Traditional Herbal Medicines for Modern Times

Bupleurum Species

Scientific Evaluation and Clinical Applications

Edited by
Sheng-Li Pan

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Series Preface

Global warming and global travel are among the factors resulting in the spread of such infectious diseases as malaria, tuberculosis, hepatitis B, and HIV. All these are not well controlled by the present drug regimes. Antibiotics, too, are failing because of bacterial resistance. Formerly less well-known tropical diseases are reaching new shores. A whole range of illnesses, for example cancer, occurs worldwide. Advances in molecular biology, including methods of *in vitro* testing for a required medical activity, give new opportunities to draw judiciously upon the use and research of traditional herbal remedies from around the world. The re-examining of the herbal medicines must be done in a multidisciplinary manner.

Since 1997, 42 volumes have been published in the book series Medicinal and Aromatic Plants — Industrial Profiles. The series continues and is characterised by a single plant genus per volume. With the same series editor, this new series, Traditional Herbal Medicines for Modern Times, covers multiple genera per volume. It accommodates, for example, the traditional Chinese medicines (TCM), the Japanese Kampo versions of this, and the Ayurvedic formulations of India. Collections of plants are also brought together because they have been re-evaluated for the treatment of specific diseases such as malaria and diabetes. Yet other collections are of the most recent investigations of the endemic medicinal plants of a particular country, e.g., India, South Africa, Mexico, Brazil (with its vast flora), and Malaysia with its rainforests, said to be the oldest in the world.

Each volume reports on the latest developments and discusses key topics relevant to interdisciplinary health science research by ethnobiologists, taxonomists, conservationists, agronomists, chemists, pharmacologists, clinicians, and toxicologists. The series is relevant to all these scientists and will enable them to guide business, government agencies, and commerce in the complexities of these matters. The background to the subject is outlined below.

Over many centuries, the safety and limitations of herbal medicines have been established by their empirical use by the "healers" who also took a holistic approach. The healers are aware of the infrequent adverse effects and know how to correct these when they occur. Consequently and ideally, the pre-clinical and clinical studies of a herbal medicine need to be carried out with the full cooperation of the traditional healer. The plant composition of the medicine, the stage of the development of the plant material, when it is to be collected from the wild or when from cultivation, its post-harvest treatment, the preparation of the medicine, the dosage and frequency, and much other essential information are required. A consideration of the intellectual property rights and appropriate models of benefit sharing may also be necessary.

Wherever the medicine is being prepared, the first requirement is a well-documented reference collection of dried plant material. Such collections are encouraged by organisations like the World Health Organisation and the United Nations Industrial Development Organisation. The Royal Botanic Gardens at Kew in the UK is building up its collection of traditional Chinese dried plant material relevant to its purchase and use by those who sell or prescribe TCM in the United Kingdom.

In any country, the control of the quality of plant raw material, of its efficacy, and of its safety in use is essential. The work requires sophisticated laboratory equipment and highly trained personnel. This kind of "control" cannot be applied to the locally produced herbal medicines in the rural areas of many countries, on which millions of people depend. Local traditional knowledge of the "healers" has to suffice.

Conservation and protection of plant habitats are required and breeding for biological diversity is important. Gene systems are being studied for medicinal exploitation. There can never be too many seed conservation "banks" to conserve genetic diversity. Unfortunately, such banks are usually

dominated by agricultural and horticultural crops with little space for medicinal plants. Developments such as random amplified polymorphic DNA enable the genetic variability of a species to be checked. This can be helpful in deciding whether specimens of close genetic similarity warrant storage.

From ancient times, a great deal of information concerning diagnosis and the use of traditional herbal medicines has been documented in the scripts of China, India, and elsewhere. Today, modern formulations of these medicines exist in the form of, e.g., powders, granules, capsules, and tablets. They are prepared in various institutions, e.g., government hospitals in China and Korea, and by companies such as Tsumura Co. of Japan, with good quality control. Similarly, products are produced by many other companies in India, the USA, and elsewhere with a varying degree of quality control. In the USA, the Dietary Supplement and Health Education Act of 1994 recognised the class of physiotherapeutic agents derived from medicinal and aromatic plants. Furthermore, under public pressure, the USA Congress set up an Office of Alternative Medicine, and this office in 1994 assisted in the filing of several Investigational New Drug (IND) applications, required for clinical trials of some Chinese herbal preparations. The significance of these applications was that each Chinese preparation involved several plants and yet was handled as a *single* IND. A demonstration of the contribution to efficacy, of *each* ingredient of *each* plant, was not required. This was a major step forward towards more sensible regulations with regard to phytomedicines.

Something on the subject of Western herbal medicines is now being taught again to medical students in Germany and Canada. Throughout Europe, the USA, Australia, and other countries, pharmacy and health-related schools are increasingly offering training in phytotherapy. TCM clinics are now common outside of China. An Ayurvedic hospital now exists in London with a B.Sc.Hons. degree course in Ayurveda available: Prof. Dr. Shrikala Warrier, Resistrar/Dean, MAYUR, The Ayurvedic University of Europe, 81 Wimpole Street, London, WIG 9RF, Tel +44207 224 6070, e-mail sw@unifiedherbal.com. This is a joint venture with a university in Manipal, India.

The term "integrated medicine" is now being used, which selectively combines traditional herbal medicine with "modern medicine." In Germany there is now a hospital in which TCM is integrated with Western medicine. Such co-medication has become common in China, Japan, India, and North America by those educated in both systems. Benefits claimed include improved efficacy, reduction in toxicity and the period of medication, as well as a reduction in the cost of the treatment. New terms such as adjunct therapy, supportive therapy, and supplementary medicine now appear as a consequence of such co-medication. Either medicine may be described as an adjunct to the other depending on the communicator's view.

Great caution is necessary when traditional herbal medicines are used by doctors not trained in their use, and likewise when modern medicines are used by traditional herbal doctors. Possible dangers from drug interactions need to be stressed.

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Preface

The editor and a number of the chapter contributors are affiliated with Fudan University, founded in Shanghai in 1905. This book is one of its centennial publications.

The Japanese equivalent of Traditional Chinese Medicine (TCM), which arrived in Japan from China in the 16th century, is known as Kampo medicine. Typically, these traditional medicines contain three to six different dried plant materials derived from different species of plants in the prescription. These are dispensed as individually weighed-out crude, dried drugs, which are put together into one package sufficient for the doses for a single day's treatment and as many such lots as are prescribed by the medical practitioner. The patient would then boil one lot with water for a defined time and, after straining the liquid from the plant material, would divide the decoction into portions, i.e., doses, taking one of these once, twice, or three times a day as recommended in the treatment. This procedure is still followed by many patients in rural and other areas.

Today, modern formulations such as dripping pills, granules, or powders are available from large-scale quality-controlled production. These provide a single oral dose with boiling water (like making instant coffee) and are available for patients attending some hospitals and for those able to afford privately such convenient medication.

Examples of companies producing such modern formulations in China are Shanghai No. 1 TCM Factory (products: Chaihu Injection, Chaihu Oral Liquid, etc.), Tasly Group (products: Bupleuri Dripping Pill etc.), Xiamen TCM Co. (products: Xiaoyao-Wan, Buzhong-Yiqi-Wan, etc.), and more than 100 other factories. In Japan, Tsumura & Co. is a notable manufacturer.

Today, at least 66% of *all* the formulations/prescriptions of TCM and Kampo contain *Bupleurum* spp., usually in the form of the dried root. The *Bupleurum* spp. used in China and Japan are different: the Chinese root may be from *B. chinense* DC. or *B. scorzonerifolium* Willd., whereas in Japan *B. falcatum* L. is used. Furthermore, the aerial parts of some Chinese species, e.g., *B. polyclonum* Y. Li et S.L. Pan, *B. scorzonerifolium* Willd. f. *pauciflorum* Shan et Y. Li, *B. marginatum* Wall. ex DC. var. *stenophyllum* Shan et Y. Li, and 16 other species, or their essential oils, are used in Chinese formulations but not in Japanese formulations.

In this volume, the important *Bupleurum* spp. are covered: their botany, including detailed descriptions of the plant parts used in medicine; their constituents; quality control; pharmacology; and clinical usage with named/defined polyherbal formulations. This book will appeal to botanists, pharmacognosists, phytochemists, pharmacologists, pharmacists, clinicians, and other health care professionals.

Medicinal *Bupleurum* spp. and the plant parts are listed in the pharmacopoeias of China and Japan. Because of their medicinal properties, these plant parts are important to a wider clinical audience and are freely available in the U.S. in the form of "dietary supplements" under Dietary Supplement Health & Education Act (DSHEA) legislation, and similarly in other countries.

The demand for the root of the official *B. falcatum* in Japan is so great that it is now contract-grown in Korea. In Japan in 2002, the gross proceeds of manufactured prescription medicines containing this root amounted to 27 billion yen, which was 26% of the total sales of Kampo clinical medicines covered under Japan's health insurance payment scheme.

The worldwide distributions of *Bupleurum* spp. are discussed. For example, in China 44 species are found, 17 varieties, and 7 forms; in Spain, 23 species; and Italy, 15 species.

Medicinally, the saikosaponins of the oleanane series are very important. They are comprehensively dealt with — for instance, there are 113, in 5 different chemical classes, in 23 *Bupleurum*

spp. found in China. The structural transformation of saikosaponins in gastric juice and in the intestinal contents is described.

The 222 different constituents of essential oils are tabulated from 19 *Bupleurum* spp. and 2 varieties with their geographical distributions. Other constituents described in detail are lignans, flavonoides, coumarins, polyacetylenes, phenyl propanides, and polysaccharides (these with anti-ulcer, antitumor, and immunomodulating properties).

In Spain, 7 *Bupleurum* spp. have received detailed study, notably yielding 20 new lignans (some with activity against the potato cyst nematode) in addition to all the usual constituents. *Bupleurum salicifolium* has demonstrated activity against *Staphylococcus aureus* ATCC 6538. The constituents and biological activities of Italian species have been similarly reported.

My thanks go to all the contributors for their work, especially Dr. Roland Hardman for his enthusiastic and continuous support throughout the preparation of this book.

Professor Sheng-Li Pan

The Editor

Sheng-Li Pan is a professor in the Department of Pharmacognosy, School of Pharmacy, Fudan University, Shanghai, People's Republic of China. He studies aspects of Traditional Chinese Medicine (TCM), including identification of components, chemical constituents, pharmacological effects, and mechanism of action. He has discovered and published six new species in the genus *Bupleurum*. He received the Academic Award from Shanghai Health Bureau in 1985, the Academic Award from Chinese TCM Ministry in 1996, and the Advanced Award on Science and Technology from the Scientific and Technical Ministry of China in 1997.

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Contents

1 Introduction

Sheng-Li Pan

Bupleurum is a genus of family Umbelliferae (Apiaceae), comprising about 200 species and primarily located in the Northern Hemisphere, Eurasia, and North Africa. The anatomy of the more important species and their geographical distribution are given in Chapters 2 and 3. The chromosomes are considered in relation to classification and cross-breeding in Chapter 4.

Under the name of Chaihu (Saiko in Japanese and Shiho in Korean), the roots of several species from the genus have been frequently used in the prescriptions of Oriental traditional medicine for the treatment of common cold with fever, influenza, inflammation, hepatitis, malaria, and also menopausal syndrome in China for 2000 years. Chaihu was first recorded in *Shen-Nong's Herbal*, a pharmaceutical book published 2000 years ago in China. In it, Chaihu was described as the best medicine to treat diseases with fever. In 1058 A.D., an atlas of materia medica, *Bencao Tu-jing*, was published, which contained five illustrations of Chaihu (Figure 1.1): Zizhou Chaihu, Danzhou Chaihu, Shouzhou Chaihu, Jiangningfu Chaihu, and Xiangzhou Chaihu. According to the figures and descriptions, four (Zizhou Chaihu, Danzhou Chaihu, Jiangningfu Chaihu, and Xiangzhou Chaihu) belong to the *Bupleurum* genus.

The requirement of *Bupleurum* radix for prescriptions and exports is about 8 million kg every year in China. This is met chiefly from wild plants, but nowadays *B. falcatum* and *B. chinense* are extensively cultivated in China, Japan, Korea, and in some regions of Europe (Figure 1.2 and Figure 1.3). In some districts of China (especially in Yunnan Province), other species, *B. polyclonum, B. marginatum* var. *stenophyllum, B. rockii*, are also cultivated (Figure 1.4). Their seasonal variations in growth and content of saikosaponins are reported in Chapters 5 and 6.

About 50 species from the genus (e.g., *B. falcatum*, *B. chinense, B. fruticosum, B. salicifolium, B. scorzonerifolium, B. gibraltaricum, B. polyclonum, B. marginatum* var. *stenophyllum, B. kunmingense,* etc.) have been studied chemically (Chapters 7, 8, and 9) resulting in the isolation of approximately 120 derivatives of saikosaponins, more than 50 lignans, as well as a number of

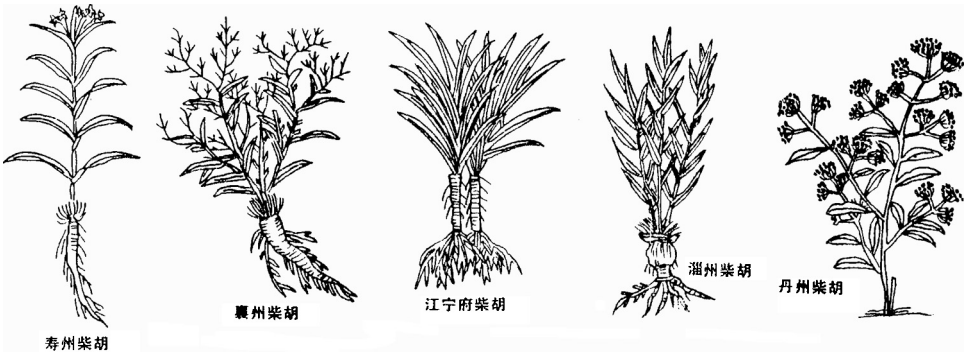

FIGURE 1.1 Five illustrations of Chaihu in *Bencao Tu-jing,* left to right: Zizhou Chaihu; Danzhou Chaihu; Jiangningfu Chaihu; Xiangzhou Chaihu; Shouzhou Chaihu.

FIGURE 1.2 *Bupleurum chinense* DC. cultivated in Gansu Province of China.

FIGURE 1.3 *Bupleurum falcatum* L. cultivated in Nagasaki, Japan.

coumarins, flavonoids, polyacetylenes, polysaccharides, sterols, phenylpropanoids, and organic acids. Moreover, the essential oils of genus *Bupleurum* have been investigated, and more than 220 compounds in these essential oils have been identified.

Saikosaponins, the principal ingredients from *Bupleurum* root, exhibit the pharmacological activity (Chapters 10, 11, and 12): anti-inflammatory, antivirus, hepatoprotective, antipyretic, anodynic, sedative, antidepressive, and anticancer. The aglycones of the chief saikosaponins (i.e., saikosaponin-a, -c, and -d) are 13β, 28-epoxyolean-11-ene-16-ol. The content of saikosaponin-a, -c, and -d in most species is 1 to 2%, but in *B. polyclonum,* it is up to 7% (Pan et al., 2000a, 2000b).

Numerous lignans are described from *B. salicifolium* (an endemic species in the Canary Islands of Spain). Some lignans (e.g., actigenin, trachelogenin) show the inhibitory effect of topo-isomerase II, an enzyme associated with the replication of HIV-1 virus responsible for AIDS (Eich et al., 1990). Bursehenin and matairesinol from the same plant inhibit the hatching of the nematodes

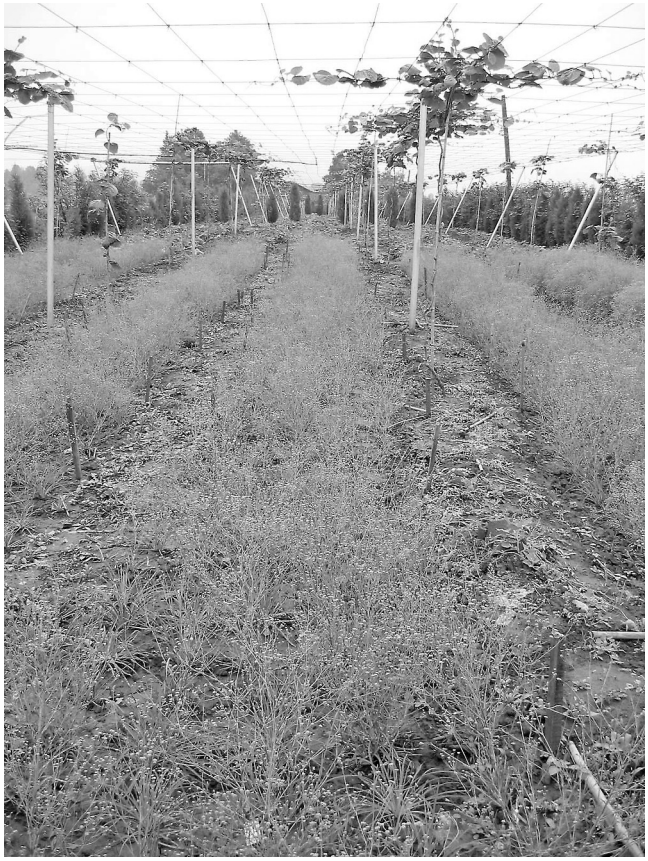

FIGURE 1.4 *Bupleurum polyclonum* Y. Li et S.L. Pan cultivated in Yunnan Province of China.

Globodera pallida and *G. rostochiensis* (Gonzalez et al., 1994). Both compounds are the first natural products known to affect the hatching of *G. pallida* and the first lignans ever reported to have an effect on a phytoparasitic nematode. The essential oils of *B. chinense, B. fruticosum,* and *B. gibraltaricum,* etc. demonstrate marked anti-inflammatory effects. The polysaccharides of *B. falcatum, B. chinense,* and *B. kunmingense* possess immunomodulatory activity, and their antiulcer and B-cell proliferation activities have also been reported (see Chapter 12).

Prescriptions and their clinical applications (Chapters 10, 11, and 12), including Chaihu Oral Liquid (containing small amounts of saikosaponins and essential oils of Bupleuri radix) and Chaihu Injection (distillate of Bupleuri radix), are used for the treatment of influenza and common cold in China. Xiao-Chaihu-Tang (Sho-Saiko-To in Japanese), an extract made from *Bupleurum* root, *Pinellia* tuber, *Scutellaria* root, jujube fruit, ginseng root, *Glycyrrhiza* root, and ginger rhizome, is widely used for the treatment of chronic disease, such as hepatitis, asthma, nephrotic syndrome, and cancer. Other prescriptions containing Bupleurum radix, such as Da-Chaihu-Tang (Dai-Saiko-To in Japanese), Chaihu-Guizhi-Tang (Saiko-Keishi-To in Japanese), are also extensively used in China and Japan. They can induce an increase in the levels of tumor necrosis factor-alpha (Yamashiki et al., 1994), stimulate natural killer cell–mediated cytotoxic activity (Kaneko et al., 1994), and enhance immunomodulation.

To date, the published patents containing *Bupleurum* number more than 500 (Chapter 16).

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Section I

Botany

2 Macroscopical Characters of the Medicinal Species of *Bupleurum* and Their Distribution in China

Sheng-Li Pan and Yun Kang

CONTENTS

2.1 INTRODUCTION

Bupleurum genus, which was named by Linnaeus in 1735, belongs to Umbelliferae, Apioideae, Ammineae. Approximately 200 species occur in the world (Su et al., 1998), primarily located in the Northern Hemisphere, Eurasia, and North Africa. In China, 44 species, 17 varieties, and 7 forms have been reported (Li and She, 1979; Pan et al., 2002). Under the name Chaihu (Saiko in Japanese), the roots of several species from *Bupleurum* genus frequently occurred in the prescriptions of Oriental Traditional Medicine. They have been utilized to treat common cold with fever, influenza, hepatitis, malaria, and menoxenia for more than 2000 years. The *Pharmacopoeia of the People's Republic of China* (2000) states that *B. chinense* DC. and *B. scorzonerifolium* Willd. were officially regarded as the standard medical plants. But according to the investigations in all provinces of China, it has been discovered that there were many more species used as medicine in different districts and markets (Song, 1981; Li, 1989; Li et al., 1993; Pan, 1996; Pan and Ohashi, 1996).

2.2 CHARACTERISTICS OF *BUPLEURUM* GENUS

2.2.1 General Description

A perennial rarely annual or biennial, glabrous, often rather glaucous herb, with a stout, woody stock. Stems solid or hollow, striate. Leaves simple, alternate, entire, with parallel veins, sometimes with cartilaginous margin. Basal leaves petiolated, cauline leaves amplexcaule at base. Compound umbel loose. Bracts leaf-like, 1 to 5, unequal. Bracteoles 3 to 10, linear, lanceolate, ovate, obovate, or orbicular; green, yellow, or purplish. Flowers bisexual; calyx teeth absent; petals 5, yellow, rarely purplish; stamens 5, yellow; stylopodium broadly conical. Cremocarps oblong or ovate, slightly compressed laterally, mericarps subterete, somewhat prominently 5 ribbed.

2.2.2 Main Medicinal Species of *Bupleurum* in China

Distributions of the main medicinal species in China are detailed in Table 2.1, and the commercial samples in Table 2.2. The microscopical characters of the following species are given in Chapter 3.

2.2.2.1 *Bupleurum chinense* DC. (Figure 2.1)

A glabrous perennial with a stout, woody stock. Root straight or curved with 2 to 3 branch roots, gray to brown at surface. Stems up to 150 cm high, solid, striate. Leaves simple, the basal 5 to 10 cm long, 0.8 to 1.2 cm wide, oblanceolate or linear-elliptic, long petiolate, with 7 to 9 parallel veins, cauline oblanceolate to long elliptic-lanceolate, 5 to 16 cm long and 0.6 to 2.5 cm wide, acuminate to obtuse-acute at apex, long attenuate and semi-amplexicaule at base. Umbellules 5- to 12-flowered, 3 to 9 per umbel. Bracts 2 to 4, narrowly lanceolate, unequal, 1 to 5 mm long and 0.5 to 1 mm wide; bracteoles 5, lanceolate, 2.5 to 4 mm long, 0.5 to 1 mm wide. Fruit ellipsoid, 2.5 to 3.5 mm long, 1.5 to 2 mm wide. Vitta 3 at vallecula and 4 at commissure. This is the most common species growing in the north and middle of China.

TABLE 2.1
Distribution and Resources of Medicinal *Bupleurum* in China

Name	Distribution (Province of China)	Resources
B. chinense	Hebei Shanxi Shaanxi Gansu Heilongjiang Jilin Henan Shandong Hubei Jiangsu Jiangxi	++++
B. scorzonerifolium	Hebei, Shaanxi, Jiangsu, Henan, Liaoning Jilin, Heilongjiang, Neimenggu Zhejiang	++
B. scorzonerifolium f. pauciflorum	Anhui Jiangsu	++
B. smithii var. *parvifolium*	Neimenggu, Qinghai Gansu, Ningxia Shanxi, Shaanxi, Heilongjiang, Liaoning	++++
B. smithii	Hebei, Shanxi, Shaanxi, Gansu, Qinghai, Neimenggu	+
B. marginatum var. *stenophyllum*	Xizhang Yunnan Guizhou Sichuan, Gansu, Hubei, Hunan	++++
B. marginatum	Sichuan, Yunnan, Guizhou, Gansu, Shaanxi	+
B. yinchowense	Shaanxi, Ningxia, Gansu, Neimenggu	++
B. bicaule	Neimenggu, Ningxia, Liaoning, Heilongjiang	++
B. angustissimum	Hebei, Ningxia, Shaanxi, Gansu, Liaoning	++
B. polyclonum	Yunnan	++
B. kunmingense	Yunnan	+
B. luxiense	Yunnan	+
B. rockii	Yunnan, Sichuan, Xizhang	++
B. sibiricum	Hebei, Heilongjing, Liaoning, Neimenggu	+
B. sichuanense	Sichuan	+
B. wenchuanense	Sichuan	++
B. chaishoui	Sichuan	++
B. malconense	Sichuan	++
B. longiradiatum	Heilongjiang, Liaoning, Jilin, Shaanxi, Gansu, Zhejiang	++++
B. komarovianum	Jilin, Heilongjiang, Liaoning	+
B. euphorbioides	Jilin	+
B. krylovianum	Xinjiang	++
B. densiflorum	Xinjiang, Qinghai	+
B. exaltatum	Xinjiang	+
B. aureum	Xinjiang	+
B. commelynoideum var. *flaviflorum*	Gansu, Qinghai, Sichuan	++
B. hamiltonii	Yunnan, Guizhou, Sichuan, Xizhang, Hubei	+++
B. candollei	Yunnan, Sichuan	++
B. longicaule var. *franchetii*	Sichuan, Yunnan, Guizhou, Hubei	++
B. longicaule var. *giraldii*	Yunnan	+
B. petiolulatum var. *tenerum*	Yunnan, Sichuan, Xizhang	+

2.2.2.2 *Bupleurum scorzonerifolium* Willd. (Figure 2.2)

Perennial, 30 to 80 cm high. Root brown reddish at surface, with many brushlike fibers in the base of stem. Leaves lanceolate to linear-lanceolate 6 to 16 cm long, 3 to 8 mm wide. 5- to 7-veined. Umbellules 7- to 12-flowered, 4 to 10 per umbel. Bracts 2 to 4, narrowly lanceolate, unequal; bracteoles 5, linear-lanceolate, 3 to 4 mm long and 0.5 to 1 mm wide. Fruit ovoid, 2 to 3 mm long, 2 mm wide. Vitta 3 at vallecula and 4 at commissure.

2.2.2.2.1 Bupleurum scorzonerifolium Willd. f. *pauciflorum* Shan et Y. Li

Similar to *B. scorzonerifolium* Willd., from which it differs in that the rays of umbel are only 2 to 3, and the umbellules have 4 to 6 flowers. Distributed in Jiangsu and Anhui; 30- to 50-cm-high seedling used as Spring Chaihu.

TABLE 2.2
Identification of 110 Commercial Samples of Chaihu

Commodity Name	Markets (City or County in China)	Identification Result
	Qingan Shenyang Beijing Tianjin Shijiazhuang Chengde Zhanhuang Taiyuan Xi'an Lueyang Kangxian Luoyang Zhengzhou Wuhan Fuyang Yushan Gao'an Pingxiang Lin'an Shaoxing Ningbo Fuzhou Xiamen Quanzhou Liuzhou	*B. chinense* (root) (25 samples)
	Kangxian Wulian Huaibei Guilin Fuzhou	*B. chinense* (aerial part) (5)
	Shenyang Fuyang Yinchuan Ankang Xining Datong Guiling Shanghai	*B. smithii* var. *parvifolium* (root) (8)
	Fuyang Suzhou Fuzhou	*B. scorzonerifolium* (aerial part) (3)
Chaihu	Tianjin Xilinhaote Hulunbeier	*B. bicaule* (root) (3)
	Wuzhong Heshui Zhenning	*B. yinchowense* (root) (3)
	Wulumuqi Aertai	*B. krylovianum* (root) (2)
	Guangzhou Nanning	*B. marginatum* var. *stenophyllum* (root) (2)
	Xinglong	*B. sibiricum* (root) (1)
	Shanghai (from Gansu)	*B. angustissimum* (root) (1)
	Antu	*B. komarovianum* (root and rhizome) (1)
	Wulumuqi	*B. densiflorum* (root) (1)
	Huangzhong	*B. commelynoideum* var. *flaviflorum* (root) (1)
	Tianjin Jinhua	*B. scorzonerifolium* (root) (2)
Red Chaihu	Tongxin Lanzhou	*B. bicaule* (root) (2)
	Guyang	*B. angustissimum* (root) (1)
	Yuzhong	*B. yinchowense* (root) (1)
Bamboo-leaf Chaihu	Liuzhou Lipu Guiyang Chengdu Lezhi Dali Kunming Deqin, Mile Huize Xishuangbanna Dianbai	*B. marginatum* var. s*tenophyllum* (aerial part) (12)
	Kunming Chuxiong Huize Lijiang	*B. hamiltonii* (aerial part) (4)
	Kunming Huize Wenshan	*B. polyclonum* (aerial part) (3)
	Kunming Lijiang	*B. rockii* (aerial part) (2)
	Luxi Jianshui	*B. luxiense* (aerial part) (2)
	Kunming Bijie	*B. longicaule* var. *franchetii* (aerial part) (2)
	Wenchuan Maoxian	*B. wenchuanense* (aerial part) (2)
	Wenchuan Maoxian	*B. malconense* (aerial part) (2)
	Kunming	*B. kunmingense* (aerial part) (1)
	Wenchuan	*B. sichuanense* (aerial part) (1)
	Wenchuan	*B. chaishoui* (aerial part) (1)
Black Chaihu	Yinchuan Tongxin Kangxian Tianshui Lanzhou Yuzhong Tianzhu Baotou	*B. smithii* var. *parvifolium* (root) (8)
Large-leaf Chaihu	Shangzhi Tonghua	*B. longiradiatum* (rhizome and root) (2)
Chaishou	Aba	*B. wenchuanense* (root) (1)
	Maerkang	*B. chaishoui* (root) (1)
Spring Chaihu	Chuzhou Fengyang Nanjing Xuzhou	*B. scorzonerifolium* f. *pauciflorum* (seedling) (4)

FIGURE 2.1 *Bupleurum chinense* DC.

FIGURE 2.2 *Bupleurum scorzonerifolium* Willd.

2.2.2.3 *Bupleurum smithii* Wolff var. *parvifolium* Shan et Y. Li (Figure 2.3)

Perennial, 10 to 30 cm high. Root brown black at surface. Leaves elliptic or oblong-lanceolate, 4 to 11 cm long, 0.3 to 1 cm wide. Umbellules 10- to 18-flowered, 4 to 9 per umbel. Bracts 1 to 2 or 0; bracteoles 5 to 8, ovate, 3.5 to 8 mm long, 2.5 to 3.5 mm wide. Fruit ellipsoid, 2.5 to 3.5 mm long, 1.5 to 2 mm wide. Vitta 3 at vallecula and 4 at commissure.

A common species distributed in the north of China.

2.2.2.3.1 Bupleurum smithii Wolff

Similar to *B. smithii* Wolff var. *parvifolium* Shan et Y. Li, from which it differs in the leaves greater, 10 to 20 cm long, 1 to 2 cm wide.

2.2.2.4 *Bupleurum marginatum* Wall. ex DC. var. *stenophyllum* Shan et Y. Li (Figure 2.4)

Perennial, 60 to 100 cm high. Rhizome very long, sometimes reached 80 cm, and hardly differentiated from root. Leaves linear-lanceolate to oblanceolate, with whitish cartilaginous margin, 6 to 10 cm long, 3 to 5 mm wide. Umbellules 6- to 14-flowered, 4 to 7 per umbel. Bracts 3 to 5, lanceolate; bracteoles 5, lanceolate, 1 to 2.5 mm long, 0.4 to 0.6 mm wide. Fruit oblong, 2.5 to 3.5 mm long, 1.5 to 2 mm wide. Vitta 3 at vallecula and 4 at commissure.

A common species distributed in southern and southwestern China.

2.2.2.4.1 Bupleurum marginatum Wall. ex DC.

Similar to *B. marginatum* Wall. ex DC. var. *stenophyllum* Shan et Y. Li, from which it differs in that the leaves are wider.

2.2.2.5 *Bupleurum yenchowense* Shan et Y. Li

Perennial, 20 to 50 cm high. Main roots long and straight, grayish at surface. Leaves oblanceolate 5 to 8 cm long, 2 to 5 mm wide, acute at apex. Umbellules 6- to 12-flowered, 4 to 8 per umbel.

FIGURE 2.3 *Bupleurum smithii* Wolff var. *parvifolium* Shan et Y. Li.

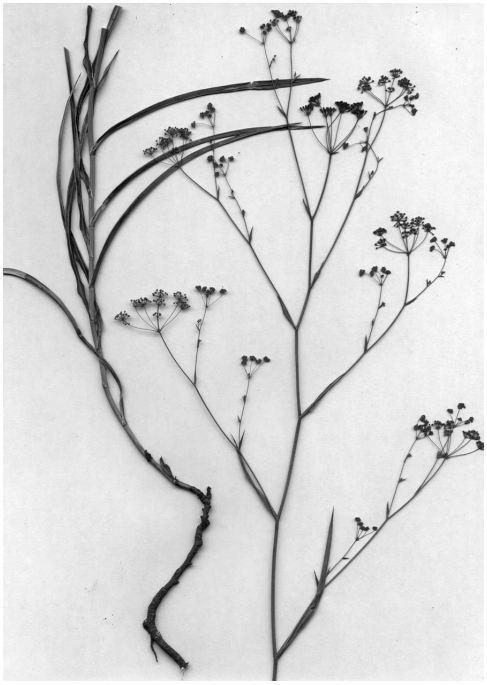

FIGURE 2.4 *Bupleurum marginatum* Wall. ex DC. var. *stenophyllum* Shan et Y. Li.

Bracts 1 to 3 or 0, narrowly lanceolate, unequal; bracteoles 5, linear, 1 to 2 mm long and 0.2 mm wide. Fruit ovoid, 2.5 to 3 mm long, 2 mm wide. Vitta 3 at vallecula and 4 at commissure.

2.2.2.6 *Bupleurum bicaule* Helm. (Figure 2.5)

Perennial, 5 to 20 cm high. Root with many brushlike fibers in the base of stem, and many obvious nodes at surface. Leaves linear, 6 to 16 cm long, 1 to 3 mm wide, 3- to 5-veined, upper cauline tapered, 1 to 4 cm long, 0.5 to 2.5 mm wide, 5- to 7-veined. Umbellules 7- to 13-flowered, 4 to 7 per umbel. Bracts 1 to 3; unequal, bracteoles 5, linear-lanceolate, 2 to 2.5 mm long and 0.6 to 0.8 mm wide. Fruit ellipsoid, 2.5 to 3 mm long, 1.5 to 2 mm wide. Vitta 3 at vallecula and 3 to 4 at commissure.

2.2.2.7 *Bupleurum angustissimum* (Franch.) Kitagawa

Perennial, 15 to 80 cm high. Root with many brushlike fibers in the base of stem. Leaves linear, 6 to 18 cm long, 0.8 to 1 mm wide. Umbellules 6- to 12-flowered, 5 to 7 per umbel. Bracts 1 to 3, lanceolate, 1 to 3 mm long, 1 mm wide; bracteoles 5, lanceolate, 2 to 2.5 mm long and 0.6 to 0.8 mm wide. Fruit ovoid, 2 mm long, 1 to 1.5 mm wide. Vitta 3 at vallecula and 4 at commissure.

2.2.2.8 *Bupleurum polyclonum* Y. Li et S.L. Pan (Figure 2.6) (Pan et al., 1984)

Perennial, 15 to 60 cm high. Root soft, grayish at surface. Stem with many branchlets. Leaves basal and lower cauline linear, 10 to 20 cm long, 2 to 3 mm wide; 3- to 7-veined, upper cauline tapered. Umbellules 7- to 15-flowered, 3 to 7 per umbel. Bracts 4 to 5, unequal, elliptic to obovate; 2 to 8 mm long, 1.5 to 3 mm wide, semi-amplexicaule; bracteoles 5, obovate, 3 to 4 mm long, 2 to 3 mm wide. Fruit oblong, 2 to 3 mm long, 1.2 to 1.8 mm wide. Vitta 3 at vallecula and 4 at commissure.