

RESOURCES OF MEDICINAL PLANTS IN CHINA

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Four aspects dealt with in this paper are as follows: 1. environment of medicinal plants; 2. brief history on studies of medicinal plants; 3. species of medicinal plants; 4. studies on development and utilization of medicinal plant resources.

Key words: China – medicinal plants – categories – therapeutic properties

ENVIRONMENT OF MEDICINAL PLANTS IN CHINA

Besides wide territorial waters, China has vast land with a land 9.6 million km² in area (about 107 million ha of its cropland), extending 49° in latitude and over 61° in longitude. The distance from east to west measures 5,000 km, and from North to South over 5,500 km. The basic topographic outline is a three-step west-east staircase. It begins with the Chinghai-Tibet Plateau 4,000 m above the sea. Crossing the Kunlun and Chilian ranges on the plateau's northern edge and the Hengtuan Mountains on its eastern edge, the land slopes away to high lands and basins from 2,000 to 1,000 m above the sea, then descends east-ward to hilly regions and plains below 1,000 m.

Since the summer monsoons coming mostly from the Pacific Ocean and partly from the Indian Ocean play a great role in dominating the climate of the coastal area, the eastern regions bear different types of forest which correspond respectively to the latitudinal zonation. They are mainly the cold-temperate deciduous needleleaf forest, the temperate mixed broadleaf deciduous and needleleaf evergreen forest, the warm-temperate broadleaf deciduous forest, the subtropical mixed broadleaf deciduous and evergreen forest and the broadleaf evergreen forest as well as the tropical seasonal forest, the tropical rain forest and the mangrove. The North-West is arid temperate region where the vegetation is either very sparse or entirely absent. Various types of desert vegetation are dominated by shrubs, semi-shrubs, dwarf semi-shrubs and semi-arbors. The semi-arid land lying between the arid and humid regions is occupied by different types of grassland.

BRIEF HISTORY ON STUDIES OF MEDICINAL PLANTS IN CHINA

There is a long history on studies of medicinal plants in China. Various kinds of books of Pen Tsao (Chinese Materia Medica) are important works which record drug knowledge every times in China. For example, Li shizhen's Pen Tsao Kang Mu (Compendium of Chinese Materia Medica), compiled in 1578, with 52 volume, 2 million words, contains 1,892 drugs. So it is a monumental work in history of the Chinese Materia Medica. From 20th century, the chinese botanists (1916, H, H, Hu) began to identify the chinese classical names of plants in chinese classics with the scientific names. Since then, many floristic studies were made by the chinese botanists with the splendid results. Many books have been published in which every species is represented by recent chinese name and corresponding scientific name. Medicinal works are also splendid. Zhong Yao Zhi (Flora of Chinese Traditional Medicine) is very important for utilization and classification of medicinal plants, and Zhong Yao Da Cidian (Dictionary of Chinese Traditional Medicine) treats actual chinese medicinal plants and each species are provided with its figure, description, distribution and uses, etc. Other compilations have also appeared, such as Compilation of the Chinese Traditional and Herbal Drugs, and New Compendium of Chinese Materia Medica, and so on.

SPECIES OF MEDICINAL PLANTS IN CHINA

China is called "the treasure-house of world medicinal plants" because it is very rich in species of medicinal plants. Many medicinal plants, such as *Panax ginseng*, *Panax notoginseng*, *Angelica sinensis*, *Astragalus membra-*

naceus, *Glycyrrhiza uralensis* and *Rheum officinale* are used broadly in China and are world-famous important medicinal materials. About 6,000 species of Chinese medicinal plants have been found up to date. However, there are about 30,000 species of higher plants in China. Therefore through screening further, more and better species of Chinese medicinal plants will be found and development potentiality of Chinese medicinal plants is very large.

These medicinal plants may be mainly classified into 17 groups according to their therapeutic properties in practice of traditional Chinese medical science.

1. *Diaphoretic plants* – Such as *Piper nigrum*, *Litchi chinensis*, *Lindera strychnifolia*, *Magnolia liliflora*, *Jasminum sambac*, *Morus alba*, etc. – This group of medicinal plants offers relief from external symptoms brought about by common cold, such as chills, fever, headache, malaise, nasal stuffiness, cough, etc.

2. *Anti-inflammatory, antibiotic, antipyretic plants* – Such as *Wikstroemia indica*, *Senecio scandens*, *Verbena officinalis*, *Mahonia bealei*, *Pulsatilla chinensis*, *Potentilla chinensis*, *Lonicera japonica*, *Arctium lappa*, *Hibiscus rosa-sinensis*, *Polygonum perfoliatum*, etc. – In traditional Chinese medical science, the result of excessive fire evil in the body is heat toxin or fire toxin. Medicaments that clear away the fire evil (fever pathogens) and heat toxin to ease the excessive fever in acute febrile illness and pyogenic infections are grouped under this category.

3. *Plants of relieving heat and dampness* – Such as *Gossampinus malabarica*, *Paeonia lactiflora*, *Dolichos lablab*, *Malva verticillata*, *Daphne genkwa*, *Sedum sarmentosum*, *Nandina domestica*, *Papaver somniferum*, *Canna indica*, etc. – “damp heat syndrome” is caused by a combination of dampness and heat invading the human body, resulting in diarrhea, jaundice, oliguria, etc. – This group of plants has mainly antibacterial, antipyretic, anti-inflammatory, and diuretic actions. It is indicated in all types of hepatitis, gastroenteritis, and diarrheal disorders.

4. *Diuretic plants* – Such as *Saururus chinensis*, *Euphorbia lathyris*, *Pyrrosia lingua*, *Liquidambar formosana*, *Coix lacrymajobi* L. var. *ma-yuen*, *Smilax glabra*, *Sapium discolor*, etc. – This group of plants has diuretic and

anti-inflammatory action. It promotes diuresis and excretion of toxins from heat and dampness. It is useful in edema, nephritis, urinary tract infection and stones.

5. *Anti-rheumatic plants* – Such as *Chaenomeles speciosa*, *Acanthopanax gracilistylus*, *Ranunculus japonica*, *Impatiens balsamina*, *Firmiana simplex*, *Aralia chinensis*, etc. – This group of plants acts by dispersing the etiological elements of wind, cold, and dampness invading the musculoskeletal system. It relieves numbness and pain, relaxes muscles and tendons, and promotes circulation. Some may have toxic effect on the liver, kidney and skeletal system. It is indicated in rheumatism associated with arthritis, trauma, lumbago and sciatica.

6. *Plants of promoting circulation and stopping bleeding* – Such as *Cirsium japonicum*, *Rosa chinensis*, *Salvia miltiorrhiza*, *Agrimonia pilosa*, *Celosia cristata*, *Trachycarpus fortunei*, *Ilex pubescens*, *Rhus chinensis*, *Loropetalum chinense*, etc. – This group of plants possesses two effects, first in promoting circulation of blood and relieving stasis. The second effect is hemostasis, vasoconstriction, and shortening coagulation time.

7. *Plants of nourishing to the “lung”* – Such as *Polygonatum odoratum*, *Sauropus changianus*, *Glehnia littoralis*, *Pinella ternata*, *Ophiopogon japonicus*, *Canarium album*, *Fritillaria thunbergii*, *Asparagus cochinchinensis*, *Lilium brownii*, *Ficus carica*, etc. – The “lung” in traditional Chinese medical science refers to the respiratory system. This group of plants promotes body fluid secretion, as well as possessing anti-inflammatory and expectorant properties. It is effective for use in cough with scanty thick sputum caused by dryness injuring the lungs, or cough associated with dryness as in pulmonary tuberculosis, bronchitis, etc.

8. *Antitussive, antiasthmatic plants* – Such as *Aristolochia contorta*, *Eriobotrya japonica*, *Platycodon grandiflorus*, *Ardisia japonica*, *Sapindus mukorossi*, *Citrus grandis*, *Manglietia fordiana*, etc. – This group of plants is useful against cough and wheezing. It has antitussive, antiwheezing, expectorant, and antibacterial actions, and is effective for asthma, pertussis, emphysema, etc.

9. *Analgesic, anesthetic plants* – Such as *Alangium chinense*, *Aquilaria sinensis*, *Staun-*

tonia chinensis, *Murraya paniculata*, etc. — This group of plants has analgesic and anesthetic actions. They relieve pain from internal and external injuries, headache, stomachache, neuralgia. Some are used in general or local anesthesia.

10. *Sedative, tranquilizer plants* — Such as *Rauvolfia verticillata*, *Pinus massoniana*, *Oxalis corniculata*, *Schisandra chinensis*, *Ziziphus spinosa*, etc. — This group of plants has tranquilizing and sedative properties. These plants are effective for anxiety, neurasthenia, insomnia, and hypertension.

11. *Tonic plants* — Such as *Panax ginseng*, *Cratagus pinnatifida*, *Dimocarpus longan*, *Blettilla striata*, *Astragalus complanatus*, *Nelumbo nucifera*, *Sedum aizoon*, *Rosa laevigata*, *Cinnamomum cassia*, etc. — This group of plants acts by restoring bodily functions, and has hematinic, nourishing, and tonifying effects. It is useful for patients with anemia, weight loss, and malnutrition.

12. *Digestive, vermifuge plants* — Such as *Caesalpinia sepiaria*, *Punica granatum*, *Quisqualis indica*, *Brucea javanica*, *Areca catechu*, *Torreya grandis*, *Melia azedarach*, *Alpinia officinarum*, etc. — This group of plants promotes digestion and kills parasites. These plants are indicated in indigestion, infantile malnutrition, and intestinal parasitism.

13. *Plants of curing of eye inflammation* — Such as *Tribulus terrestris*, *Cassia occidentalis*, *Vitex rotundifolia*, *Celosia argentea*, etc. — This group of plants reduces inflammation of the eyes and is useful in acute conjunctivitis, keratitis, etc.

14. *Antineoplastic plants* — Such as *Scutellaria barbata*, *Sarcandra glabra*, *Crotalaria sessiliflora*, *Solanum nigrum*, *Livistona chinensis*, etc. — This group of plants has variable inhibition against malignant cell growth, and the improvement of cancer symptoms. But the mechanism of action is not clearly understood, and awaits further study by the common efforts of traditional and west doctors. Clinically, it is used supplementary to operation and radiotherapy.

15. *Plants of snake and insect bites* — Such as *Lobelia chinensis*, *Paris chinensis*, *Rabdosia amethystoides*, etc. — This group of plants has

excellent antitoxic effect against snake and insect bites, reducing local swelling and pain. It is useful in bites by poisonous snakes, centipede, wasp sting, etc.

16. *Plants of traumatic injury* — Such as *Albizzia kalkora*, *Carthamus tinctorius*, *Caesalpinia sappan*, *Paeonia suffruticosa*, *Crocus sativus*, *Ardisia crenata*, *Sambucus javanica*, *Toddalia asiatica*, etc. — This group of plants acts by promoting circulation and dissolving stagnant blood, reducing swelling and pain. It is useful in traumatic contusions, sprains, cuts and fractures. It can be used topically and systemically.

17. *Antiseptic, antipruritic plants* — Such as *Trollius chinensis*, *Phytolacca acinosa*, *Nerium indicum*, *Ricinus communis*, *Impatiens chinensis*, etc. — This group of plants has antifacterial, anti-inflammatory, and antipruritic actions. It is mainly used externally, though some are taken internally too. It is effective against furuncles, carbuncles, abscesses, ringworms, scabies, dermatitis, and eczema.

STUDIES ON DEVELOPMENT AND UTILIZATION OF MEDICINAL PLANT RESOURCES IN CHINA

Studies on development and utilization of Chinese medicinal plant resources are at following seven levels:

1. Expeditions on a large scale have been carried out many times in species, distribution, ecology, folk utilization of medicinal plants.

2. Original plants (all or part of plant body) are directly used as drugs. For example, whole bodies of herbaceous plants are used as drugs, such as *Aristolochia mollissima*. Roots or rhizomes of plants are used as drugs, such as *Pseudostellaria heterophylla*. Stems, barks, woods, leaves, flowers, fruits and seeds are used as drugs respectively, such as *Impatiens balsamina*, *Albizzia julibrissin*, *Caesalpinia sappan*, *Pyrrosia petiolosa*, *Hibiscus syriacus*, *Prunus mume*, and *Brassica juncea*. In China this group of original plants is known as medicinal materials or crude drugs.

3. Crude extracts from medicinal plants are made up directly into drugs, such as many Chinese medicinal liquid, medicinal liquor, tablet, pill, powder and ointment. In China,

this group of drugs is known as medicine already prepared by a pharmacy.

4. Effective components from plants are made into new drugs. Through screen research of plants, especially systematic research of chinese traditional medicaments, many new drugs of chemically pure compounds obtained from plants have been developed, such as anisodamine and anisodine from *Scopolia tangutica*, agrimophol from the winter buds of *Agrimonia pilosa*, huperzine A from *Huperzia serrata*, Bao-Gong-Teng A from *Erycibe obtusifolia*, etc.

5. Synthesis and modification of structures of active components from plants have been elaborated in order to secure more favourable therapeutic agents, such as the sulfonate from tanshinone II_A which was isolated from *Salvia miltiorrhiza*, etoposide from podophyllotoxin which was isolated from *Podophyllum* spp., and biphenyl dimethyl-dicarboxylate from the intermediates of schizandrin C total synthesis.

6. It has been studied to produce speedily effective components by biotechnology (cell culture, tissue culture, rapid propagation, etc.). In China about 100 species of medicinal

plants have been cultured *in vitro*. *Panax ginseng*, *Cartharanthus roseus* (*Vinca roseus*), *Artemisia annua* and *Lycium barbarum*, etc. have been cited as successful examples.

7. Introduction and cultivation of medicinal plants are carried out in order to enlarge medicine source. More than 1,000 species of medicinal plants have been introduced and cultivated in China. For example, *Panax ginseng*, *Panax notoginseng*, *Angelica sinensis*, *Coptis chinensis*, *Eucommia ulmoides*, *Amomum villosum*, *Glycyrrhiza uralensis*, etc. have been cultivated on a large scale. *Panax quinquefolium*, *Amomum compactum* and *A. kravanh* from abroad have been introduced in the large.

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