

THE LOTUS COLLECTION

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The lotus collection is housed in the greenhouse tropical zone at the University of Bristol Botanic Garden

The lotus collection at the University of Bristol Botanic garden was started in 2007 with several aims:

- **Cultivation:** in keeping with the Chinese Herb Garden in general, to investigate the cultivation and ultimately the production of the medicinal herb from the living plant.
- **Education:** to display this primitive plant to students of botany and herbal medicine. I will not be covering the evolutionary botanical history in this article.
- **Research:** the lotus collection meets this aim through trials to determine which varieties which are most suited to the climate of the UK.

The lotus collection was achieved by way of our collaboration with Nanjing Botanic Gardens and, through them, with the Centre for Chinese Lotus Research in Wuhan. The Wuhan Centre is the leading Asian lotus breeding research centre in the world, with 300 ponds growing 500 lotus varieties. We are following their classification of cultivars in our collection.

From the fossil records, 8 species of *Nelumbo nucifera* were present worldwide 15 million years ago. After this time, the species were reduced to two. These are the Asian lotus and

the American lotus. The Asian form includes China and Indian distribution. The flowers of the Asian lotus cultivars are restricted to shades of red through pink to pure white. The distribution in the wild also includes India, where it is equally revered. In contrast, the American form is yellow. There is also a common confusion with the so called Egyptian lotus. These are in fact not true lotus, but waterlilies and come in 2 forms, the white *Nymphaea lotus* and the famous Egyptian blue lotus *Nymphaea caerulea*.

MEDICINAL USES OF LOTUS

Archaeologists have found charred lotus seeds being used as a food source 5000 years ago. Its historical use in medicine is equally ancient. The use of the lotus in food and medicine depends on which part of the plant is used and the season it is collected.



Lotus rhizome is a popular tonic food. The holes through the rhizome conduct water to the leaves

The **rhizome** (ou jie) is rich in sugar and starches and up to 2% protein. The mild sweet taste and crisp texture make it a popular health food, and also for use as a medicine for children.

The old winter rhizomes are considered the best for medicine. Rhizomes from south of the Yangtse river are considered to be a superior source.

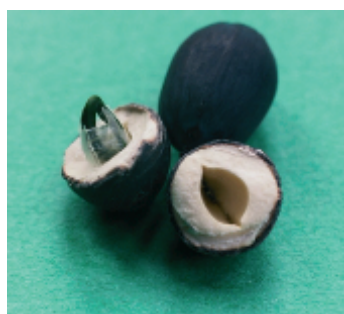
The **seed** (lian zi), has a much higher protein content, up to 16% with additional minerals

and vitamin C. Seeds are often made into a flour to make bread. Another name for the seed is pi guo (spleen seed) which reflects its tonic regenerative power. The seeds are best collected at the end of the summer before they turn into the hard winter seeds. This is known by farmers as the 'bell ringing' stage, as the dry seeds can be heard rattling in the wind. Summer and winter seeds have distinct medical uses. The seed is sweet, astringent and neutral in temperature and may be made sweeter by adding sugar for children or weak adults who suffer from diarrhoea or urine incontinence.



Lotus seed at the 'bell ringing' time of year

The bitter shoot of the seed, known as the **plumule**, is first removed and this in turn forms another distinct and much more cooling medicine (lian zi xin). You will see the hole in the centre of the seed used in the dispensary, where the shoot was growing.



The bitter green shoot is removed to be used as a separate medicine

In the spring, we can harvest the young leaves and stem as a food. Lotus **leaves** (he ye) and **stems** (he gen) are eaten raw, or used to wrap other food for cooking. They are somewhat bitter, cooling and astringent when older but this does make them suitable as a medicine. The fresh juice can be used to stop

bleeding from external injury. The leaf is also used as a folk medicine with *Coix lacryma jobi* (yi yi ren) as a slimming tea. Both are known to reduce dampness.

In summer the flowers emerge and we have a new range of herbs at our disposal. The first of these is a herb rarely used in the UK. This is the **calyx** (he di). The calyx is the outer covering of the flower bud before it opens. It has a particular use in medicine. It is also cold and is used for clearing heat and has a specific use in pregnancy for calming a restless foetus.

The **flower** itself has a short lifecycle of 3 days. On day 1 it opens partially. On day 2, it is at its peak with full scent and open form. This is the time for identification and photography. On day 3, the petals start to fall off and the fertilization is complete.

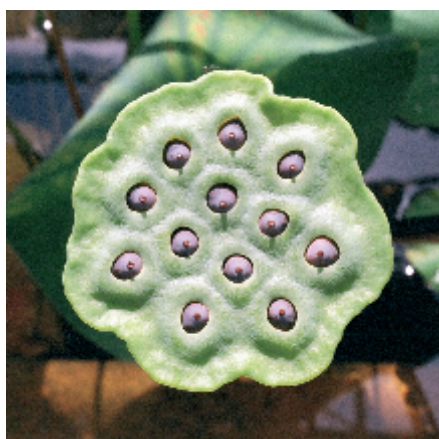
If you know your way around the flower and timing, you can extract up to 4 separate herbs from the flower.



The yellow male stamens surround the receptacle in the centre, which contains the female stigma

On day 2, the male **stamens** (lian xu) which produce the pollen, are the first parts to become active. It is these stamens which produce the scent to attract the insects needed for pollination. Self pollination only occurs in 20% of cases. The quality of the stamens is astringent and neutral. As a food, they are used to flavour tea. Medicinally, they contain the aromatic essence of the plant which will enhance the digestion and counteract the astringency. But the real treasure is the essential oil itself.

The **essential oil** (lian you) can be collected, but to obtain any volume, you would need many flowers. As the oil can only be extracted by cold processing, the yield is low. For this reason, the essential oil of lotus is the most expensive in the world. Weight for weight it is 3 times more expensive than gold. 5 ml will cost you over £100. Perhaps this is some of the allure of the scent. Anything so rare has value. But it does not explain why everyone who enters the greenhouse at this time begins to sink into a relaxed stupor. It is clearly nourishing the heart shen. I have seen reference to the pollen being indicated for calming the spirit. Since the pollen is produced on the stamens at the same time as the scent, then this may confirm my observations. Other parts of the plant relate to the heart, notably the plumule, which will clear heat from the heart to calm anxiety and to treat insomnia.



After flowering, the receptacle grows to nourish the seeds

Once the flower has lost its pollen, the anthers rapidly wither away and the petals start to drop off. The main energy of the plant is now sent to the **receptacle** (lián fāng), located in the centre of the flower. This distinctive container houses the female stigma and ovaries which will turn into the seeds. The fertilized seeds now start to swell inside the receptacle. Once they are swollen in summer, then the plant is raided again, this time for food. The green seeds are a delicacy. But the herbalist has to wait a bit longer, until the receptacle has turned brown and the seeds have hardened in the autumn. In contrast to the seeds, the receptacle is better when aged for a year or more. This is then known as lao

lián fāng. The receptacle is classified as bitter and warm. It is unusual to have a bitter and warm herb. It suggests a gentle combination of cooling and tonification, for use in either cold or warm cases.

As you can see, the medicinal actions of the different parts of the plant are quite diverse. These are summarised in the table on p.23. But we can draw some general guidelines on the overall medicinal actions of the plant.

As a food, the seed and rhizome are high in **sugars, protein, minerals and vitamins**. This is one reason for the use of lotus as a tonic. But equally important, if not more central, is its use as an astringent. Astringents can tonify the body by preventing loss of fluids, blood and essence. The astringent quality is attributed to the **tannin** content. This astringent action to stop bleeding is enhanced by processing the herb in a carbonisation chamber, which reduces the dried herb to charcoal. The receptacle in particular, is usually prescribed in this form.

Whilst carbonisation (chao tan) does increase the haemostatic action, it reduces the second action, which is to move the blood. The ability to move the blood is due to the rich **flavonoid** content. Because of this double action of astringency and blood moving, the effect is gentle and does not lead to the build up of stagnation which is common with stronger astringents. This makes it ideal for children and weak patients.

The plant is also generally cooling in action, some parts more than others. Some of this action is undoubtedly due in part to the **alkaloid** content. Several alkaloids have been found in different parts of the plant. The alkaloid nelumbine, extracted from the receptacle, has been used in clinical trials for cervical cancer. The alkaloid neferine, found in the seed, has been shown in scientific studies to reduce hypertension. The effect is short-lived and is achieved through dilation of the peripheral blood vessels.

Whilst the lotus is most commonly used as an adjunctive herb, without the rank of emperor, it does appear in several classical formulae. The leaf (he ye) is specified in Qing Luo Yin. This is a classical formula for summer heat, where all the ingredients are picked in the summer and used in fresh form. The other

Medicinal uses of different parts of *Nelumbo nucifera*

Part of Plant	Pinyin Name	Taste	Primary and Secondary Actions
CLEAR SUMMER HEAT			
LEAF			
young fresh	sheng he ye	3TAF	Aromatic to clear damp and heat. Raise Spleen
dried-summer	he ye	3TAF	Clear fever and diarrhoea from damp heat
charred-winter	he ye tan	4AT	Stop bleeding from heat stagnation in lower zhao
STEM	he gen	3TAF	Similar to leaf. Also to open the chest
COOL BLOOD HEAT			
PLUMULE	lian zi xin	2T	Cool HT. Insomnia, delirium. Hot blood bleeding.
STOP BLEEDING			
RECEPTACLE			
charred	lian fang tan	5AT	Continuous uterine bleeding with cold. Frequent urine.
raw dried	gan lian fang	4TA	Warm and move blood. Retained placenta. Restless foetus.
RHIZOME			
raw juice	sheng ou jie	3WA	Topically to stop bleeding. Nose bleeds.
dried-winter	lao ou jie	4WA	Move blood and stop bleeding.
charred	ou jie tan	5A	Stop bleeding especially LU/ST. Also urine, piles.
STABILISE AND BIND			
SEED			
shelled-summer	bai lian zi	4WA	Secure KID jing. Incontinence. KID/HT communication
	rou		
bran fried	chao lian zi	5WA	SP tonic. Drain damp. Secure KID jing. Calm HT.
in shell-summer	hong lian zi	4AW	Stop diarrhoea. Poorer quality than bai lian zi.
shelled-winter	shi lian rou	2TA	Cold and bitter. Sudden heat turmoil. Gastroenteritis
with shell-winter	qiao shi lian	2AT	Incessant chronic dysenteric disorder.
STAMENS	lian xu	2AT	Astringent to secure KID. Incontinence. Cools HT.

Taste: A=Astringent T=Bitter W=Sweet F=Fragrant

Temperature: 1=very cold 2=cold 3=cool 4=neutral 5=warm 6= hot 7=very hot

herbs in this formula are *Lonicera japonica* (jin yin hua), *Dolichoris lablab* (bai bian dou), *Lophatherum gracile* (dan zhu ye) and *Luffa cylindrica* (si gua pi).

The formula Shen Ling Bai Zhu San draws on the tonic and damp draining properties of the seed (lian zi) to assist the emperor.

Finally the stamens (lian xu) are an important deputy in Jin Guo Gu Jing, used to stabilise the Kidney essence.

LOTUS BREEDING

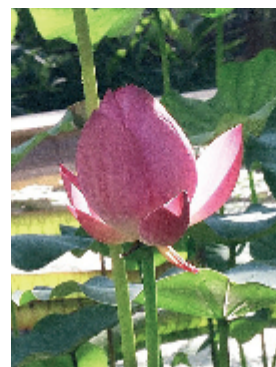
The lotus does tend to throw up many naturally occurring variations and these have been taken for breeding natural cultivars. A more advanced method of producing varieties in flower and size is through selective breeding. With selective breeding the stigma is covered and fertilised by hand with pollen from a known parent. This has produced another wide range of flower sizes and colours. In 1979, there were 33 classified lotus cultivars. There has been a great interest in breeding since this time and the count is now 500. In recent years, Chinese research has accelerated the evolutionary process even faster by subjecting seeds to radioactive cobalt to produce genetic mutation. Finally in truly heroic style in 1994, 442 seeds of 13 cultivars were sent up in a satellite. On return to earth, they were found to produce some unusual variations, including flowers of different colours on the same plant. In Bristol, we are only at the first stage, having collected for the first year natural mature hybrid seeds. But we do hope to enlarge the collection to show some of these more modern cultivars in the future. Even though we have only 13 cultivars of lotus in our collection, they have been carefully chosen to show the range of flower forms and colours.

The classification of the cultivars relates to the size of the plant and the colour and form of the flower. The closest to the original wild form in our collection is the large **qingling honglian**. This is similar to the native wild red single-petalled flower seen in many wild lakes across China. As its name suggests, this variety originates from the Qingling region of Hubei province, while the cultivar **xiao foushou** is a smaller version of **qingling**.

The shape of the flower of **qingling honglian** [and of **xiao foushou**] stands high at the edges, [known as a bowl]. There are four basic flower shapes used for classification. These are the cup, bowl, plate and flying dance.



qingling honglian is an example of a 'cup' flower form



xiao foushou is a smaller version of qingling honglian

There is a natural variation in the wild populations and these throw up varieties for the observant lotus breeders. **Hong xian lian** is a wild pink lotus from Hunan. It does not flower as long, but the change in colour to a pink form heralds other medium-sized pink cultivars.



hong xian lian on day one with flower just

One beautiful medium sized pink cultivar is **yan hua piaoxiang**. As its name suggests, it is a fragrant form but more open in form. This form is known as a bowl.



yanhua piaoxiang on day 3. The stamens are spent and the petals beginning to fall

The cultivar **yin qian biyu** shows a transition into white. You can still see the remains of the pink parent, but more importantly, you can see that the yellow anthers and pistils which will turn into seeds in the centre are both normal in structure. As breeding continues both of these will become petaloid to produce double and duplicate forms.



yin qian biyu on day two with ripe stamens producing pollen

White lotus came later in the breeding process. One of the first was the famous white **wawa lian** (Children's lotus). The Children's lotus was originally bred in Beijing, and this fact, together with its small form, makes it

one of the most exciting cultivars in the collection. The origins from the north of China and the small compact shape are ideal candidates for a small summer outdoor container plant for the UK.

A larger white cultivar for comparison is **xiao bi lian**. Whilst **wawa lian** owes its elegant beauty to its few petal form, **xiao bi lian** shows the more intricate double petal flower structure .



wawa lian is a small elegant single petal white lotus used for breeding



xiao bi lian is a double petal white which produces good seed

Another double petal lotus is seen in **shengxian fenlian**, originating in Shengxian city in 1980. This variety flowers over an incredible 78 day period in ideal conditions, making it a most prized specimen.

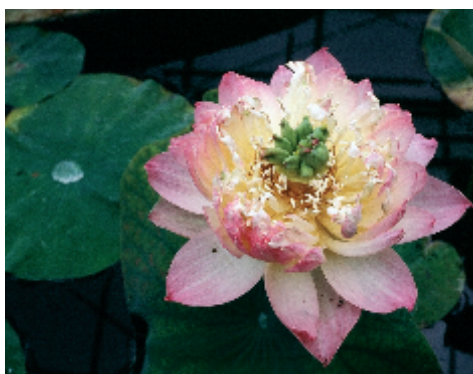


shengxian fenlian is a good example of the double petal 'bowl' flower form

In the variety **guanyin lian**, you can see that the pistils in the centre have started to appear in a petaloid form, as is also the case with **yicai**. This is the result of intensive breeding where reversions occur. In evolution, all flower parts have originally formed leaves and petals and the lotus flower is a relatively primitive flower type. The reversions have been taken up by breeders to create double and duplicate forms.



The stigma in guanyin lian have reverted to a petaloid form, through intensive breeding



yicai also has petaloid stigma and these varieties do not produce many viable seed

The most beautiful of these doubles, in my opinion, is the rare versicolour **yimeng qingsi**. This is also our only example of the flying dance flower shape.



yimeng qingsi has many narrow petals which go in different directions making the 'flying dance' form

The final stage of breeding in this collection is seen with the duplicate petalled **zhizi lian**. In this case both the anthers and the pistils have reverted to petaloid form.

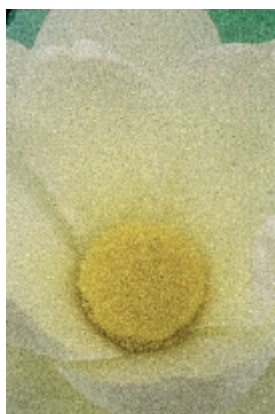


The duplicate form zhizi lian is named after the gardenia flower which it resembles

Finally, to complete the collection, we have one example of the more recent breeding between the Asian and American lotus. This introduces the yellow colour which is lacking in the Chinese forms. Our example of this is the pale yellow **jinlian hua** (golden lotus)



Cross breeding with the yellow American lotus produced this few petal jinlian hua (golden lotus)



jinlian hua (golden lotus) detail

We are intending to introduce new varieties over the next few years or even produce our own unique hybrid.

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VISITING THE UNIVERSITY OF BRISTOL BOTANIC GARDEN



Qingling honglian (cover picture)

The University of Bristol Botanic Garden is open to the public 10am - 4.30pm on Wednesdays, Thursdays, Fridays and Sundays. The Garden will also be open on Saturdays throughout June, July and August. For details see the website at www.bris.ac.uk/Depts/BotanicGarden

Lotuses flower from early July until the end of August.

For further details see also the **RCHM website**, which has general updates on the Chinese Herb Garden and details on courses.