

15

Sustaining herbal supplies: China



GENERAL INFORMATION

- ◆ **Implementing institution**

Institute of Medicinal Plant Development (IMPLAD)

- ◆ **Head**

Dr. Shilin Chen (deputy director)

- ◆ **Details of institution**

Address: Institute of Medicinal Plant Development,
Chinese Academy of Medical Sciences,
Beijing, China, 100094

Tel.: (+86) 10 6289 9701

Fax: (+86) 10 6289 6288

E-mail: impladcams@263.net

Web site: www.cams.ac.cn/cams

- ◆ **Implementation period**

1995-2003

- ◆ **Costs**

US\$200,000 for a Major Programme from the National Natural Science Foundation of China and US\$700,000 from the Chengdu Enwei Group.

SUMMARY

Bulbuls fritillariae cirrhosae is one of the most widely used traditional Chinese medicines with the function of relieving coughs and eliminating phlegm. In the Chinese Pharmacopoeia, “bulbuls fritillariae cirrhosae” refers to the bulbs of four species. *Fritillaria cirrhosa* — the tendril-leaf fritillary (fig. 1) — is the most widely used, but *F. unibracteata*, *F. przewalskii* and *F. delavayi* are recognized as suitable alternatives.

The manufacture of fritillaria preparations has developed into a large-scale industry worth an estimated US\$400 million a year in China, and there are currently more than 400 manufacturers producing over 200 kinds of fritillaria preparations. Even so, the demand for fritillaria products is growing fast and the annual output covers only some five per cent of the market demand. Cultivation techniques are still unsuccessful, however, and most fritillaria is collected from wild populations which, as a result, are declining rapidly.

The Institute of Medicinal Plant Development (IMPLAD) has therefore developed a two-pronged approach to the sustainable use of fritillaria resources.

First, in a break from traditional methods of cultivating medicinal plants, a system for cultivating *F. cirrhosa* in its natural environment has been developed. This marks the first time such a large-scale “natural fostering” system has been used to protect and sustainably use an endangered medicinal plant.

Second, species in the same genus as *F. cirrhosa* have been investigated as possible alternative sources of bulbuls fritillariae cirrhosae. Five species in particular have been analysed and found to contain chemical components similar to those of *F. cirrhosa* with similar pharmacological and curative activities. These alternative species are also easier to cultivate than *F. cirrhosa* and could become useful substitutes for *F. cirrhosa*, helping to satisfy the market demand for the popular remedy.

BACKGROUND AND JUSTIFICATION

The unsustainable use of herbal medicine resources is one of the most important obstacles hindering the further development of phytopharmaceutical products.

In 2002, eight Chinese ministries and committees issued the “Outline of Modernized Development of Chinese Medicine (2002-2010)”. The report listed the sustainable use of Chinese medicines and development of the traditional medi-

Figure 1 | The tendril leaf fritillary, *Fritillaria cirrhosa*, the bulbs of which provide the source of bulbuls fritillariae cirrhosae, a traditional Chinese cough medicine.



cine industry as basic principles. "While fully utilizing the resources, we must pay attention to protecting the resource and the environment", continued the report. "We must also protect biodiversity and ecological balance, especially to recover and regenerate those Chinese medicine material resources that are seriously threatened or in short supply." The report also further emphasizes the protection and sustainable utilization of Chinese traditional medicine resources as one of the six "key tasks" to be addressed over the next few years.

Responding to these issues, development and research into bulbuls fritillariae cirrhosae have recently been accorded special priority.

In the Chinese Pharmacopoeia, bulbuls fritillariae cirrhosae - a popular remedy for coughs and phlegm - refers to the bulbs of *Fritillaria cirrhosa*, *F. unibracteata*, *F. przewalskii* and *F. delavayi*, and all four species have been listed in the Wild Official Species under Protection of the State according to Wild Medicine Material Protection Rules issued by the Chinese State Council.

In China, these fritillaria resources, and *F. cirrhosa* in particular, are becoming seriously threatened. Shortages in supply mean that, although the annual output of bulbuls fritillariae cirrhosae has reached about 100,000 kilogrammes, it is far from meeting the current market demand of about 2 million kilogrammes. Bulbuls fritillariae cirrhosae, therefore, is becoming one of the most expensive Chinese herbal medicines, with prices for the

best-quality material reaching as much as US\$100 per kilogramme.

To strengthen the conservation and sustainable use of Chinese herbal medicine resources, IMPLAD has developed a research programme aimed at the conservation and cultivation of wild plant medicinal materials, the results of which should benefit not only China but also the rest of the world.

DESCRIPTION

In China, fritillaria products have been used as medicine for at least 1,000 years. Scientific tests confirm that bulbuls fritillariae cirrhosae, made from the bulbs of *F. cirrhosae* and related species, can relieve coughs, eliminate phlegm and treat asthma. It also has antibacterial properties. For these reasons, most of the best-selling traditional medicines for treating respiratory system ailments in China are made from bulbuls fritillariae cirrhosae.

In 2002-2003, the production value of fritillaria preparations was about US\$400 million. Indeed, the annual sales of one fritillaria product, Nin Jiom Pei Pa Kao/Fritillaria Loquat Syrup reached some US\$70 million — and 50 more pharmaceutical factories produce similar products.

To satisfy the growing demand for bulbuls fritillariae cirrhosae, most fritillaria bulbs are collected from the wild in mountainous regions of the Tibetan plateau. Populations of *F. cirrhosa*, in particular, are declining rapidly. Therefore,

IMPLAD has designed the following model for the sustainable development of fritillaria products.

GUARANTEEING A SOURCE OF MEDICINAL MATERIALS THROUGH THE NATURAL FOSTERING OF *F. CIRRHOSA*

The endangered *F. cirrhosa* is endemic to the Tibetan plateau, where conditions such as the high altitude and severe weather mean that it grows and reproduces slowly.

An ecological survey of the areas in which *F. cirrhosa* thrives was aimed at providing a scientific basis for its natural cultivation. The survey showed that natural plant communities containing *F. cirrhosa* (fig. 2) fall into six types based on the main species present, most of which are low-growing shrubs:

- the *Dasiphora fruticosa*, *Spiraea alpina* and *S. myrtilloides* community;
- the *Polygonum viviparum* and *P. sphaerostachyum* community;
- the *Rhododendron litangense* community;

- the *Sabina pingii* var. *wilsonii* community;
- the *Salix sclerophylla* community; and
- the *Sibiraea angustata* community.

Having identified the most suitable areas for *F. cirrhosa*, an area at an altitude of some 4,000 metres was selected for the plant's natural cultivation. Such fostering is based on increasing the density of the *F. cirrhosa* population in areas where there is less human activity and where unregulated collection of the plant can be controlled. In addition, such isolated areas reduce the chance of infection with diseases from outside sources. Indeed, as the identified plant communities are integral to the growth of *F. cirrhosa*, planting *F. cirrhosa* in these areas has the advantage of maintaining the plant's preferred ecology and providing natural pest and disease control. This lowers production costs, as there is no need to apply pesticides, herbicides or chemical fertilizers. Natural fostering in the wild environment, therefore, should allow the sustainable development of this wild medicinal plant resource.



Figure 2 | Example of the Tibetan plateau habitat favoured by natural populations of *Fritillaria cirrhosa*.

RESEARCH ON SUBSTITUTE SPECIES FROM THE FRITILLARIA GENUS

Research on *F. cirrhosa* and other species from the *Fritillaria* genus, including *F. taipaiensis*, *F. pallidiflora*, *F. ussuriensis*, *F. wabuensis* and *F. mellea*, shows that their chemical components are very similar. For example, all these species contain alkaloids. Further tests have verified that the alkaloid fraction can relieve coughs and relax muscles, the saponin fraction can be used to eliminate phlegm, and an alcohol extract fraction can be used to relieve asthma. All the substitutes, therefore, can be used in preparations containing components similar to those in bulbs *fritillariae cirrhosae*.

Field trials have also demonstrated that these species can be cultivated much more easily than *F. cirrhosa*. The wider cultivation of such substitutes for an endangered species is a direct and efficient method for protecting natural populations — in this case, *F. cirrhosa* and the habitats in which it thrives — and for increasing the supply of a valuable medicinal resource.

PATENTING AND COMMERCIALIZATION

The Chengdu Enwei Group is establishing the large-scale natural fostering base for *fritillaria* commercialization. In the near future, Hong Kong-based Nin Jiom Medicine will also join the project.

PARTNERSHIPS

IMPLAD is also a World Health Organization (WHO) Collaborating Centre for Traditional Medicine. With over 500 employees, IMPLAD has three branch institutes (in Guangxi, Hainan and Yunnan). The Institute also maintains four medicinal plant gardens covering 340 hectares in which are conserved about 5,000 species of medicinal plants. The mission of the institute is to develop, protect and utilize Chinese herbal resources with modern technology and methods.

The Chengdu Enwei Group, the main collaborator of IMPLAD in this project, is a high-tech, multinational enterprise with annual sales of some US\$100 million. The company regards the cultivation of medicinal plants as one of the key targets for its own ongoing development.

REPLICABILITY

The model of natural fostering developed for *F. cirrhosa* should be easily adaptable to other threatened plant species with medicinal properties not only in China but throughout the world.

LESSONS LEARNED

As the ecological environment has an important influence on species differentiation, the environment may cause great

differences in the chemical composition and characteristics of cultivated medicinal plants. Using alternative fritillaria species and the natural fostering of *F. cirrhosa* helps to overcome these problems.

POLICY IMPLICATIONS

The natural fostering of *F. cirrhosa* was initiated because of government policy decisions on the wise use of indigenous medicinal plant resources.

IMPACT

Natural fostering of *F. cirrhosa* populations, together with the identification and cultivation of suitable alternative species, has helped to provide a sustainable source of plant material, thus ensuring that the Chinese herbal medicine industry has a continuous supply of the principal ingredient for China's most popular cough remedy. In addition, the creation of an area set aside for the natural fostering of *F. cirrhosa* has provided the local population with social and economic benefits.

FUTURE PLANS

Some 70 per cent of Chinese herbal medicines are collected from the wild. There is therefore a great need to promote both the domestication and cultivation of many medicinal plant species. Cultivating them in their wild environment — i.e.,

natural fostering — can generate a new medicinal ecological industry. For these reasons, there are plans to expand the natural fostering of *F. cirrhosa*. The Chengdu Enwei Group has developed an area of over 140 hectares for *F. cirrhosa* cultivation to provide a source of seeds, and an additional area of 10,000 hectares will be set aside in the Ganzi area of Sichuan and Tibet for the natural fostering of the plant. These two initiatives are aimed at recovering the resource population in its natural condition and ensuring the future supply of fritillaria materials.

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Case study prepared by:

Shilin Chen

Institute of Medicinal Plant
Development, Chinese Academy of
Medical Sciences, Beijing, China, 100094
Tel.: (+86) 10 6289 9701
Fax: (+86) 10 6289 9776
E-mail: scslchen@sohu.com

Project participants:

Shilin Chen, IMPLAD: Project leader.

Xue Gang and Dai Yong, Chengdu Enwei
Group: Phytopharmaceutical
development and creation of the base
for fostering *F. cirrhosa* in the wild.

Wang Shu and Tang Xinyao, Sichuan
University: Chemical analyses and plant
cultivation.

*Xiao Peigen, Zhang Bengang, Mingru Jia and
Yu Wang*: Research into plant resources.