

Sustainability of Chinese medicinal herbs: a discussion

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Abstract

Demand for Chinese medicinal herbs has grown rapidly over past decades. Practitioners are starting to be concerned not only about the quality of the herbs they use, but also about their sustainability. This article discusses some of the complex relationships and divergence of interests among herb-market participants and looks at initiatives that can work towards a sustainable future for Chinese medicinal herbs.

Introduction

Sustainability - or sustainable development - is a strategy for living on our planet that uses its finite resources without exhausting or destroying them. This can only be achieved by shifting the focus from maximum yield and fastest growth to considering the health of the entire ecosystem - developing, producing and growing only at a speed that does not destroy the system's balancing mechanisms.¹ Since we - as humans - are part of the system, its sustainability is obviously in our own interests. This kind of development is necessarily slower than what can be pressed out of an industry or a system if maximum growth is the priority. As far as sustainability of medicinal herbs is concerned, it means that the quantity grown or harvested does not endanger the future survival of the source plant, be it by over-gathering the wild population, over-exploiting the soil and terrain or severely diminishing the genetic pool/biodiversity.

A little history

Prior to the 1950s, demand for Chinese herbs was considerably smaller than it is today, and their trade was more regional. Traditional herbal medicine was mostly taught in relatively small private schools in China, with fewer herbalists graduating and practising. From the 1950's onwards, however, TCM (traditional Chinese medicine) was established as a subject of study and research at university level and began to form a major part of the newly established national healthcare system, alongside modern medicine. Even doctors of modern medicine were encouraged to study it. The number of people working with Chinese medicinal herbs began to increase dramatically, while at the same time the international trade in Chinese herbs grew - initially mainly to Japan and Taiwan, then more widely. To be able to meet this ever-increasing demand, researchers were sent out to discover 'new' herbs on the one hand and to find new alternatives for known herbs on the other hand. It was then that many herbs started to be cultivated outside their 'daodi'

(traditional) area and the guidelines in the official Chinese Pharmacopeia on what part of the herb or which species could be used for wild-gathered herbs were changed. For example, for Xi Xin (*Asari Herba*)² and Lu Gen (*Phragmitis Rhizoma*) the whole plant was used rather than just the root, and the *Aristolochia fangchi* species began to be used for Fang Ji (called 'Guang Fang Ji').

It was at this time also that many newly discovered medicinal herbs were added to the pharmacopeia with little prior research - *Aristolochia* being just one example.

Herbs gathered in the wild

Currently between 75 and 90 per cent of Chinese medicinal plants species are gathered in the wild,³ with the result that few resources have been devoted to establishing what conditions (fertilisation, water needs etc.) these plants would require if they were to be cultivated. The reasons for this are purely economic; as long as the price of any medicinal is relatively low, almost no one will invest in trying to grow it. This has led to many medicinal plant species being over-exploited, a situation that is not unique to China. International conservation organisations differ on how to deal with this,⁴ some recommending that all wild species be brought into cultivation, and others recommending 'sustainable harvesting', which means restricted wild gathering according to specific rules (see below).

In China pharmacognosists and others try to encourage small local farmers or communities to experiment with the cultivation of potentially or actually over-exploited medicinal plants that have not yet been cultivated. According to Professor Zhang Hao, one of the author's pharmacognosy teachers in Chengdu, this work has become somewhat easier in recent years as farmers are beginning to notice the decline of wild herbs they had historically been able to gather to generate a little extra income. Often, to find them at all, they now have to walk greater and greater distances. Examples of these are Chong Lou (*Paridis Rhizoma*), Chuan Mu Xiang (*Vladimiriae Radix*), Qiang Huo (*Notopterygii*

Rhizoma seu Radix), Du Huo (*Angelicae pubescentis Radix*), Da Huang (*Rhei Radix et rhizoma*) and many others. Rarity naturally increases value, and for Chong Lou recent price increases have made it more attractive to go through the pains of cultivating it. For others, cultivatable alternatives have been found.

Another example is Shi Hu (*Dendrobii Herba*) whose source plant is an orchid which has been so over-picked that it has been included in the CITES list of endangered species. Fortunately, researchers have been able to cultivate other *Dendrobium* orchids, which have a similar chemical composition and medicinal function and therefore can now substitute for Shi Hu. This is the reason why Shi Hu became difficult to obtain a few years ago but is more readily available again in its cultivated form. However, because most Chinese believe the wild variety is more potent than the cultivated, a single kilo of wild Shi Hu can fetch \$US1,100 to 14,000.

Another famous orchid, Tian Ma (*Gastrodiae Rhizoma*) is in a similar position. It can be cultivated but nevertheless - despite being illegal to do so - it is still gathered in the wild.

Other plants have not had as much attention as the orchids. For example Ji Xue Teng (*Spatholobi Caulis*), originally a common vine in the southern Chinese area of Guangxi, was picked to extinction there before it could be cultivated. It is now gathered in the wild in the woods of Vietnam or replaced by other species not indigenous to Guangxi.

The same has happened to the famous medicinal San Qi or Tian Qi (*Notoginseng Radix*) which is also indigenous to Guangxi, but has been eradicated there and not replaced by cultivation. The main production area now is in Yunnan where it has become one of the province's most famous exports.

Of course there are plants that simply do not seem to like being cultivated, even though a great deal of time and effort has been devoted to the attempt. One example is Chuan Bei Mu (*Fritillariae cirrhosae Bulbus*) in Sichuan. This small and pretty *Fritillaria* species prefers growing on its own in the grasslands - so much so that people are now trying to grow it with the so called 'half-wild' method. This means seeds are just scattered, or widely-spaced seedlings are planted in areas the plant likes to grow in, thereby at least increasing the yield of gathered plants. This method is also used for other 'difficult' plants.

Besides threatening the population of specific medicinal plants, over-gathering can contribute to additional problems, for example accelerated desertification in the north of China due to over-gathering of Gan Cao (*Glycyrrhizae Radix*) and Fang Feng (*Saposhnikoviae Radix*) - both herbs with thick and long roots which stabilise the ground. Paradoxically this has had its positive side, drawing attention to the problem and resulting in several projects devoted to replanting these herbs. Other strategies focus on controlling the gathering of wild Gan Cao, so that one year it can only take place in a certain area and the next year in another, thereby leaving more time for the population in each area to recover.

For herbs that only grow in the wild, such regional and temporal restrictions on gathering them are the only sustainable option. Implementation is a major problem, however, especially in areas that are huge and inhabited by hundreds of thousands of people - many used to gathering herbs to increase their low income and supply an ever-increasing demand. In the long run, if there is to be a sustainable future for Chinese medicinal herbs, unrestrained commercial gathering of herbs in the wild will need to be reduced to a minimum and replaced by controlled restricted gathering on the one hand and cultivation where possible and ecologically sound on the other. Cultivation in the home garden or small-scale cultivation by farmers as described above are good examples of this. Since these methods of cultivation help in conservation of endangered medicinal plant without destroying its ecosystem, as well as helping the farmer to generate some income (if successfully grown), they can be called truly sustainable.

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Cultivated herbs currently sold in China for the national market are often of poor quality because the overall low price of herbs does not encourage extensive growing and consequent improvements in quality. This is compounded by the fact that people - often correctly - perceive herbs grown in the wild to be more potent and therefore more attractive, and there are enough people - both inside and outside China - willing to pay the ever-increasing prices.

One thing to note when considering the provenance of herbs is that those gathered in the wild may legally be sold as 'organically grown', even if they are not gathered in a sustainable manner. Within China - as in the West - there is a desire for natural products, cultivated without artificial fertilisers and pesticides, and this increasing demand for organically grown herbs may in fact be endangering some herb species.

Cultivated herbs

Even though most herb varieties are not yet cultivated, when viewed simply in terms of quantity (the number of tons of herbs sold and used), cultivated herbs make up more than fifty per cent of the market. This is because those herbs that are used in large quantities and high dosages have been cultivated for many years - some of them, like Fu Zi (*Aconiti Radix lateralis*), for longer than a millennium. The cultivation of Fu Zi, as well as Di Huang (*Rehmanniae Radix*), Bai Shao Yao (*Paeoniae Radix alba*) or Chuan Xiong (*Chuanxiong Rhizoma*) and many others, is described in old materia medicas, some even as far back as the Han dynasty *Shen Nong Ben Cao Jing*.⁵ These texts also give information about where specific herbs grow best - known nowadays as

their 'daodi' area. But however attractive the daodi tradition is, it seems clear that with the ever-growing demand for Chinese herbs, they cannot endlessly be grown in the same, often size-limited, area. To take Fu Zi as an example, demand has for many years far exceeded what can be grown in its daodi area, with over ninety per cent of annual production pre-ordered by the three main companies producing patent medicines that contain Fu Zi. The remainder is battled over by smaller buyers. So the only other option to a shortage of Fu Zi, is to cultivate it beyond its daodi area.

Increasing demand also impacts negatively on traditional cultivation methods. To yield good Fu Zi the aconite plant should be transplanted in the autumn, worked on at the winter solstice and harvested at the summer solstice before processing, but since Fu Zi is required all year round in such large quantities, these timings can no longer be observed.

Another way in which traditional guidelines for growing medicinal herbs conflict with market demands is the number of years the ground is considered to need to rest before a particular herb can be grown again to achieve a good medicinal quality. Most herbs require at least three years - and in the case of Huang Lian (*Coptidis Radix*) ideally fifty years - of recovery during which time the ground should only be used for food crops. This makes traditional growing methods far less attractive economically, and encourages the use of chemical fertilisers to bypass the recovery period, resulting in plants that grow big but are neither strong nor potent.

The special limitations of traditional daodi areas have been a recognised issue for many years and on the positive side, finding new growing areas for certain herbs is not really an unsolvable problem. Of course herbs cannot simply be grown anywhere people have the soil and need an income; they should be cultivated in areas that resemble their natural home in as many aspects as possible. This is currently the subject of extensive research in China.

Problems of pollution

Although there are justifiable concerns about the pollution of medicinal herbs due to the use of pesticides or fungicides in the growing process, this is so far not a major problem (although it is becoming more so due to the overall increase in the use of pesticides in Chinese agriculture). Among the reasons for this are:

- Many herbs are relatively resistant to pests compared to other crops, due to their special chemical components (often the very same components that make them useful medicinals).
- Many farming people know of both ancient and modern ways to protect the plants naturally, for example flushing away pests with water in the cultivation of Mai Men Dong (*Ophiopogonis Radix*), inter-planting protector plants, and using natural pesticides such as Ku Shen (*Radix Sophorae Flavescentis*) extract.

- Pesticides and fungicides are expensive (although the author has heard of farmers who were unwilling to buy pesticides because of their price, but were persuaded when the pesticides were sold to them as powerful tonics for their herb plantations).⁶

Some Chinese herb importers in Switzerland perform laboratory tests for pesticides, heavy metals and other pollutants on every batch.⁷ They report that a more common problem is pollution due to inappropriate storage of harvested herbs, for example in a place where harmful substances have been kept. Another problem that is increasingly widespread is contamination by pesticides from neighbouring fields (this can be shown because the pesticides are not suitable for the herbs but for other crops). These are particularly unfortunate sources of pollution, since the herbs themselves may have been grown free of chemical contaminants, and shows why careful testing of medicinal products is necessary. Another source of pollution is heavy metal accumulation in the soil, caused either by human activity or naturally occurring. To avoid the latter, the soil should be analysed before cultivating herbs in a new terrain.⁸

Biodiversity and GAP

It is widely accepted that large monocultures are not sustainable in the long run because of decreased genetic variety in the crops, decreased biodiversity in the fields and resultant increased susceptibility to pests. In Chinese medicinal herb cultivation only a relatively small number of herbs are grown on large scale, for example Dan Shen (*Salviae miltiorrhizae Radix*), Di Huang (*Rehmanniae Radix*), Shan Yao (*Dioscoreae Rhizoma*) etc. Most growers are smaller farms or cooperatives - so much so that implementing GAP (Good Agriculture Practice) norms for Chinese herbs is often a very difficult task, except in the case of large producers. GAP regulates the whole growing process in order to guarantee quality and uniformity of the end product. This means, for example, that uniformity of seeds and seedlings is required and regional or local seeds/species variants can no longer be used, thereby decreasing plant biodiversity. This reveals one of the areas of conflict between an increasingly demanding community of consumers (both international and Chinese) who ask for consistently high quality and clearly identifiable herbs, yet also want to preserve their romantic image of wild-gathered or traditionally hand-grown herbs.

In fact, not implementing GAP universally for Chinese herbs is has prove⁹ helpful in terms of supporting biodiversity because it means small growers, using different seeds in different areas, can still hold on to a niche market. But it makes the whole market more difficult to control since the variety of source plants stays large and few people are able to clearly identify and distinguish them. This is one of the many challenges that the production of Chinese herbal medicinals faces today.

Traceability

Before I decided to become a Chinese medicine practitioner I spent three years working on organic and biodynamic farms. This may be one of the reasons I have always been interested in knowing where my herbs come from and how they are produced. I also want to make informed choices as to where to buy or order herbs, so I can support responsible suppliers rather than just buying the cheapest.

The better importers of TCM medicinals into Europe might know where a particular herb's main growing area is, but they are unable to tell us where and how the batch they are currently selling has been grown and processed. Even very responsible companies who perform systematic laboratory controls on every batch of herbs they sell will only be able to say if there are contaminants in the herbs and if the source plant is appropriate for this particular TCM medicinal. For any further information they are reliant on their Chinese or Taiwanese suppliers, or what they read on various kinds of certificates, but it is generally difficult and often impossible to verify that information. It would mean tracing any particular medicinal back to its source, which at present is only possible in a few cases.

There are various reasons for this traceability problem. Firstly, the source plants for TCM medicinals come from many diverse climates and soils. No single area of China can grow all of the herbs needed, even for a small materia medica. So a wholesale herb company needs to build contacts in every part of the country to purchase all the herbs needed, and will usually additionally buy some at one of the major herb markets. They have an interest in simplifying the number of contacts by buying as many herbs as possible from one supplier, thus delegating the search for those herbs to others, resulting in ignorance of their origin. Traceability is particularly an issue for Chinese herbs because of the sheer number of medicinals needed for a TCM pharmacy and the very large percentage of small farmers producing small batches of herbs that may be subsequently mixed together.

Secondly, since there was never a totally systematic approach to the naming of medicinal plants (and plants in general) in Chinese before the introduction of modern botany with its systematic classification, many different names are still used for the same plant in different regions, as well as the same name for different plants in different regions. If you look at any European herbal, you will discover that the same is true for our medicinal plants. Taking chamomile as an example, there are at least eight different plant species from four different genera – that are all called chamomile. For comfrey, the same plant is called by at least five different names in English alone (black root, bruise wort, knitbone, slippery root and wallwort) let alone other European languages. The reason herb identification is easier for us (aiding traceability) is that unlike in China, most of our flora has already been classified using the Linnaean system - both because Europeans started using the system earlier and because we have a much smaller variety of plants in the first place.¹⁰

Before the growth of the modern Chinese herb industry, the many different names were not such a problem, since herb selling and buying was on a small scale and more personal and local, with buyers and growers knowing their herbs well. Nowadays, however, there is a lot of miscommunication leading to potentially dangerous confusion about the identity of a specific herbal medicinal or its source plant.

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One famous example is Mu Tong (*Akebiae Caulis*). There are five different plants that can be used to produce the TCM medicinal Mu Tong, including Chuan Mu Tong (*Clematis armandii*) and Guan Mu Tong (*Aristolochia manshuriensis*). Whilst Chuan Mu Tong is safe, Guan Mu Tong contains toxic aristolochic acid. It has now been excluded from the official Pharmacopeia of the PRC (where it had only been included since the 1950's), but if buyers and sellers just talk about 'Mu Tong' without including the prefix saying which kind of Mu Tong, they might end up trading not just a different plant but a plant that may injure those who consume it. Furthermore, since the now illegal form cannot be sold, some growers and traders may be inclined to sell it as something else rather than going through the tiring and costly process of changing the whole production system round to producing the legal kinds of Mu Tong.

Of course Mu Tong is a particularly well known example. Everyone dealing with Chinese herbs should be well aware of it by now yet several studies¹¹ have revealed that potentially toxic *Aristolochia* can still be found in some patent medicines as well as amongst raw herbs on the market.

Another problem with traceability is that since prices vary according to the region a specific medicinal plant comes from (more expensive from daodi areas), plants grown elsewhere will often be transported to their daodi area in order to obtain a higher price. A further difficulty is that TCM medicinals are not necessarily just the air-dried form of the source plant. They have frequently undergone a more or less complex form of processing (*paozhi*), part of which is done immediately after harvest and part at small or larger processing factories which often buy and process source plants from many different producers. Because, as stated above, different plants may be used in different regions as the basis of the same TCM medicinal, they are quite likely to be mixed together in the course of processing.

These examples suffice to demonstrate how difficult it can be to trace many TCM medicinals back to where they were grown.

Conclusion

Chinese herbal medicine is a now very big business, not only in China but also in Japan and Taiwan, and to a lesser extent the rest of the world. The biggest challenge to sustainability

for any agricultural product - and especially such sensitive crops as medicinal herbs - is increasing demand. This demand is found not only in the world-wide TCM community, but also in the international cosmetics and food industries which develop wellness products containing Chinese medicinal herbs. For example Wu Wei Zi (*Shizandrae Fructus*) is used in a 'purifying' drink and Jin Yin Hua (*Lonicerae Flos*) in a herbal ice-tea. Both of these herbs are partly gathered in the wild. Imagine the quantities needed to produce drinks for a population as large as the Chinese one, let alone the wider world. Another herb, Tu Fu Ling (*Smilacis glabrae Rhizoma*), has become rare in the wild mainly because of its use as a popular traditional health food in China.

A sudden increase in demand is even more difficult to handle. The explosion of international interest in Gou Qi Zi (*Lycii Fructus*, 'goji berry'), sold as the ultimate health and longevity food, is a good example. It is clearly impossible to suddenly sustainably produce the quantity of Gou Qi Zi needed to satisfy a world desire for 'superfoods', when previously the plant was only known in China itself and as a TCM medicinal. That is why most of the Gou Qi Zi is now of poor quality and tests positive for pesticides (even though much of it is sold as organic or even as wild-grown). In a few years, production will have been established and will function well, but by then 'Gou Qi Zi-fever' might already be over, to be replaced by another hype.

In China there is growing awareness of these challenges. The work of identifying and analysing medicinal plants, maintaining seed-banks as reservoirs and trialling cultivation of herbs normally gathered in the wild, as well as controlled gathering and 'half wild' cultivation, is well on its way. Of course it is not only Chinese researchers who are interested; Novartis has built a huge plant research centre near Shanghai and it is probable that many other similar companies are keen on exploring and exploiting the rich resources of Chinese herbal medicine.

Although the non-Chinese TCM community plays a relatively small role in the threat to sustainability and biodiversity in China, we are all responsible for our actions. Our concern for sustainability and other ecological issues means that we should use our position to influence and inspire our contacts in China to find ways to promote sustainable cultivation and gathering of Chinese medicinal herbs. To do that, however, we have to reflect carefully on our own priorities. Is it more important, for example, to have every herb readily available to us, whenever we want it, and at the best price? Or are we willing to compromise - adapting ourselves to availability and paying a higher price to companies that are willing and able to give us the information we need to know if their herbs are grown or gathered in a sustainable way and if they themselves are engaged in promoting sustainable growing methods?

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References

- 1 The biggest challenges to sustainable growth are sudden and large increases (or decreases) in demand.
- 2 All the Latin names given are the so-called pharmaceutical names, i.e. the name given to the finished herbal medicine, irrespective of which source plant has been used. The pharmaceutical name is usually the name of the source plant that is most often used and is considered best quality. For some herbal medicines several different source plants are permitted and are considered to be of equal quality.
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- 5 *The Divine Farmer's Materia Medica*, a compilation of oral traditions written between about 300 BCE and 200 CE.
- 6 There is no room for complacency, however, as thanks to Monsanto, Syngenta and the like, China, just like most other countries in the world, is being blessed with these gifts of modern agriculture.
- 7 Annual report sent to clinics and pharmacies by Complemedis, Switzerland, available on request from the author.
- 8 Some herbs will be especially prone to accumulate heavy metals in the growing process.
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- 12 A Swiss multinational pharmaceutical company based in Basel.