

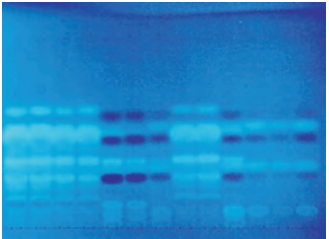


LfL

Bayerische Landesanstalt für Landwirtschaft

Chinese medicinal plants from Bavaria

Controlled cultivation – reliable therapy





The use of medicinal plants plays an essential role in Traditional Chinese Medicine (TCM). It was in 1999 that our interdisciplinary research group dedicated itself to the establishment of the controlled production of selected Chinese medicinal herbs in

Germany. This resulted in the availability of reliable quality TCM herbs.

The work was based on the confirmation of the botanical identity, as well as on the development of suitable cultivation and processing standards. The yield and constituent contents of some species are improved by plant breeding. In a number of pharmaceutical studies and therapeutic observations the quality and efficacy of the herbal remedies was analyzed. Consequently, in 2005 this interdisciplinary research led to the field cultivation of several Chinese medicinal plant species and to high quality materia medica from Bavaria. The certified herbal remedies are distributed via retailers and pharmacies.

The research work in the field, lab and medicinal practice is conducted by the Bavarian State Research Center for Agriculture (LfL; project leader), the Ludwig-Maximilians-Universität München, the Universität Graz, the companies PhytoLab GmbH & Co. KG and Kräuter Mix GmbH, as well as the medical associations DECA (Association for the Documentation of Empirical Knowledge of Chinese Herbal Therapy DECA GmbH) and SMS (International Society of Chinese Medicine). Meanwhile after 16 years of research, the interdisciplinary consortium with its networking in the international context of TCM has developed a unique expertise covering all fields from botany through cultivation and processing to the patient.

This knowledge will be focused and further developed in the Center of Competence for Chinese Medicinal Plants.

Interconnected research

Cultivation studies and breeding

Up to now, more than 20 species of Chinese medicinal plants have been tested for cultivation and processing techniques, harvest times and different seed sources. Seed, which has had its botanical identity approved, together with information of production standards have been released to seed multipliers and farmers for regional production of Chinese medicinal plants (www.LfL.bayern.de/ipz/heilpflanzen/). The available seed sources are mostly heterogeneous populations and do sometimes cause problems in cultivation. Out of these populations, suitable plant types have been selected for crop improvement. The main breeding goals are homogeneity, high and reliable yields, high constituent contents, improved seed quality and plant health or reliable survival after the Central European winter conditions. *Artemisia scoparia*, *Astragalus mongholicus*, *Bupleurum chinense*, *Leonurus japonicus*, *Salvia miltiorrhiza* and *Saposhnikovia divaricata* are part of the breeding program.

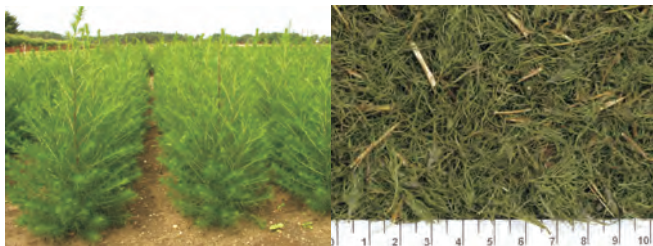
Commercial GAP cultivation in Bavaria

At present, 10 Chinese plant species are commercially produced in Bavaria. The farmers who produce these species are greatly experienced and professionally equipped for medicinal plant production. Several samples of the plants and their materia medica are as follows:



Commercial field of *Siegesbeckia pubescens*

Artemisia scoparia, Yinchen, 茵陈
Virgate wormwood



Leonurus japonicus, Yimucao, 益母草
Chinese motherwort



Saposhnikovia divaricata, Fangfeng, 防风
Saposhnikovia, Also cultivated in Bavaria:



Also in the bavarian cultivation

Angelica dahurica,

Astragalus mongholicus,

Paeonia lactiflora (Radix rubra),

Salvia miltiorrhiza,

Scutellaria baicalensis,

Sigesbeckia pubescens,

Xanthium sibiricum.

Botanical Identification

The botanical taxon of each plant species and seed source under agricultural experimentation must be precisely identified. The basic tool is the analysis of DNA sequences reconfirmed by the morphological and chemical characters of the plants. This is the guarantee for the secure identity of TCM materia medica from Bavarian cultivation.

5. webrounG1: 319977944	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. webrounG1: 31781384	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. buegerp1anaG1: 249813434	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. buegerp1anaG1: 158122134	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. koyasanaaG1: 317814188	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. koyasanaaG1: 249813434	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. koyasanaaG1: 249813434	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. koyasanaaG1: 256774133	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. koyasanaaG1: 158122133	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. nobouaG1: 317814187	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. nobouaG1: 317814186	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. nobouaG1: 317814185	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. n1sgpennaaG1: 317814130	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. n1sgpennaaG1: 315579733	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. n1sgpennaaG1: 185813923	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. n1sgpennaaG1: 34184333	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. n1sgpennaaG1: 218676443	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. n1sgpennaaG1: 223814443	GGAAACCTCAGGAGAGGCTCCCTCCCTGATGCCCCCTTCGGGTGCTCCGGAGGACAGGCTCTCTTTGAAAGTCTATACGACCTCTCGGACAGGAT
5. webrounG1: 315477544	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. webrounG1: 317813184	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. buegerp1anaG1: 249813434	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. buegerp1anaG1: 158122134	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. koyasanaaG1: 317814188	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. koyasanaaG1: 249813434	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. koyasanaaG1: 249813434	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. koyasanaaG1: 256774133	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. koyasanaaG1: 158122133	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. nobouaG1: 317814187	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. nobouaG1: 317814186	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. nobouaG1: 317814185	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. n1sgpennaaG1: 317814130	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. n1sgpennaaG1: 315579733	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. n1sgpennaaG1: 185813923	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. n1sgpennaaG1: 34184333	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. n1sgpennaaG1: 218676443	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC
5. n1sgpennaaG1: 223814443	ATCTAGGCTCTCCATCGATGAGAGCTAGGAAAGCGATCTTGGTGAAATCGGAAATCCCGTGAACCTCGGCTCGGCTTTTGGACCTAGTTCGGC

Compositional analysis

The pharmaceutical quality must be safely reached by the domestic herbs in accordance to the Chinese and European pharmacopoeia. Therefore, the accessions were analyzed depending on the growing, harvesting and processing methods for their level of constituents. The analysis methods had to be adapted or newly developed for certain species, e.g. *Radix Astragali* and *Fructus Xanthii*.

Assurance of purity

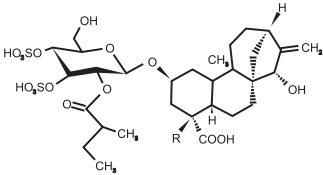
Besides the constituents, the reduction of harmful substances plays an important role. For example, certain species such as *Artemisia* accumulate cadmium. The use of certain seed sources and fertilizer can assist in the reduction of cadmium accumulation in this species.

The naturally occurring of microorganisms on the fruits of *Xanthium* could be reduced by higher drying temperatures. Tests showed that the classic roasting of Fructus Xanthii in a wok may not lead to the complete degradation of the toxin carboxyatractylosid, which naturally occurs in *Xanthium* fruits. Therefore, key parameters for effective detoxification of *Xanthium* were elaborated.

Cangerzi, 苍耳子
Fructus Xanthii



Carboxyatractylosid
(CATR)

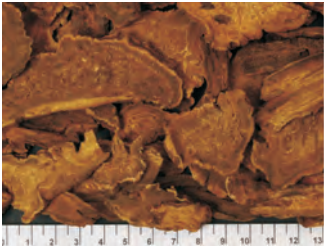


Assessment by laboratory, pharmacists and doctors

The quality of domestic drugs and Chinese commercial import was compared for their pharmaceutical and sensory quality. The fresh aroma, purity and high level of constituents of the domestic drugs was highly satisfactory. The clinical testing as part of an observational study was positive. Therefore, the use of the TCM herbs produced in Bavaria can be recommended.

Radix et Rhizoma Rhei,
Imported TCM herbs

Radix et Rhizoma Rhei,
TCM herbs from
experimental cultivation



Pharmacists are used to the outside appearance of TCM herbs imported from Asia. Therefore, it is important to inform the wholesalers and pharmacists about the good quality and safety of domestic materia medica even if they differ visually. An additional aim of the project is to establish a standardized slicing for root drugs.

Monographs

The interdisciplinary team of researchers is contributing in national and international committees, e.g. in expert groups of the EDQM (European Directorate for the Quality of Medicines and Healthcare) and the German Pharmacopoeia Commission. The findings of the project are incorporated in the preparation of monographs for the German and European Pharmacopoeia.

Advantages of locally grown TCM herbs

TCM herbs produced in Germany have the great advantage of being grown in a controlled and completely documented cultivation according to the GAP guidelines and restrictive European legislation. Pesticides are not permitted for use in the production of TCM herbs in Germany. In fact, some of the herb growers are even certified organic farmers. Thus, patients can be treated safely with this materia medica. Quality assurance and standardization are the strengths of the herbal remedies produced in Germany. They meet the official requirements of the German and European pharmacopoeia. As a result, the use of locally produced TCM herbs has been recommended by renowned TCM doctors.

Gefördert durch



Bundesministerium für
Ernährung, Landwirtschaft
und Verbraucherschutz

aufgrund eines Beschlusses
des Deutschen Bundestages

deca



Societas Medicinæ Sinensis

SMS

Internationale Gesellschaft
für Chinesische Medizin e.V.



LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN



the nature network®

PhytoLab



Imprint

Editor: Bavarian State Research Center for Agriculture (LfL)
Vöttinger Straße 38, 85354 Freising-Weihenstephan
www.LfL.bayern.de

Compilation: Institute of Crop Science and Plant Breeding
Am Gereuth 8, 85354 Freising
E-Mail: Pflanzenbau@LfL.bayern.de
Tel.: 08161/71-3637, Fax: 08161/71-4102

Edition: September 2014
Print: **diedruckerei.de**, 91413 Neustadt a. d. Aisch
© LfL all right reserved, nominal charge: 0,50 €