

Article

## Naturalness and preference for species selection of Chinese medicinal seed plants

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### Abstract

In present study, the electivity index was used to estimate the preference for species selection of Chinese medicinal seed plants based on the code database of Chinese herbal medicine, CHM-DATA Ver. 1.0 (Zhang, 2017a-d) and the world's seed plant data. The results showed that people consciously select Chinese medicinal seed plants from the families Polygonaceae and Ranunculaceae, followed by Liliaceae, Solanaceae, Umbelliferae, etc., and people avoid select medicinal seed plant species from Cyperaceae and Gramineae, followed by Euphorbiaceae, Leguminosae, Compositae, Cruciferae, Rubiaceae, Convolvulaceae, Orchidaceae, Polygonaceae, Scrophulariaceae, Dianthus, Malvaceae, and Rosaceae, etc.

**Keywords** Chinese medicinal plants; seed plants; species selection; preference.

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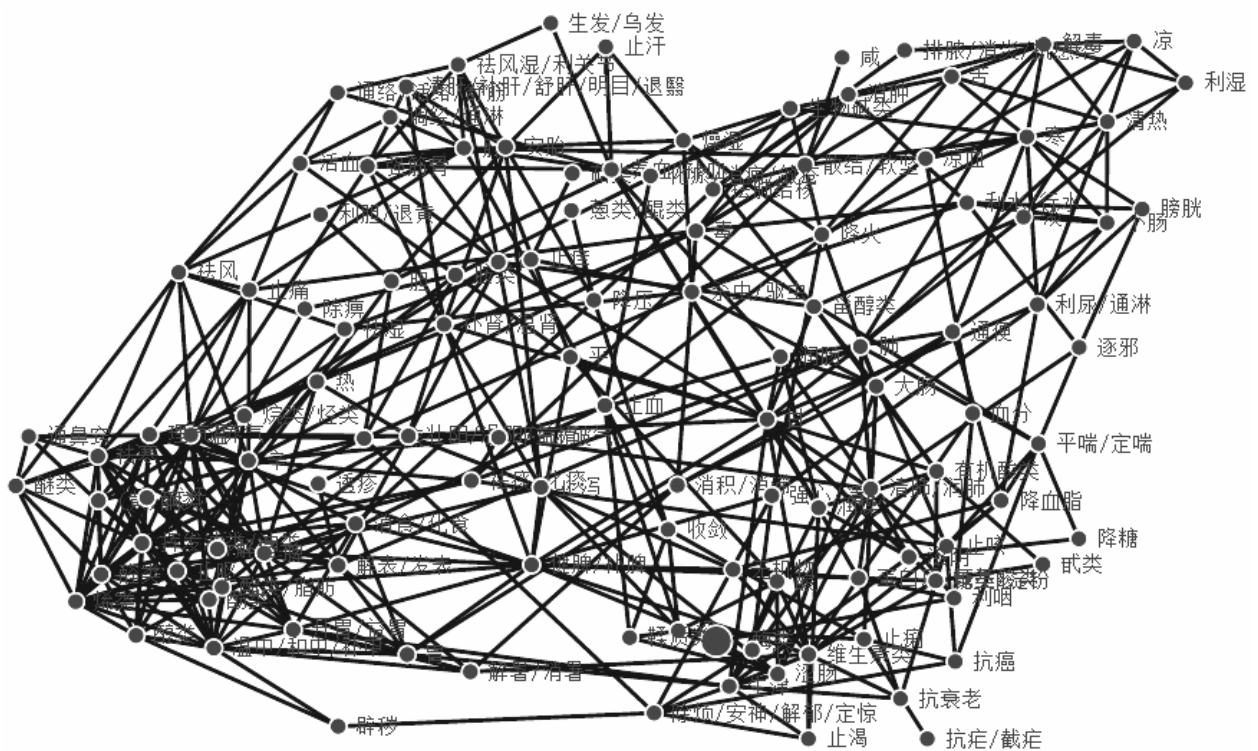
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### 1 Introduction

For the last thousands of years, Traditional Chinese Medicine has played an important role in ensuring the health and longevity of Chinese people (Fig. 1), and the theory and practice of Traditional Chinese Medicine have been continuously improving and developed over the past thousands of years (Zhang, 2017a-d). The theory of Traditional Chinese Medicine stresses the regulation of biological networks (Fig. 2; Zhang, 2012, 2016, 2017a-d, 2018), which brings a hope to disease prevention and drug research / development. In China, there are more than 11000 medicinal plants and fungi, accounting for more than 85% of traditional Chinese medicines. We are interested in the fact that the ancients have certain rules to follow in the species selection of Chinese medicinal plants. To this end, we conducted a preliminary analysis based on the past studies.



**Fig. 1** Licorice, *Glycyrrhiza uralensis* Fisch, is a perennial Chinese medicinal plant belonging to the family Leguminosae.



**Fig. 2** Correlation network for attributes and efficacies of Chinese herbal medicines (positive correlation) (click on the image above to open the interactive network animation). In the interactive network animation, you can drag any node to see the nodes with positive correlation to it. The interactive network can also be found at <http://www.iaees.org/publications/journals/np/cn/CHM/ChineseHerbMedicinesNetwork/ZhangWJ-ChineseHerbMedicinesNetwork-Posi.html> (Zhang, 2017a-d).

## 2 Material and Methods

First, choose our code database of Chinese herbal medicine, CHM-DATA Ver. 1.0 (Zhang, 2017a-d). The database had selected 1127 kinds of Chinese herbal medicines, involving 210 families, and most of which were seed plants (1115 seed plant species, 98.94%). The database has no other special preference for selection of plant species. In addition, the world's seed plant data is used (Pan, 1997). After statistic summary, the results are shown in Table 1. Here we assume that world seed plants are coincident with Chinese seed plants.

**Table 1** The number of the world's seed plants and the Chinese medicinal seed plants.

World Seed Plants			Chinese Medicinnal Seed Plants		
Family	Number of species	%	Family	Number of species	%
Compositae	30000	25.44	Compositae	93	8.34
Legumes	17600	14.92	Labiatae	55	4.93
Gramineae	10000	8.48	Leguminosae	52	4.66
Euphorbiaceae	8000	6.78	Ranunculaceae	38	3.41
Rubiaceae	6000	5.09	Rosaceae	31	2.78
Cyperaceae	4000	3.39	Liliaceae	28	2.51
Labiatae	3500	2.97	Polygonaceae	28	2.51
Rosaceae	3300	2.8	Umbelliferae	27	2.42
Cruciferae	3200	2.71	Rubiaceae	21	1.88
Scrophulariaceae	3000	2.54	Euphorbiaceae	21	1.88
Umbelliferae	2800	2.37	Solanaceae	20	1.79
Boraginaceae	2000	1.7	Gramineae	18	1.61
Solanaceae	2000	1.7	Scrophulariaceae	18	1.61
Liliaceae	2000	1.7	Rutaceae	18	1.61
Orchidaceae	2000	1.7	Zingiberaceae	17	1.52
Ranunculaceae	1900	1.61	Rosaceae	17	1.52
Convolvulaceae	1800	1.53	Menispermaceae	16	1.44
Caryophyllaceae	1750	1.48	Lauraceae	15	1.35
Crassulaceae	1600	1.36	Moraceae	15	1.35
Chenopodiaceae	1400	1.19	Araliaceae	15	1.35
Malvaceae	1000	0.85	Papaveraceae	15	1.35
Amaranthaceae	900	0.76	Verbenaceae	12	1.08
Gentianaceae	900	0.76	Caryophyllaceae	12	1.08
Polygonaceae	800	0.68	Aristolochiaceae	12	1.08
Primulaceae	800	0.68	Araceae	12	1.08
Iridaceae	800	0.68	Cucurbitaceae	11	0.99
Geraniaceae	780	0.66	Cruciferae	11	0.99
Willowaceae	600	0.51	Orchidaceae	11	0.99
Salicaceae	540	0.46	Amaranthaceae	11	0.99
Saxifragaceae	500	0.42	Ericaceae	11	0.99
Lonicerae	450	0.38	Oleaceae	9	0.81
Rinaceae	400	0.34	Amaryllidaceae	9	0.81

Plumbaginaceae	350	0.3	Convolvulaceae	8	0.72
Plantaginaceae	270	0.23	Apocynaceae	8	0.72
Zygophyllaceae	240	0.2	Magnoliceae	8	0.72
Orobanchaceae	180	0.15	Chenopodiaceae	8	0.72
Cuscutoidaeae	170	0.14	Berberidaceae	8	0.72
Betulaceae	140	0.12	Celastraceae	8	0.72
Tamaricaceae	120	0.1	Cyperaceae	7	0.63
Potamogetonaceae	100	0.08	Polypodiaceae	7	0.63
Ephedraceae	40	0.03	Malvaceae	7	0.63

From Table 1, calculate the electivity index (Zhang, 2007) of Chinese medicinal seed plants

$$E = (r - n) / (r + n)$$

where,  $E$ : electivity index,  $-1 \leq E \leq 1$ ;  $r$ : proportion of Chinese medicinal seed plants;  $n$ : proportion of seed plants in nature.  $0 \leq E \leq 1$  means the special preference for selecting the seed plant family; and  $-1 \leq E \leq 0$  indicates the intention to avoid selection of the seed plant family.

### 3 Results

From Table 1, we conclude that, most Chinese medicinal seed plant species come from the dominant families of seed plants, especially Compositae, Leguminosae, Rosaceae, etc. This is just the naturalness for the species acquisition of Chinese medicinal seed plants, that is, the seed plant families with more species in nature, and more species are acquired. On the other hand, there are also differences in proportional ordering between the two lists. The main reason is that people will make selection in a targeted or preferential manner.

It can be seen from Table 2 that in the common subjects, people consciously select Chinese medicinal seed plants from the families Polygonaceae and Ranunculaceae, followed by Liliaceae, Solanaceae, Umbelliferae, etc. People avoid select medicinal seed plant species from the families Cyperaceae and Gramineae, followed by Euphorbiaceae, Leguminosae, Compositae, Cruciferae, Rubiaceae, Convolvulaceae, Orchidaceae, Polygonaceae, Scrophulariaceae, Dianthus, Malvaceae, and Rosaceae, etc.

The results show that people tend to think that the seed plant species in the family Polygonaceae, Ranunculaceae, Liliaceae, Solanaceae, and Umbelliferae, etc., are more valuable as Chinese herbal medicines.

**Table 2** Preference for the species selection of Chinese medicinal seed plants.

World Seed Plants		Chinese Medicinal Seed Plants		$E$
Family	Proportion (%)	Family	Proportion (%)	
Polygonaceae	0.68	Polygonaceae	2.51	0.5737
Ranunculaceae	1.61	Ranunculaceae	3.41	0.3586
Liliaceae	1.7	Liliaceae	2.51	0.1924
Solanaceae	1.7	Solanaceae	1.79	0.0258
Umbelliferae	2.37	Umbelliferae	2.42	0.0104
Rosaceae	2.8	Rosaceae	2.78	-0.0036
Malvaceae	0.85	Malvaceae	0.63	-0.1486

Caryophyllaceae	1.48	Caryophyllaceae	1.08	-0.1562
Scrophulariaceae	2.54	Scrophulariaceae	1.61	-0.2241
Chenopodiaceae	1.19	Chenopodiaceae	0.72	-0.2461
Orchidaceae	1.7	Orchidaceae	0.99	-0.2639
Convolvulaceae	1.53	Convolvulaceae	0.72	-0.36
Rubiaceae	5.09	Rubiaceae	1.88	-0.4605
Cruciferae	2.71	Brassicaceae	0.99	-0.4649
Compositae	25.44	Compositae	8.34	-0.5062
Leguminosae	14.92	Leguminosae	4.66	-0.524
Euphorbiaceae	6.78	Euphorbiaceae	1.88	-0.5658
Gramineae	8.48	Gramineae	1.61	-0.6809
Cyperaceae	3.39	Cyperaceae	0.63	-0.6866

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