Goji Berry: A Millennium Journey from Origin to Industry

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South China National Botanical Garden







Content



1. Origin & Taxonomic Status
2. Historical Written Records
3. Food-medicine Use in Classics
4. Changes of Properties & Production Areas
5. Cultivation of Goji
6. Summary

Content



1 Origin & Taxonomic Status

2 Historical Written Records

3 Medicinal-Food Use in Classics

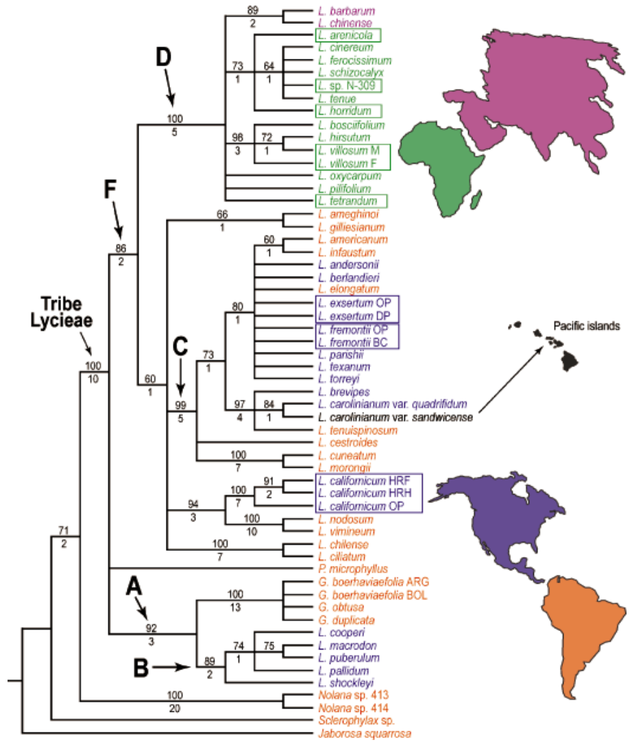
4 Changes of Properties & Production Areas

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Genetic origin of *Lycium* spp.

- **Goji, Wolfberry, Desert-thorn, Christmas berry Matrimony vine, and Duke of Argyll's tea tree ;**
- ***Lycium* is an important genus in Solanaceae**
- **About 80 species in genus *Lycium***
- **South America is the origin center of genus**
- **A single diffusion event from the Americas to Africa and then to eastern Asia**



Levin and Miller, 2005, Amer. J. Bot. 92:2044

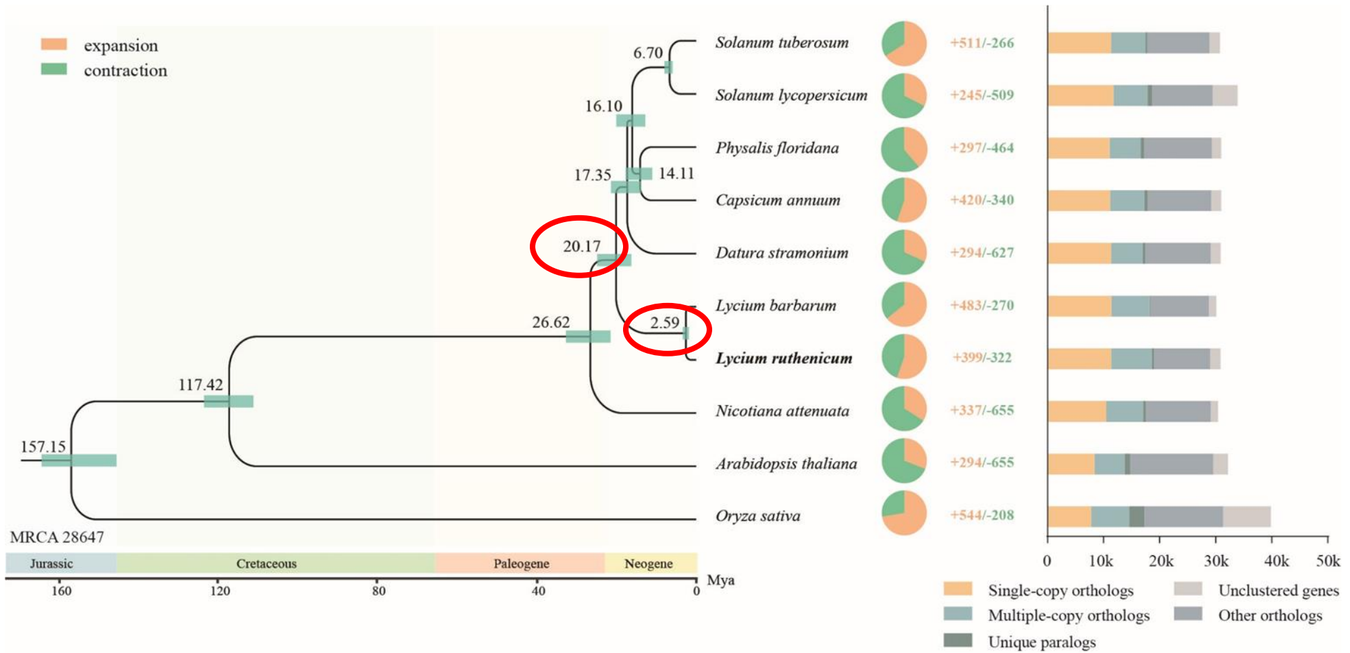
Native Chinese species

Lycium barbarum
***Lycium barbarum* var. auranticarpum**
Lycium chinense
***Lycium chinense* var. potaninii**
Lycium ruthenicum
Lycium truncatum
Lycium yunnanense
Lycium dasystemum
Lycium cylindricum
***Lycium dasystemum* var.rubicaulium**

5 newly published species:
***Lycium amarum* L.Q. Huang**

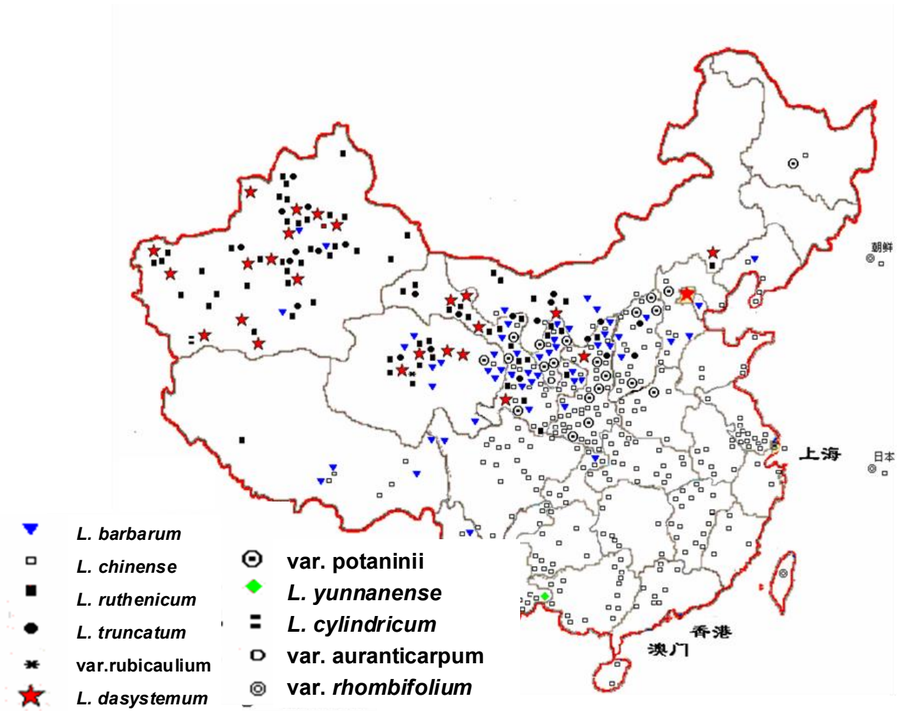
Chinese *Lycium* species

- **Differentiation time of *Lycium* from Solanaceae trunk was about 20-26 MYA;**
- **Most Chinese species are diploid, but there are tetraploid, hexaploid and octoploid species distributed in South America and South Africa;**
- ***Lycium* species in China have experienced a unique evolution process under specific geographical conditions.**



Unpublished data;

Chinese *Lycium* species



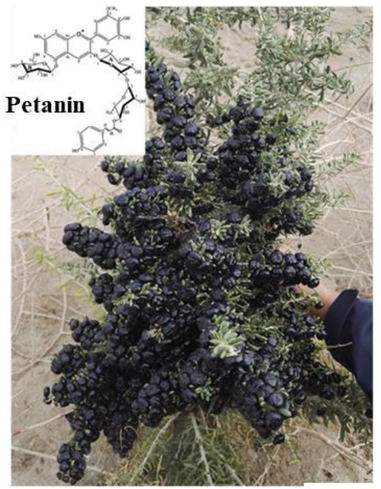
宁夏枸杞



玉米黄素双棕榈酸酯
类胡萝卜素

Lycium barbarum L.

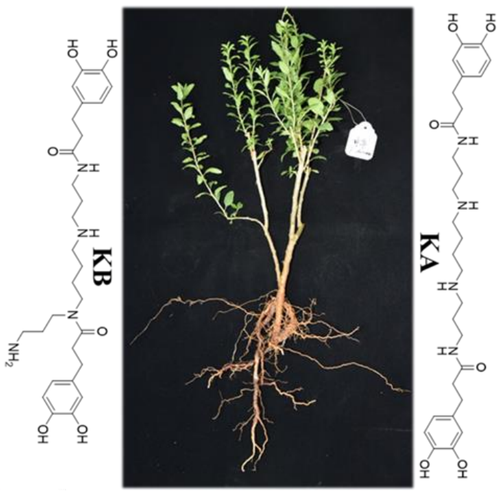
黑果枸杞



矮牵牛素衍生物 Petanin
花青素

Lycium ruthenicum Murr.

中华枸杞



地骨皮甲素/乙素
精胺

Lycium chinense Mill.

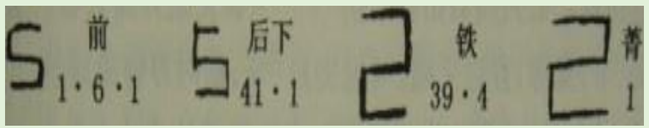
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About 3,000 years of written history

Oracle Bones: about 3200 year ago ---- willow



Book of Songs《诗经》：

- 7 earliest records of Goji
- about 3000 years ago，Zhou Dynasty
- Protection: “Do not break my planted qi”
- Harvest: “I climb the northern hills to gather qi”

The Classic of Mountains and Seas《山海经》

- 2500 years ago, the Warring States period
- "Qi" fruit trees are all *Lycium* plants
- records red juice of Goji berry like human blood, suggesting understanding of the nutritional function.

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3 **Medicinal-Food Use in Classics**

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Traditional TCM for both food and medicine

Shennong's Classic of Materia Medica (*L. chinense* Mill.)

- 2200 years ago in the Han Dynasty
- first recorded here as " Upper-Grade Wood Herb "
- bitter-tasting and cold in nature
- treat pathogenic qi in the five internal organs, internal heat with wasting-thirst, and general bi-obstruction;
- long-term consumption strengthens bones and tendons, lightens the body, and retards senescence.
- named qigen, digu, gouqi, and difu;
- grows in flat marshlands of ancient Changshan State (Xingtai in Hebei province);
- most likely refers to root-bark, also known as digupi.



《神农本草经》...上品中药

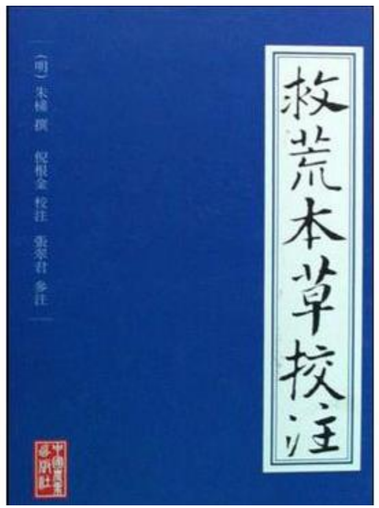
上品（木部），味苦寒。主五内邪气，热中，消渴，周痹。久服，坚筋骨，轻身不老。一名杞根，一名地骨，一名枸忌，一名地辅。生平泽。

Traditional TCM for both food and medicine

Materia Medica for Famine Relief

- about 620 years ago, Ming Dynasty
- 12 feet long, several inches in circumference, without thorns, and cherry-sized fruits;
- blanch the young **leaves**, rinse them clean with water, season with oil and salt for eating, or cook them into soup. When thirsty, boil the leaves to prepare a beverage as a substitute for tea.
- The ripe red **fruits** are also edible.

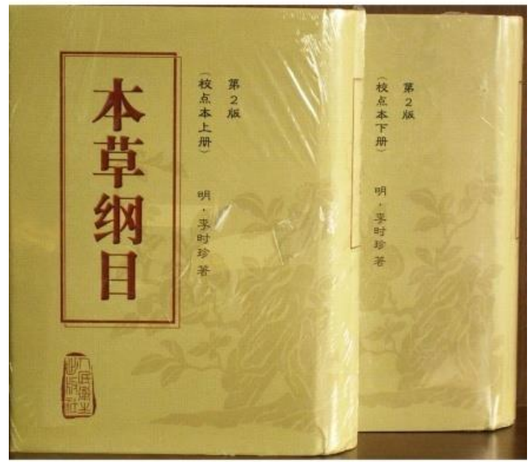




Traditional TCM for both food and medicine

Compendium of Materia Medica

- **author LI Shizhen, the great medical scientist and pharmacologist from Ming Dynasty, printed in 1596;**
- **firstly interprets the name “gou qi”: “It has thorns of gou and twigs of qi, therefore named gou-qi;**
- **leaves harvested in spring are TianJingCao; flowers in summer ChangShengCao; fruits in autumn GouQiZi; roots in winter DiGuPi;**
- **Since all plant parts can be gathered year-round for use, goji was highly valued in antiquity.**



- 春采叶，名天精草
- 夏采花，名长生草
- 秋采子，名枸杞子
- 冬采根，名地骨皮

Traditional usage as TCM

From pre Qin period to the Tang and Song Dynasties (about 1500 years)

- Materia Medica for Dietetic Therapy (Shiliao Bencao)
- Records of Famous Physicians (Mingyi Bielu)
- Treatise on Medicinal Properties (Yaoxing Lun)
- Compendium of Materia Medica (Bencao Gangmu)
- Decoction Materia Medica (Tang-ye Bencao)
- Essentials of Materia Medica (Bencao Beiyao)

Tonify the kidney and replenish essence, nourish the liver to improve eyesight, and moisten the lung to nourish yin, turn grey hair black, brighten eyes and calm the spirit, and prolong life …

Ancient imperial prescriptions

- **QIN Shi Huang era: the Youth-Restoring Pill, Seven-Treasure Hair-Restoring Elixir, and Longevity Consolidating Pill.**
- **FANG Xuanling (a chancellor of the Tang Dynasty): health-promoting effects for mental and physical exhaustion from overwork.**
- **Empress Dowager Cixi of the Qing Dynasty: the Longevity Ointment and Changchun Longevity Pellets.**
- **Multiple imperial prescriptions compiled in the Tang and Song dynasties documented *Lycium* plants.**

Tonify the kidney and replenish essence, nourish the liver to improve eyesight, and moisten the lung to nourish yin, turn grey hair black, brighten eyes and calm the spirit, and prolong life …

Three key Chinese *Lycium* species



枸杞
Lycium chinense Mill.



宁夏枸杞
Lycium barbarum L.



黑果枸杞
Lycium ruthenicum Murr.



“枸杞 Gou qi” **Goji**

Current use in Pharmacopoeia

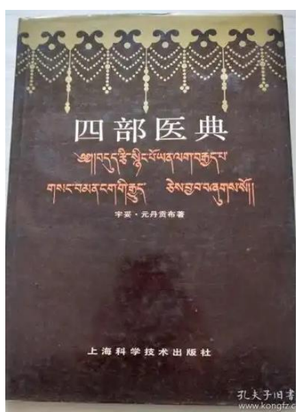
In Chinese Pharmacopoeia

- Lycii Fructus (*Gouqizi*, dry fruit of *L. barbarum*)
- Lycii Cortex (*Digupi*, dry root bark of *L. chinense* and *L. barbarum*)

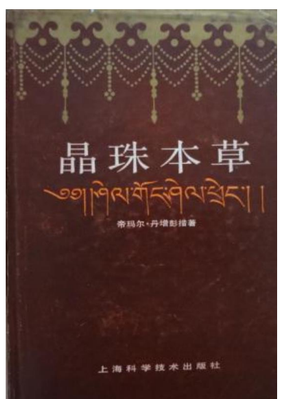




- *L. ruthenicum* Murr. (black goji berry), **not in Chinese Pharmacopoeia**
- long been utilized in ethnic medicine systems of western China (Tibetan, Uyghur and Mongolian medicine)
- *Four Medical Tantras* (Si Bu Yi Dian): documented "Pangma" for heart-heat disorders and menstrual irregularities.
  Oldest record 8th century, Tibetan medicine







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From "Bitter Cold" to "Sweet Neutral"

202 BC to 598 — **Han — Northern/Southern Dynasties**

Shennong Bencao Jing: bitter, cold;
Mingyi Bielu: slightly cold, non-toxic

618-1279 — **Tang — Song Dynasties**

Yaoxing Lun: sweet, neutral; Bencao Gangmu synthesized as "sweet, neutral"

1636 - — **Qing Dynasty to Modern Pharmacopoeia**

Chinese Pharmacopoeia: sweet, neutral. Liver/kidney meridians.

Causes: base species shifted from *L. chinense* (bitter-cold) to *L. barbarum* (sweet-neutral)

Han — Tang: Shaanxi, Gansu

Bencao Jingji Zhu: "grows in Changshan plains & hills"; authentic area around Hanzhong, Shaanxi

Song — Ming: Hebei, Shandong

Bencao Tujing: "found everywhere now"; Hebei "sweet goji," Shandong "Juzhou goji" renowned

Qing — Present: Ningxia Zhongning

Ben Cao Gang Mu already noted "Ningxia ones are best"; Qing *Zhongwei Xianzhi*: "goji is best from Ning'anbao." **Zhongning goji = national GI product, recognized authentic area**

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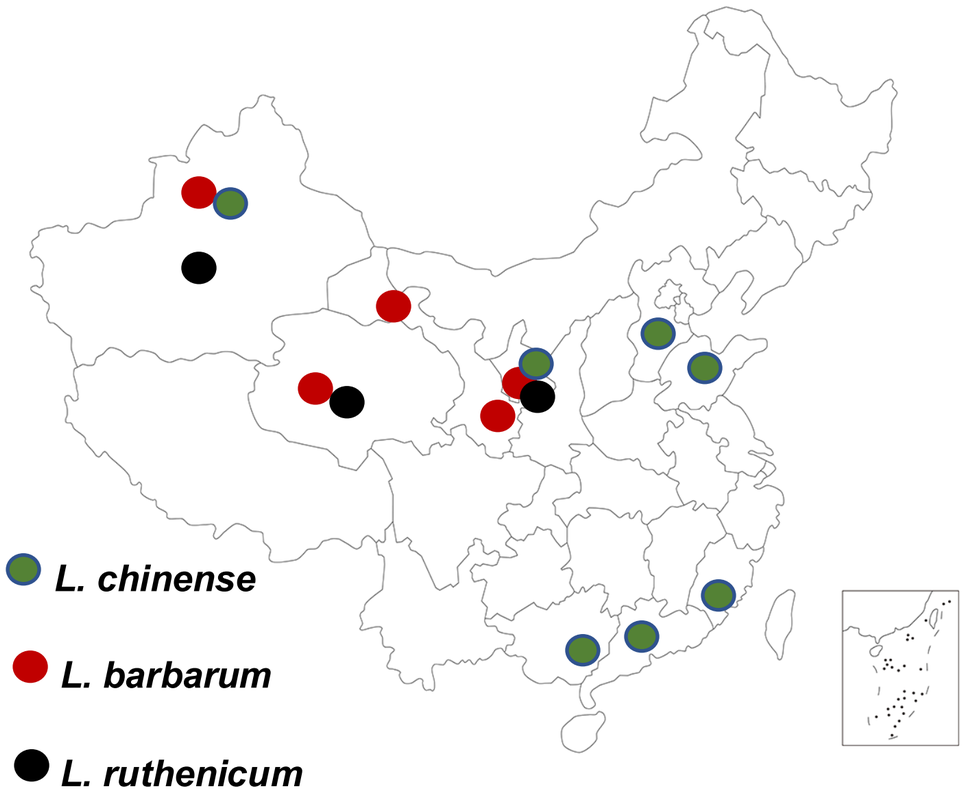
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Main production regions vs. Daodi regions



- **By the end of 2024, the total area of *L. barbarum* was 1,592,700 mu, and the total output of dried fruits was 299,600 tons.**

Province	Planting area (10000 mu)	Percentage of the national area	Industrial characteristics
Gansu	69.34	43.5%	The largest production area in the country, mainly in the Hexi Corridor (Jingyuan and Guazhou), with the dry fruit output ranking first in the country.
Qinghai	46.00	28.9%	Qaidam Basin, the largest organic Goji base in China.
Ningxia	22.87	14.4%	Daodi production area, focusing on improving quality and efficiency.
Xinjiang	20.00	12.6%	Jinghe is the main production area, mainly producing round fruits.

Three cultivar systems: Fruit, Black Fruit, Vegetable

L. barbarum Fruit-Use Goji (Red)

- Ningqi No.1 (appr. 1987, largest area)
- Ningqi No.7 (2010, high yield, large)
- Ningqi No.10 (2018, stress-tolerant)
- Ningnongqi No.9/15’and Keqi 6082
- Zhongke Lvchuan No.1
- Ningnongqi No.19 and 20
- Zhongke Huangqi No.1
- Zhongke Dingqi No.1

Traits: Red fruit, high polysaccharides & carotenoids; medicinal-food dual use;

Breeding: High yield, quality, stress resistance, mechanization-ready

L. ruthenicum Black Fruit Goji

New varieties:

- Black Goji No.1 (appr. 2016)
- Black Goji No.2, No.3
- PVP right from NFGA

Traits: Purple-black fruit; OPC far exceeds blueberries; used in Mongolian/Tibetan medicine; most saline-tolerant

L. chinense Vegetable-Use Goji

New cultivars:

- Tianjing No.1 (2014, leaf use)
- Tianjing No.2, Tianjing No.3
- Ningcaiqi No.1, etc.

Traits: Tender stems/leaves; anciently "Tianjing grass"; rich in protein, amino acids, calcium, flavonoids

Market: Southern veg market, goji leaf tea, functional vegetables; multiple harvests/year

Great potential for functional fruit and vegetable in 21 century





Great potential for functional fruit and vegetable in 21 century



枸杞枝条末端
20 cm嫩茎叶

枸杞菜

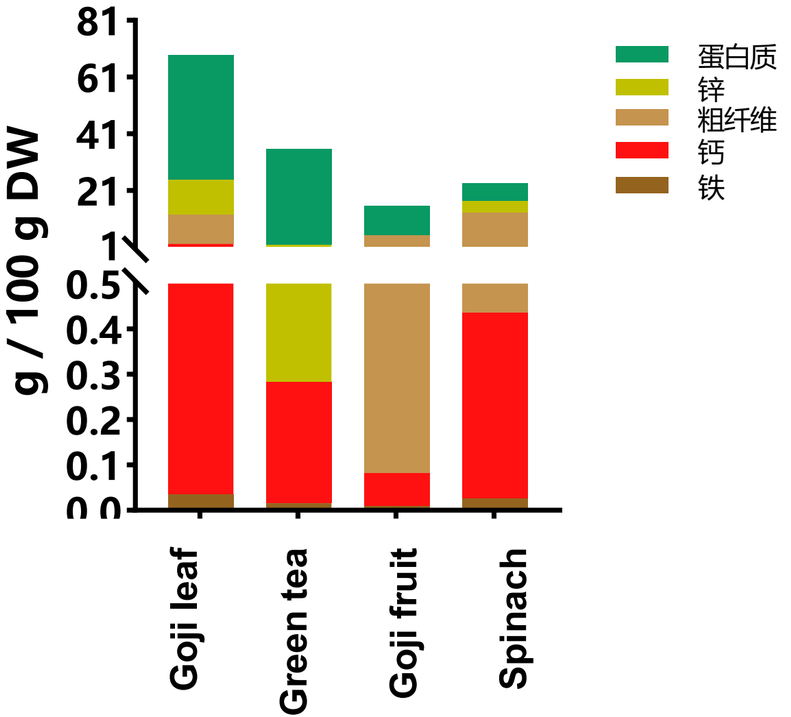




茎尖
(一心二叶)

枸杞芽茶



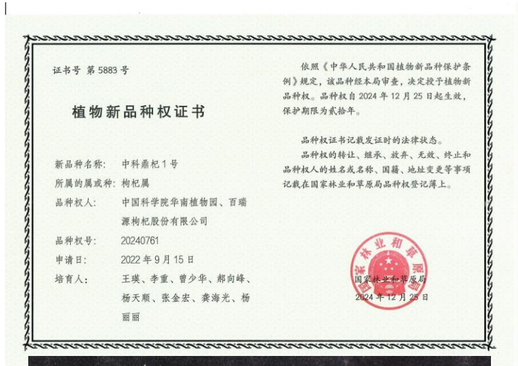


Drying method

Drying method	Temperature condition	Characteristics
Natural sun drying	Ambient temperature: 20–35 ℃; fruit surface temperature >40 ℃	Uncontrollable with large fluctuations
Hot-air drying	45–60 ℃	Stepwise temperature rise; widely used in industry
Heat pump drying	40–55 ℃	Mild and controllable; promoted by the industry, power-saving
Low-temperature vacuum drying	≤30 ℃	Low temperature and low pressure; high product quality
Freeze drying	Pre-freeze -35 ~ -40 ℃; main drying ＜ 0 ℃; desorption ≤30 ℃	Excellent retention of active components; high cost, long cycle, fragile product



Future trend for cultivation


证书号 第5883号

植物新品种权证书

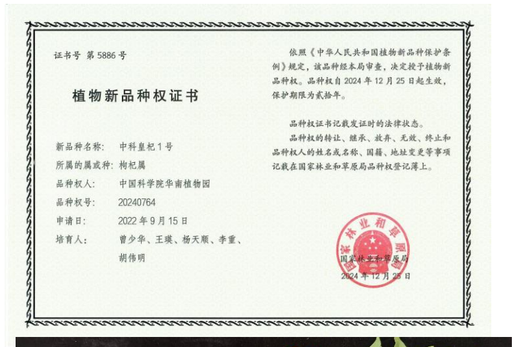
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所属的属或种：枸杞属
品种权人：中国科学院华南植物园、百瑞源枸杞股份有限公司
品种权号：20240761
申请日：2022年9月15日
培育人：王瑛、李重、曾少华、郝向峰、杨天顺、张金宏、龚海光、杨丽丽

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国家林业和草原局
2024年12月25日




证书号 第5886号

植物新品种权证书

新品种名称：中科皇杞1号
所属的属或种：枸杞属
品种权人：中国科学院华南植物园
品种权号：20240764
申请日：2022年9月15日
培育人：曾少华、王瑛、杨天顺、李重、胡伟明

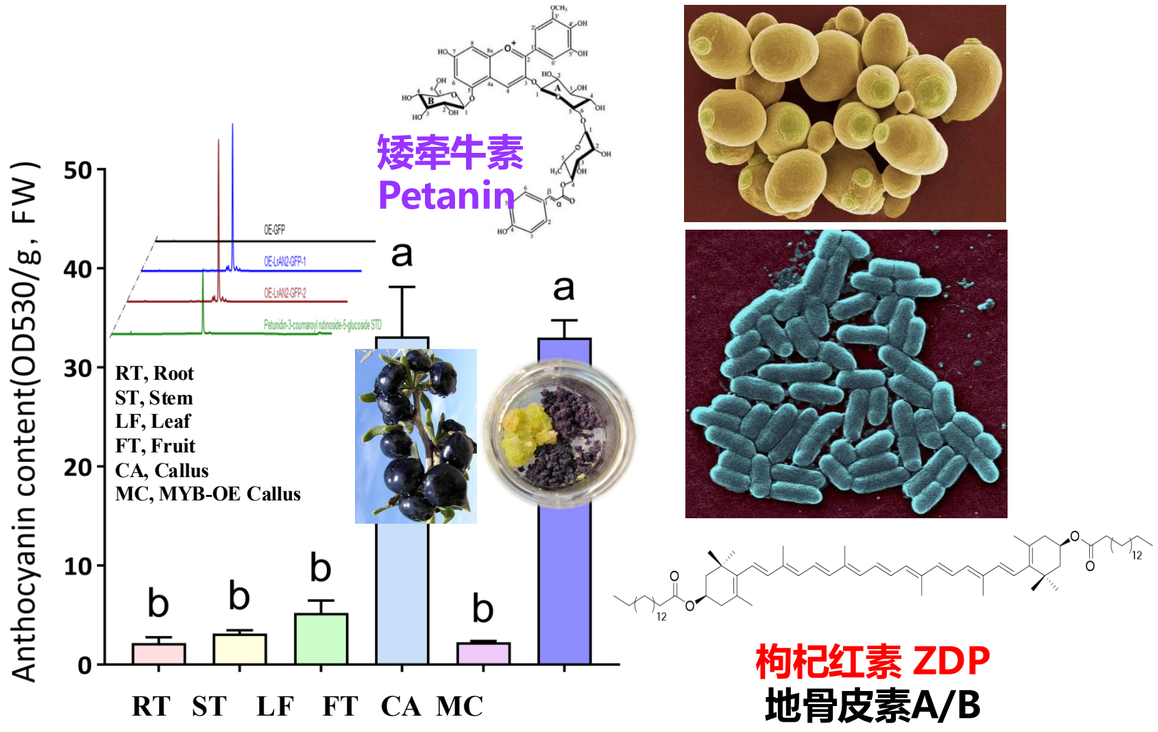
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国家林业和草原局
2024年12月25日



large fruit、high level of bioactive compunds



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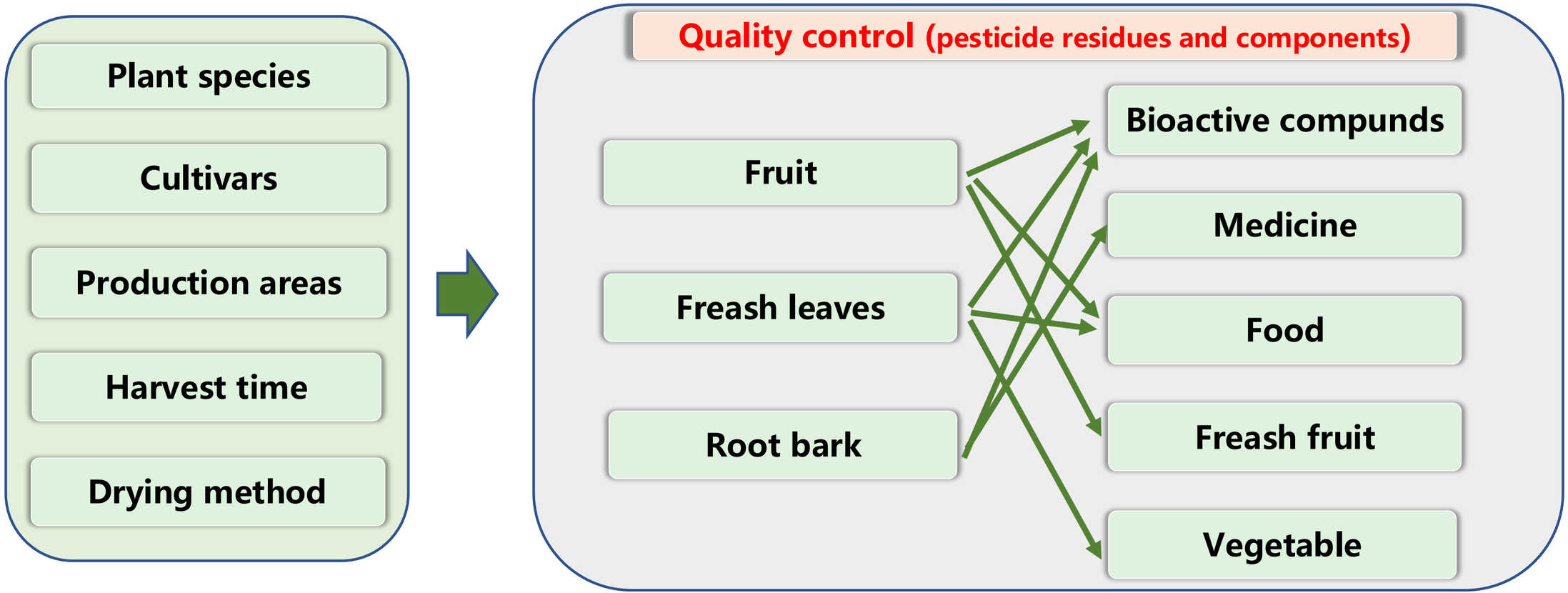
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Summary


Plant species
Cultivars
Production areas
Harvest time
Drying method
Quality control (pesticide residues and components)
Fruit
Freash leaves
Root bark
Bioactive compunds
Medicine
Food
Freash fruit
Vegetable

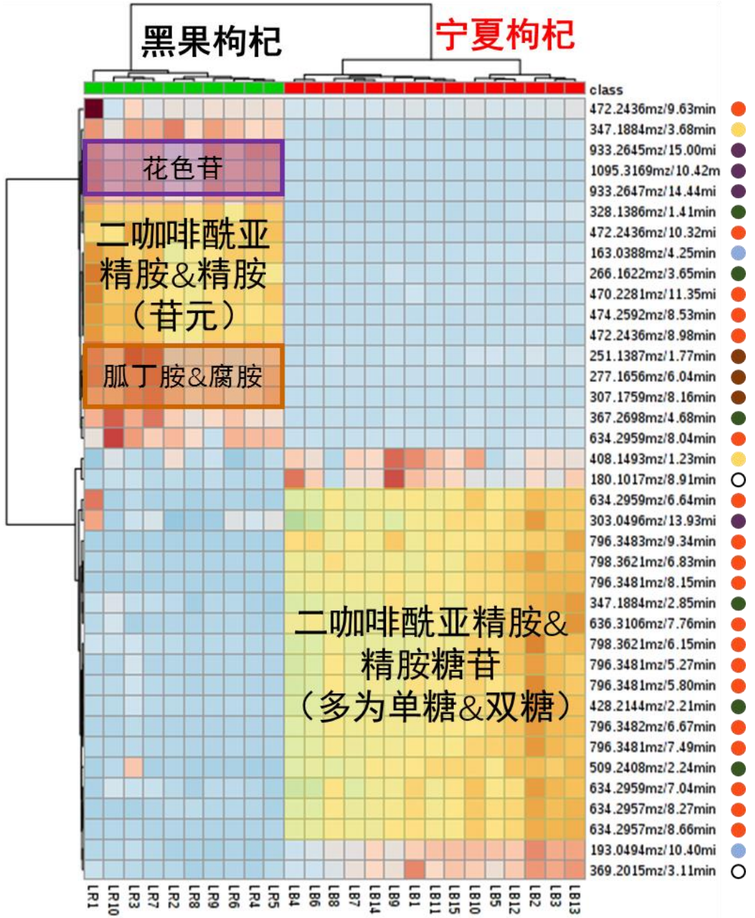






Welcome to South China National Botanical Garden (Guangzhou)


He is my grandson
Stop abusing elder


黑果枸杞
宁夏枸杞
class
花色苷
二咖啡酰亚精胺&精胺（苷元）
胍丁胺&腐胺
二咖啡酰亚精胺&精胺糖苷（多为单糖&双糖）
472.2436mz/9.63min
347.1884mz/3.68min
933.2645mz/15.00mi
1095.3169mz/10.42m
933.2647mz/14.44mi
328.1386mz/1.41min
472.2436mz/10.32mi
163.0388mz/4.25min
266.1622mz/3.65min
470.2281mz/11.35mi
474.2592mz/8.53min
472.2436mz/8.98min
251.1387mz/1.77min
277.1656mz/6.04min
307.1759mz/8.16min
367.2698mz/4.68min
634.2959mz/8.04min
408.1493mz/1.23min
180.1017mz/8.91min
634.2959mz/6.64min
303.0496mz/13.93mi
796.3483mz/9.34min
798.3621mz/6.83min
796.3481mz/8.15min
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798.3621mz/6.15min
796.3481mz/5.27min
796.3481mz/5.80min
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LR10
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LR2
LR8
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