

Chapter 15

Lilium lancifolium 百合 (Baihe, Tiger Lily)

Yanze Liu

15.1 Botanical Identity

Lily, a perennial ornamental crop belonging to the family Liliaceae, has great decorative, medicinal, and edible value. The genus *Lilium*, which includes approximately 100 species, is native to Asia, Europe, and North America in the Northern Hemisphere. There are about 55 species in China. China is the diversity center of wild *Lilium* in the world [1]. The flowers of lilies are often fragrant, and come in a range of colors including whites, yellows, oranges, pinks, reds and purples. More and more ornamental hybrids have been developed around the world. Numerous species have been widely grown in the garden as ornamental plants in the West.

In China, there are three bulbs of *Lilium* species (*Lilium lancifolium* Thunb, *L. pumilum* DC., and *L. brownii* F.E. Brown var. *viridulum* Baker) that have been used as legal resources of medicinal purpose recorded in The Pharmacopeia of People's Republic of China and other historical Chinese herbal records [2]. Its Chinese name Baihe means “hundred meetings”, referring to the many tightly overlapping scales that form the bulb.

The plant of *L. lancifolium* has an erect stem that is non-branched, and can be grass green, red or purple with brown spots. With underground bulbs, bulbs form a broadly ovate or lanceolate shape, and are white or orange. Fleshy scales hold the synthetic spherical outer membranous layer, making the bulb 6–8 cm in diameter. The flowers of *Lilium* species are borne on an erect stem that is 20–100 cm tall, clothed with the more or less linear leaves that are 6–10 cm long and 1–2 cm broad.

Y. Liu (✉)

Institute of Medicinal Plant Development, Chinese Academy of Medical Sciences
and Peking Union Medical College, 100193 Beijing, China
e-mail: yzliu@implad.ac.cn

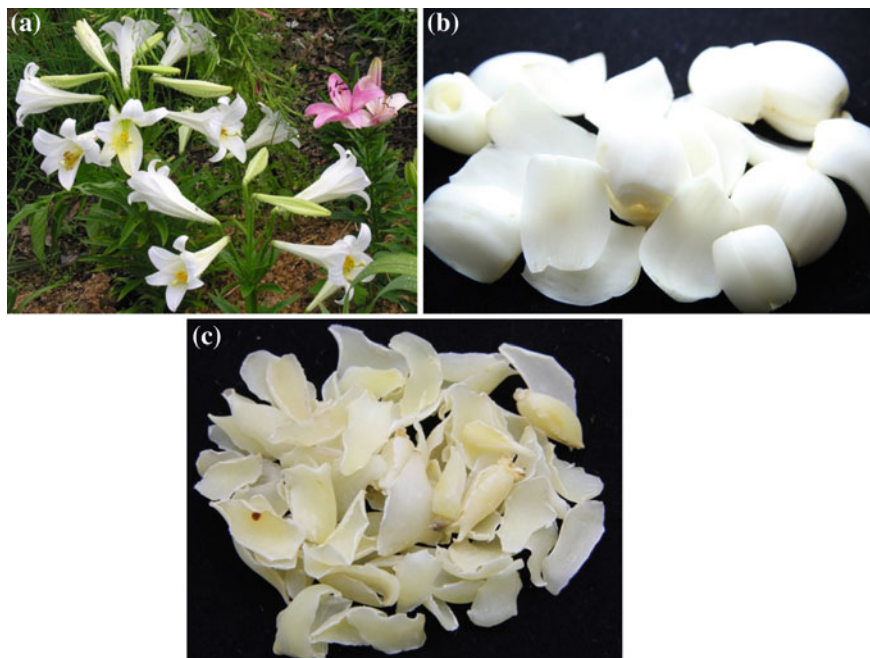


Fig. 15.1 The flowering plant (a), fresh bulb scales (b), and dried bulb scales (c) of *Lilium brownii* F.E. Brown var. *viridulum* Baker

The part used in Chinese medicine is the bulb. For medicinal use, the lily bulbs should be harvested in the fall. Harvesting includes excavation, washing, stripping scale leaves, dipping in boiling water briefly and drying. Quality of Baihe consists of white bulb scales that are hard and fleshy. Dried bulb scales for medicine are hard and fragile, fracture relatively even, horny, odorless, and taste slightly bitter (Fig. 15.1).

15.2 Chemical Constituents

Either as a common nutritional food or as a frequent used herbal medicine for Yin-deficiency, Baihe is frequently used in life. However, the chemical components, especially the marker and/or active one are not certain so far. There are many reports dealing with alkaloids like colchicine [3], phenolic compounds like gallic acid, epicatechin, kaempferol, and rutin [4, 5], and polysaccharides, but steroidal saponins seem to be more significant components for some pharmacological or clinical effects. Stigmasterol (1) and β -daucosterol (2) are two representative compounds among such kind of components, and stigmasterol showed activity to relieve cough and decrease inflammation reaction [6, 7] (Fig. 15.2).

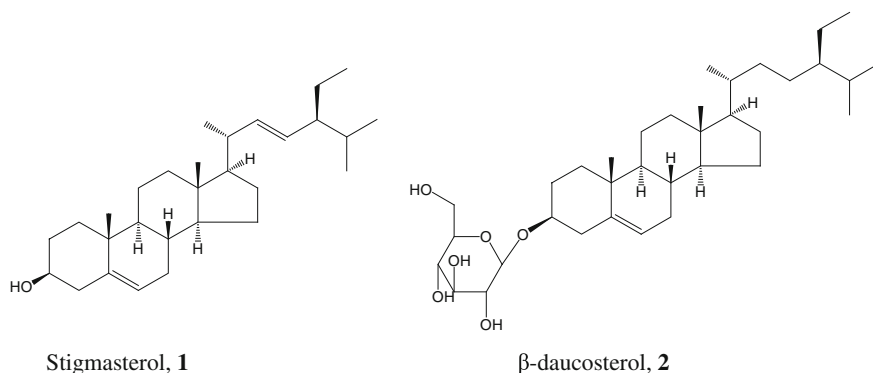


Fig. 15.2 Representative steroidal saponins isolated from Baihe

15.3 Pharmacological Studies

Phenolic compounds naturally occur in all plant material, and are prominently ubiquitous in fruits, vegetables, seeds, and herbs, but also in plant products, such as beverages, wine, and cocoa [8]. These compounds are potent antioxidants and play an important role in human nutrition as preventative agents against several diseases, and protecting the body tissues against oxidative stress [9]. As an important group of secondary metabolites presented in *Lilium*, phenolic compounds play an important role in the quality and nutrition value of lily species [10]. Recent reports disclosed three major classes of bioactive antibacterial compounds of the methanol extract of lily bulbs that exhibited strong antioxidant activity: total phenolic contents, total flavonoid contents and total flavanol contents [6]. The difference of phenolic composition might explain the different antioxidant abilities of lily bulb extracts observed. It can be also speculated that phenolic compounds present in the extracts may exert their antioxidant capacity individually as well as synergistically. Flavanols, a subgroup of the flavonoid family, have demonstrated positive effects with human health, including the recovery of endothelial function, improvements in insulin sensitivity, decreased blood pressure, and reductions in platelet aggregation [11].

Rutin is a type of flavanol with various biological activities that may protect against spatial memory impairment accompanying hippocampal pyramidal neuron loss [10]. Kaempferol was mainly abundant in *L. lancifolium*. The flavonols kaempferol and quercetin have been reported to effectively recycle vitamin E (an antioxidant) and are also known to reduce inflammation, tumorigenesis, and cell damage caused by oxidation [12, 13].

Researchers had investigated the anti-inflammatory effects of methanol extract of *L. lancifolium* Thunb root in LPS-stimulated Raw264.7 cells. The results showed that methanol extract significantly inhibited NO, PGE, IL-6, and TNF-production in LPS-stimulated cells. They also found that the iNOS and COX-2 expression was

suppressed simultaneously. The mechanism-based study in this paper indicates that anti-inflammatory effects of methanol extract from *L. lancifolium* Thunb root are due to down-regulation of iNOS and COX-2 via suppression of NF- κ B activation and nuclear translocation as well as blocking of ERK and JNK signaling in LPS-stimulated Raw264.7 cells [14].

Water extract of *L. lancifolium* Thunb root was found to significantly inhibit the number of macrophages and neutrophils in BALF due to pulmonary inflammatory response in a CS-exposed mouse. It also reduced the protein secretion levels of TNF- α , IL-6, IL-1 β , and MCP-1 in BALF and the RNA expression levels of TNF- α , IL-6, IL-1 β , MCP-1, and MMP-12 in lung tissue compared with mice only exposed to CS. Moreover, MMP-12 in serum was down-regulated in *L. lancifolium* Thunb root water extract treated mice contrasted with CS-exposed mice. The water extract treated mice demonstrated a significant reduction in air space size compared to mice only exposed to CS [15].

15.4 TCM Applications and Dietary Usage

15.4.1 TCM Applications

Due to their health promoting properties to treat chronic bronchitis, pneumonia fatigue, anxiety, and some sleep problem related symptoms [12, 16], Baihe has been extensively used as a traditional Chinese herbal medicine for many centuries in China.

Based on TCM theory, Baihe's major Chinese medicine uses are: moisten the lung and nourish lung yin, relieve coughs, calming state of mind and calming anxiety. Syndromes to be treated: cough due to yin deficiency, sputum with blood, insomnia and restless sleeping. Some formula has been used widely: (1) Liqi Dingchuan Pill: cough due to yin deficiency; (2) Jieyu Anshen Granule: clearing heart and anti-anxiety.

15.4.2 Dietary Usages

Baihe has been broadly used as nutritional food to provide nourishment as a tonic [17, 18], as well as herbal medicine for many centuries in China, Korea, Japan, and other countries. Baihe bulbs are sweet and can be eaten in dried or fresh form. In China, the bulb scales are commonly cooked in water, or fresh fried as a regular vegetable. They may also be baked, grated or ground into flour. They are traditionally eaten in the summer season, as they have been believed to have cooling and moistening effects to all the body organs.

15.4.3 Soup and Tea

Lily Almond Porridge consists of 30 g of Lily, 9 g of peeled almonds in a wok with 100 g of rice. Lily porridge is used for the treatment of dry cough caused by lung-yin deficiency. It can also be a treatment for heart deficiency caused by insomnia, irritability, and anxiety etc.

15.5 Safety Evaluation and Toxicity

Lilium bulbs have been used as a medicine and a nutrient for centuries in China. For medical purposes, the recommended dose is around 9–30 g. To date, there is no clinical report on the toxicity or side effect available, which could be directly related to the use of *L. lancifolium* and other species.

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