably lost significance and disappeared or were replaced in these regions by more modern treatments. It is now difficult to find any local knowledge of medicinal uses within these regions. It may still be possible, however, to obtain some kind of evidence on local uses through a comprehensive survey if done in a timely manner.

Recipes

Although folk uses of *Camptotheca* can be traced back centuries in some regions. It was only in the early 1970s, that majority Chinese doctors (Han nationality) began to use the fruit, bark, and leaves of *Camptotheca* to treat certain kinds of cancer in hospitalized patients. Traditional Chinese medical theory holds that *Camptotheca* is bitter and puckery in taste but cool in nature (Table 1). Its therapeutic action is through the liver, gallbladder, spleen and stomach [11]. All

Table 1. Primary medical uses of fruit, bark, and leaves of *Camptotheca*.

Factors	Fruit	Bark	Leaves
Taste	bitter & puckery	bitter	bitter
Nature	cold & toxic	cold	cold
Action Channels	liver, spleen, lungs & stomach	liver	liver & heart
Actions	anti-cancer, clearing away heat & killing insects	eliminating dampness & expelling pathogenic wind	clearing away heat & lessening virulence of any pathogenic organism
Applications	cancers, leukemia, psoriasis & schistosomiasis	psoriasis	all sores, boils, carbuncles & furuncles
Methods	externally or orally (liquid)	externally or orally (liquid)	externally crush fresh leaves mixed with salt
Sources	[13]	[13]	[11]

parts of the tree, including fruit, root bark, stem bark, branches, and leaves can be used as a source for the drug. Materials can be collected in all seasons. The major products of *Camptotheca* are summarized in Table 2 and Fig. (5).



Fig. (4). A senior native Bulang (布朗族) in Xishuangbanna, Yunnan, described the local medicinal uses of *Camptotheca yunnanensis* (photo by S.Y. Li, 1997).

According to the Zhejiang Min Jian Chang Yong Cao Yao [13], "Chinese happytree is also used for psoriasis by simmering chips of bark (or branches) in water. The concentrated liquid thus produced is then mixed with 5 to 10 parts yangmaozhi (wool fat) and Vaseline to make a 10-20% ointment for external applications. Internal medicine is made by simmering 50-100 g of bark/branches in an equal amount of water. The liquid is then taken orally once a day in vari-

ous dosages depending on the severity of the malady. Leaves are also simmered in water and used to wash affected parts of the skin. There is a strong caution against the use of ironware to simmer the materials because of interactions with the drug.



Fig. (5). Two common drugs extracted from *Camptotheca* in China: camptothecin (CPT) and 10-hydroxycamptothecin (photo by S.Y. Li, 1995).

In clinical trials of 101 patients with psoriasis: 13 showed 100% recovery, 29 demonstrated greater than 90% recover, 32 had 50-90% recovery and all were treated without significant side effects [14].

Zhong Cao Yao Xue of Jiangxi (Chinese Herbs in Jiangxi) records that the Chinese happytree is used at the early stage of furuncle, skin ulcer, carbuncle and swollen extremities. Young leaves are pounded and mixed with pieces of salt for external application [11].

According to Zhong Cao Yao Xue of Shanghai (Chinese Herbs in Shanghai), the Chinese happytree is compatible with: (1) *Bupleurum marginatum* good for treatment of all cancers; (2) *Schoepfia chihehsis* for cancer, leukemia and schistosomiasis treatment and (3) Rhinoceros horn for

Table 2. The medical products from *Camptotheca* in China.

Product	Application	Recipe	Distribution	Source (manufacturer)
Happytree fruit	orally & externally	dry fruit	major traditional medicine markets, rural Chinese doctors	many
Alkaloid camptothecin (95-98%)	-----	extracts from any parts of plants	some institutions in Jiangxi, Sichuan, & Yunnan	many
Injectable sodium salt of camptothecin	injection	extracts from any parts of plants	some cancer hospitals. This has been superseded by new formulations	many
Injectable 10-hydroxycamptothecin	intrathecal injection	extracts from fruit	one of dominant anti-cancer drugs in cancer hospitals	(Huangshi Feiyun Pharmaceutical Co., Ltd., Hubei)
Suspension of camptothecin	veinal injection	extracts from any parts of plants	some major pharmacological stores & hospitals	(Suzhou College of Medicine)
Injectable Happytree fruit	veinal injection	extracts from fruit	some major pharmacological stores & hospitals	Yang 1981
Happytree fruit extract tablet	orally	extracts from fruit	some major pharmacological stores & hospitals	Yang 1981
Happytree fruit compound tablet	orally	5,000 g Happytree fruit with 2,500 g Zhuru, 2,500 galang grass (root of <i>Imperata eylindrica</i> var. <i>major</i> , 3,000 g starch, etc.	some major pharmacological stores & hospitals, rural Chinese doctors	Yang 1981
Happytree fruit-ternate pinellia tablet	orally	made from 2,500 g Happytree fruit, 250 g ternate pinellia (the tuber of <i>Pinellia ternata</i>) & others	some major pharmacological stores & hospitals, rural Chinese doctors	Yang 1981
Happytree fruit honeyed bolus	orally	made from 2,500 g Happytree fruit, 250 g ternate pinellia, & 250 g powder of Happytree fruit	some pharmacological stores & hospitals, rural Chinese doctors	Yang 1981
Happytree powder	orally	any parts of the plants	some pharmacological stores & hospitals, rural Chinese doctors	Yang 1981

Table 3. Wood properties of *Camptotheca acuminata*.

Location	Density (g/cm ³) natural air dry	Shrinkage (%) R ¹ T ² V ³	Bending Strength (kgf/cm ²)	Bending Elasticity Modulus (10 ³ kgf/cm ²)	Crushing Strength along the Grain (kgf/cm ²)	Hardness (kgf/cm ²) R ¹ T ² Side
northern Sichuan ⁴	0.412 0.516	0.149 0.307 0.475	700	---	366	284 252 386
Geju, Yunnan ⁵	0.440 0.541	0.146 0.302 0.480	706	86	442	313 329 464

1. R---radial. 2. T---tangential. 3. V---volumetric. 4. from Cheng *et al.* 1992. 5. from Luo 1989.

leukemia. Clearly, the Chinese happytree has a long history of use in traditional Chinese medicine [11].

Other Uses

In Yunnan and Hunan native Bai people (白族) have used the leaves of *Camptotheca* as green fertilizer for rice seedlings since at least 1950. According to local farmers, rice production is greatly increased by this application. It is also claimed that use of the leaves controls insect pests and diseases of rice. Application of the leaves as green manure challenges current theory that the Chinese happytree is allelopathic and limits the growth of many crops [15-18]. According to Yang and Li (1992), in fact, the leaves of the Chi-

nese happytree contain 2.62% N, 0.51% P, 2.56% K in dry weight. Therefore, 500 kg of dry leaves may have the same fertility as 12.75 kg superphosphate, or 65.5 kg ammonium phosphate, or 25.5 kg potassium sulfate [19].

In Guangdong, local farmers use the fruit to make soap and detergent. There are undoubtedly additional uses; however, the above indicates that *Camptotheca* has been a part of the daily lives of Chinese people for centuries.

Wood Uses

The properties of the wood of Chinese happytree are summarized in Table 3. The wood is soft, light, odorless,

easy to dry, easy to process, insect resistant, smooth grained and even-textured with high flexibility and low strength. Primary products are rulers, packaging materials, general furniture, mine timbers, pulpwood and fuelwood [20-22] (Fig. 6).



Fig. (6). In central Sichuan, *Camptotheca acuminata* trees are often harvested for mining poles (photo by S.Y. Li, 1995).

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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PATIENT'S CONSENT

Declared none.

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