

## **Herbs in Mongolia**

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***Abstract:** Herbal plants have been an extremely important part of Mongolian medicine for centuries. They constitute an equally important group of drugs as synthetic drugs and are widely use in both prophylaxis and therapy of various types of diseases. Despite the rich history of the use of Mongolian herbs, many of them have still not been studied. Moreover the knowledge about many species, even the most commonly used, remains unknown to scientists. This review presents both a historical and geographical outline of Mongolian herbal medicine as well as the most popular species of herbs, their systematic, chemical composition and usage.*

***Keywords:** Mongolian herbs, plant species, medicine and Mongolia.*

### **Introduction**

Mongolia is a landlocked country with an area of about 1.5 million square kilometres, located in East Asia, bordering on the north with Russia and from other directions with China. Mongolian geographical features are primarily Siberian forest taiga, high mountains, Gobi desert and Central Asian steppe [1, 3] (Table 1). Moreover, the raw continental climate, low rainfall and dry atmosphere provide a specific environment for some plant species.

In addition to geographical factors significant impact on the position of herbal plants in the Mongolian medicine have historical traditions, religion (Tibetan Buddhism), customs and culture. Under these conditions, a strong position of Mongolian traditional medicine, Chinese medicine, Indian Ayurveda and Tibetan medicine have developed simultaneously in the country.

### **Historical and geographical outline**

Reaching for the oldest history, various species of medicinal plants were used in the daily life of the Mongols. Famous travellers Marco Polo and Plano Carpini refer in their writings many examples of the use of Mongolian herbs in the prevention and treatment of a number of diseases [1]. Moreover, herbs had been used as a resource of food and medicines for any diseases during the Mongolian empire. In ancient history, Mongolian medicine derived from Chinese and Tibetan traditional medicine due to geographical location [2].

An important moment in the modern history of Mongolia, influencing also the development of medicine, was the regaining of the independence in 1911 and formation of the government in 1921 by the Mongol People's Revolution Party that remained under the influence of Soviet Russia. Since that time, the impact of Soviet Russia and then the USSR reached not only politics, but also the economy, social relations and science. That is why Russian scientists played a significant role in the development of Mongolian medicine.

In the 1940s, the Government of Mongolia invited Soviet scientists, including doctors Tsatsekin, Unatov and Grubov, to undertake scientific research on traditional Mongolian herbs. Grubov identified and described many species of rare herbal plants for the first time [1, 5].

**Table 1.** The numbers of the plant species in Mongolia regions [3]

| Region | Name of mountain ranges  | Family | Genera | Species | Total endemics, % |
|--------|--|--------|--------|---------|-------------------|
| East   | Eastern Mongolia<br>Khentii mountain                             | 6      | 10     | 12      | 10.0              |
| South  | Gobi region<br>Dzungarian Gobi                                   | 9      | 13     | 21      | 17.5              |
| West   | Mongol Altai mountain<br>Khangai mountain<br>Gobi Altai mountain | 29     | 49     | 79      | 65.8              |
| North  | Northern Mongolia<br>Khubsugul mountain                          | 6      | 7      | 8       | 6.6               |

Mongolia is characterized by a raw and dry continental climate. The average altitude is 1580 m above sea level. The highest precipitation is observed in the north of the country, and the lowest in the south. 70% of all days of the year are days without rainfall. Many plant species have adapted to these difficult climatic conditions, but some of them are threatened with extinction.

Batugal et al. reported that 72% of traditional Mongolian medicines are plant medicines, while the remaining 28% are medicines derived from animal and mineral sources. Over the centuries, many publications on traditional Mongolian medicine have been written. However, few of them survived the test of time. Most of them were written in a Tibetan or traditional Mongolian script. The authors of these works were mainly monks who specialized in the development of traditional plant medicines.

Moreover, Mongolian traditional medicine always connects with Indian Ayurveda, traditional Chinese and Tibetan medicines. Traditional Tibetan medicine was introduced to the country in the 16<sup>th</sup> century. However, Mongolian traditional medicine did not spread all over the world like Chinese, Tibetan and Indian phytomedicines [4].

## Inventory

As mentioned in [5, 6], about 3160 species (included 133 subspecies and 33 varieties), 684 genera, and 108 families of vascular plants exist in Mongolia. Among them, herbal plants rich in vitamins, essential oils, tannins, dyes, flavonoids, alkaloids and coumarins were distinguished (Table 2).

**Table 2.** The classification of the Mongolian plant species [5, 6]

| No | Plant specie                   | Content |
|----|--------------------------------|---------|
| 1  | Herbal medicine                | ~1100   |
| 2  | Ornamental plants              | 480     |
| 3  | Alkaloid bearing plants        | 280     |
| 4  | Tannins bearing plants         | 250     |
| 5  | Flavonoid bearing plants       | 231     |
| 6  | Essential oil producing plants | 200     |
| 7  | Dye-stuff plants               | 200     |
| 8  | Industry-use plants            | 200     |
| 9  | High vitamin content plants    | 150     |
| 10 | Soil protecting plants         | 68      |
| 11 | Coumarin bearing plants        | 65      |

About 32% of the total vascular plants found in Mongolia are registered as medicinal plants, and among them more than 200 plants species could be used for manufacturing modern western medicines [1, 5-7].

*Fabaceae*, *Asteraceae*, *Rosaceae*, *Ranunculaceae* and *Papaveraceae* are the most dominant families in the Mongolian herbal plant species (Table 3) [3].

**Table 3.** The plant species of families of the vascular flora [3]

| No | Family name           | Genera name       | Genera number | Species number | Percent of total flora |
|----|-----------------------|-------------------|---------------|----------------|------------------------|
| 1  | <i>Fabaceae</i>       | <i>Faba</i>       | 6             | 40             | 1.3                    |
| 2  | <i>Asteraceae</i>     | <i>Aster</i>      | 12            | 23             | 0.7                    |
| 3  | <i>Rosaceae</i>       | <i>Potentilla</i> | 3             | 16             | 0.5                    |
| 4  | <i>Ranunculaceae</i>  | <i>Ranunculus</i> | 6             | 9              | 0.3                    |
| 5  | <i>Papaveraceae</i>   | <i>Papaver</i>    | 2             | 6              | 0.2                    |
| 6  | <i>Brassicaceae</i>   | <i>Draba</i>      | 4             | 5              | 0.2                    |
| 7  | <i>Lamiaceae</i>      | <i>Lamium</i> L   | 3             | 3              | 0.1                    |
| 8  | <i>Plumbaginaceae</i> | <i>Limonium</i>   | 1             | 3              | 0.1                    |
| 9  | <i>Juncaceae</i>      | <i>Juncus</i> L   | 2             | 2              | 0.1                    |
| 10 | <i>Plantaginaceae</i> | <i>Plantago</i> L | 1             | 1              | 0.1                    |

The main life form of the plant species with orthodox seeds is a perennial followed by annual and biannual grasses [1] (Table 4).

**Table 4.** Distribution of different plant lifeforms [1]

| No | Plant life form         | Content, % |
|----|-------------------------|------------|
| 1  | Perennial grasses       | 72.2       |
| 2  | Annual/biannual grasses | 13.5       |
| 3  | Semi-shrubs/shrubby     | 3.7        |
| 4  | Shrub                   | 6.0        |
| 5  | Shrubby                 | 2.0        |
| 6  | Low trees               | 1.6        |
| 7  | Large trees             | 0.7        |
| 8  | Vines                   | 0.3        |

## Useful medicinal herbs

In 2013, member states of WHO's Western Pacific Region introduced details the nature and application of the most useful medicinal herbs found in Mongolia. Most of the Mongolians apply the medicinal herbs in their everyday life. There are some samples of the most popular medicinal herbs [8]:

**Mongolian name:** *Ikh Shuudergene*

**Tibetan name:** *Donroiselva*

**English name:** *Greater Celandine*

**Traditional uses:** It is bitter in taste with cooling potential and is used for treating typhoid fever, bile disorder burn wounds alleviating fever, soothing pain dermatitis and papillomas.

### Chemical constituents:

1.4-4.3% organic acids, 0.01% essential oil, saponins, flavonoids, phenol carboxylic acid, alkaloids: chelerythrine, sanguinarine chelidoniumine (Figure1), berberine, coptisine, chelidimerine, chelirubine. The main alkaloids are chelidoniumine, chelerythrine, sanguinarine and berberine.

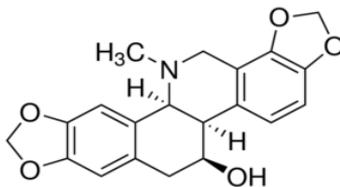


Figure 1. Chelidoniumine

**Bioactivities:** sedative, anesthetic, spasmolytic, antifungal, antiviral antibacterial, hypotensive, analgesic, cytostatic, cytotoxic, antitumor antimicrobial, stimulation of the dopaminergic system and inhibition of the serotonergic system.

**Mongolian name:** *Ikh Tavansalaa i Ukher-Uurgene, Khongolon*

**Tibetan name:** *Taram*

**English name:** *Rippleseed Plantain*

**Traditional uses:** It is sweet in taste with warming potential and is used for treating diarrhoea, hematuria and as diuretic drug.

### Chemical constituents:

The leaves contain sugars: 20% polysaccharide, pectic acid, mannitol, sorbitol, iridoids: 1% aucubin (Figure 2), catalpol, phenolcarboxylic acids and their derivatives: vanillic, *n*-hydroxybenzoic, chlorogenic and neochlorogenic acids, flavonoids: baicalein, baicalin, scutellerein, luteolin and others, alkaloids, and terpenoids.

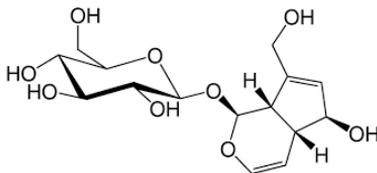


Figure 2. Aucubin

**Bioactivities:** sedative, antihypertensive, anti-inflammatory activity, ulcerogenic, antimicrobial activity, mucolytic.

**Mongolian name:** *Yagaan Mugez (Altangagnuur)*

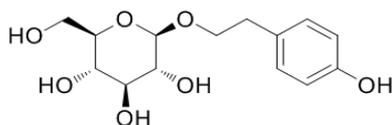
**Tibetan name:** *Tsanser*

**English name:** *Rose boot*

**Traditional uses:** It is bitter in taste and has astringent and cooling properties, and is used for treatment of inflammation of the lung fever and to strengthen the body. In addition, it is used to tap the mouth to refresh the breath.

**Chemical constituents:**

Sugars: glucose, galactose, arabinose, rhamnose, organicacids, 15.9-20.3% tannins, 0.8-0.9% essential oil: *n*-decanol, geraniol, geranyl formate, geranyl acetate, benzyl alcohol, phenylethyl alcohol, linalool, nonanal, decanal, nerol and cinnamyl alcohol, phenylpropanoid: rosavin, rosin, rosarin; phenylethanol derivatives: salidroside (Figure 3), tyrosol; flavonoids: rodiolin, kaempferol, astragalin, rodionin, rodiosin, acetylrodalgin, trycin, kaempferol-7-rahmnoside, trycin-7-glucoside, 8-methylgerba-cetin, rhodioflavonoid and others; terpenoids: rosiridol, rosiridin, rhodioloides A-E; steroids: b-sitosterol, daucosterol; phenol carboxylic acids: chlorogenic, 4-hydroxycinnamic, gallic, isochlorogenic, neochlorogenic acids and lotaustralin.



**Figure 3.** Salidroside

**Bioactivities:** cytotoxic, antibacterial, central nervous system effects.

**Mongolian name:** *Yulden Taravganshiir*

**Tibetan name:** *Saradgar*

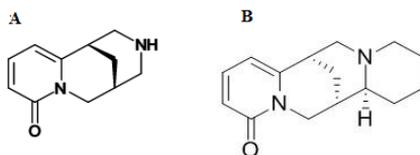
**English name:** *Lanceolata Thermopsis*

**Traditional uses:** It is bitter in taste with cooling properties and is used for treating wounds and fever, and to fortify the body.

**Chemical constituents:**

Alkaloids: cytisine, anagrinepachycarpine, rhombifoline, *N*-methylcytisine, *N*-formylcytisinethermopsine (Figure 4), thermopsidin, lupaninsparteine, 5, 6-dihydro-lupanin, baptifoline, epibaptifoline, 17-oxosparteine 11,12-dehydro-anagryneammodendrine, isoammodendrine.

**Bioactivity:** mucolytic.



**Figure 4.** A-Cytisine, B-Thermopsine

## The risk of extinction of valuable species

Due to the progressive degradation of the natural environment, drastic climate changes, and especially illegal, mass acquisition of rare medicinal plants, many species of Mongolian herbs are in danger of extinction (Table 5). About 40% of natural habitats of rare, endangered plant species have been included in areas with special protection [1].

**Table 5.** The classification of threatened of the plant species [1]

| Plant species   | Content of plant species | Percent of the extremely threatened, % |
|-----------------|--------------------------|--|
| Medicinal       | 75                       | 26.6                                   |
| Natural food    | 11                       | 54.5                                   |
| Industrial      | 16                       | 25.0                                   |
| Ornamental      | 55                       | 18.2                                   |
| Soil protecting | 15                       | 33.3                                   |

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