Ethnobiological study on traditional medicinal plants and fungi recorded in the Naxi Dongba sutas

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Abstract

**Background:** The Naxi people, living in Southwest China, have a long history and rich characteristic culture. Their ancestors recorded their life practices by ancient hieroglyphs and gradually formed the Dongba Sutras, which, among other knowledge, included the traditional knowledge of Naxi medicine. In the past, most studies on the Dongba Sutras focused on the humanistic culture of Naxi people, whereas studies have rarely focused on Naxi herbal medicinal plants and fungi described in the Dongba Sutras. Studying this aspect is helpful for exploring the traditional culture of Naxi people from the perspective of traditional medicine.

**Methods:** From February to September 2019, we screened the medicinal plants and fungi from the Dongba Sutras with the help of Dongba. Then, we carried out field investigations and collected voucher specimens of traditional medicinal plants and fungi with the help of 104 Naxi folk healers. The specimens were identified and stored in the Herbarium of Yunnan Branch, Institute of Medicinal Plants, Chinese Academy of Medical Sciences (IMDY). Through semi-structured interviews, we obtained ethnobotanical information of medicinal plants and fungi. The obtained quantitative data were analyzed using the informant consensus factor (ICF) method and the number of citations.

**Results:** A total of 85 species of medicinal plants and fungi belonging to 51 families and 71 genera were recorded in the Dongba Sutras. Among them, 25 species were endemic to China, and eight species were only distributed in Naxi distribution areas. These medicinal plants and fungi were mainly obtained from the wild, and 22 species could be used as food. The most frequent method of taking medicinal materials was oral-taking after decoction, followed by topical and sometimes buccal. The methods of processing these medicinal materials included water decoction, warm water flushing, and drinking after soaking. The medicinal plants and fungi in the Dongba Sutras are used to treat 96 conditions classified into 13 disease groups according to the International Classification of Primary Care second edition. Further analysis indicated that most of these species were utilized for treating diseases from the digestive (D) group, followed by those from the respiratory (R) group, musculoskeletal (L) group, general, and... (Continued on next page)
Background
The Naxi people inhabit areas of Southwest China, and they have a long history and a rich characteristic culture. Dongba symbols are the only hieroglyphs in the world that are still in use [1]. Joseph F. Rock collected about 8000 copies of Dongba scriptures, which were later deposited in major European and American libraries. Since his book was titled The Ancient Na-Khi Kingdom of Southwest China [2], Naxi people and their Dongba culture are famous throughout the world. The Dongba Sutras have become the main written materials for studying the Dongba culture. The Dongba Sutras is a special scripture and different from Buddhism Sutras or other classics. The content of Dongba Sutras covers the history, philosophy, society, religion, language and script, music, art, dance, and many other traditional subjects related to the Dongba culture. It is praised by academic circles as “the encyclopedia of ancient Naxi people” [3]. Naxi medical culture is an important part of Dongba culture. The Dongba Sutras contain information about the unique medical culture of the Naxi people, and they are the most important documents for studying Naxi medicine. The name “Dongba” is the appellation of the Naxi religious clergy and can be translated as “the wise.” They are senior intellectuals and the main inheritors of the Dongba culture of the Naxi people, and most of them are skilled in singing, dancing, calligraphy, history, painting, and medicine.

Naxi ancestors have rich medical experience in the practice of fighting against diseases, and they created “Naxi medicine” or “Dongba medicine” [4]. These traditional medical experiences have been recorded by the Naxi people in the form of hieroglyphs, and they formed the Dongba Sutras. Only the Dongba who as the clergyman can recognize the hieroglyphics of Dongba sutras, and they lack of scientific research methods including ethnobotany. Therefore, in the existing literature, the medicinal plants and fungi recorded in Dongba sutras rarely corresponded to their scientific names.

Due to historical reasons, a large number of Dongba scriptures have been lost, some of them are scattered abroad or collected by privates. Currently, there are about 30,000 volumes of the Dongba Sutras, which are mainly stored in museums and libraries in China, the USA, Germany, France, Great Britain, and other countries [3]. These sutras are based on extensive experience in treating diseases and provide great knowledge of medicine. Chien Song Lü and Chongren Pandi to Find Medicine are the most representative sutras [5]. Chien Song Lü is the only medical book written in hieroglyphs of the Naxi people, and it includes data on dozens of medicinal plants. Chongren Pandi to Find Medicine includes records of the traditional treatment methods, the morphology, and function of some medicinal plants, and it has important reference value for the current medical practice [5]. The publication entitled The Complete Works of Dongba Sutras in Naxi [6] lays the foundation for deciphering the mysterious Naxi Dongba medicine.

In addition to the Dongba Sutras, in Naxi culture, a lot of valuable traditional knowledge has been transmitted orally, including a lot of precious medical information. Therefore, Naxi culture still needs to be further studied and systematically organized [4]. In recent decades, ethnomedical knowledge in Naxi communities has lost rapidly along with the high-speeded development of the Chinese economy. In particular, Lijiang is a famous tourism destination, and few young generations study traditional medicinal knowledge from the old generation. Less and less Naxi people use (or even recognize) traditional medicinal plants. Thus, it becomes very urgent and necessary to study medicinal plants recorded in the Dongba Sutras.

Materials and methods
Study area
Lijiang is a prefecture-level city in Yunnan Province, Southwest China. It is located in Hengduan Mountains, between 25° 23′–27° 56′ N and 99° 23′–101° 11′ E. The total area of Lijiang City covers 20 600 km² [7]. The terrain of the area is high in the northwestern part and low in the southeastern part, with the highest altitude of 5596 m and the lowest altitude of 1015 m. The maximum altitude difference of Lijiang is 4581 m [8]. The climate of Lijiang belongs to subtropical humid climate [9]. There is abundant rainfall and a distinct dry and wet season. The average annual rainfall is about 1
000 mm, and the rainy season lasts from May to October being particularly pronounced in July and August. The annual average temperature is between 13 °C and 20 °C, the average temperature of the hottest month is 18–26 °C, and the average temperature of the coldest month is 4–12 °C. Lijiang has 2500 h of annual sunshine and 147 kcal/cm² of annual solar radiation [9].

Lijiang has a forest coverage rate of 70%. The area is rich in medicinal materials and other exploitable biological resources and is known as the “kingdom of alpine plants” and “hometown of medicinal materials” [8].

The key areas of the present study were Gucheng District and Yulong County in Lijiang city, Yunnan Province, China. This area is the most concentrated area of the Naxi population in the world, with about 210,000 people, accounting for 68.5% of the total Naxi population. Naxi people live in mountainous areas with inconvenient transportation and abundant biological resources, which is why their tradition is the most convenient mean of resisting diseases. At the same time, the inheritance model of Dongba culture is masters teaching apprentices that makes a better inheritance of the Naxi traditional medicinal culture.

Data collection
From February to September 2019, we screened the medicinal plants and fungi from the Dongba Sutras with the help of Dongba (the clergies who can read and write hieroglyphs) and translate the hieroglyphs into the Naxi language. Then, we carried out field research with assistance from 104 Naxi folk healers and collected traditional medicinal plant specimens. The basic survey information such as age and gender was collected and recorded. Using semi-structured interviews [10], ethnobotanical knowledge was obtained, including information about the local name, medicinal parts, harvesting methods, preparation methods, and indications of the medicinal plants and fungi from the Dongba Sutras. The informed consent of the participants was obtained before conducting the interviews, and the ethical guidelines prescribed by the International Society of Ethnobiology [11] were followed. The local names were transliterated from the Naxi or local Chinese pronunciation into the Roman alphabet following the Scheme for the Chinese Phonetic Alphabet [12] and the Basic Rules for Hanyu Pinyin Orthography [13]. The diseases treated by the medicinal plants and fungi from the Dongba Sutras were classified according to the International Classification of Primary Care (ICPC-2) [14] of the WHO (World Health Organization) [15, 16].

Plant materials
With the help of Naxi folk healers, 3–5 specimens of each species were collected, and the information about their habitats (e.g., altitude, latitude, longitude, and vegetation type), plant morphology (e.g., plant height, color of flowers, and corolla type), and date of the collection were recorded. The scientific and Chinese names were recorded on the label. These specimens were stored at the Herbarium, Yunnan Branch, Institute of Medicinal Plants, Chinese Academy of Medical Science (IMDY).

Plant identification
The following literature was used to identify the family and species names of the collected plants: Flora of China [17], Flora Reipublicae Popularis Sinicae [18], and Flora Yunnanica [19]. The scientific names were checked on The Plant List website [20]. All the plants listed are sorted at family level circumscription follows APG IV [21].

Data analysis
The data obtained in this study were analyzed using Microsoft Office Excel (2010) spreadsheet software. Quantitative data analysis was conducted using the informant consensus factor (ICF) method and the number of citations. ICF was calculated as ICF = (Nur - Nt) / (Nur - 1), where Nur is the sum of plant species used by all the respondents to treat a particular disease, and Nt is the number of identical plant species used by all the respondents to treat a particular disease [22].

Results and discussion
Demographic features of the respondents
A total of 104 respondents were interviewed (Table 1). Among them, male respondents highly outnumbered the female respondents, and 79.81% of them were over 50 years old. Naxi people live in mountainous areas and commonly collect medicinal plants. In this harsh environment, men have an advantage over women due to their physical abilities. Because the experience of treating diseases is based on long-term practice, the medical experience mastered by older healers is more comprehensive and reliable than those learned by younger healers. Moreover, it ensures the reliability of the knowledge obtained in this survey.

The educational level of the respondents was generally low, and most of them had no higher education. However, this did not affect the reliability of the results, because the acquired traditional knowledge has truly maintained the characteristics of the Naxi people.

The respondents were mainly Naxi (71.158%), followed by the Lisu (15.38%). Other ethnic groups included Han, Tibetan, Bai, and Yi. All of these people lived in Naxi communities, and their medical skills were learned from Naxi healers. All the respondents were folk healers. Although there are many
ways to learn medical skills, most respondents (70.19%) developed their medical experiences with the help of their ancestors. None of the respondents had regular jobs, and many of them were local Dongba who were priests and folk healers.

| Age       | Number | Proportion (%) |
|-----------|--------|----------------|
| 31–40     | 7      | 6.73           |
| 41–50     | 14     | 13.46          |
| 51–60     | 28     | 26.92          |
| 61–70     | 24     | 23.08          |
| 71–80     | 24     | 23.08          |
| 81 and above | 7    | 6.73           |

| Sex       | Number | Proportion (%) |
|-----------|--------|----------------|
| Female    | 4      | 3.85           |
| Male      | 100    | 96.15          |

| Education level | Number | Proportion (%) |
|-----------------|--------|----------------|
| Illiterate      | 10     | 9.62           |
| Primary school  | 61     | 58.65          |
| Junior middle school | 12  | 11.54          |
| Senior middle school | 8   | 7.69           |
| Teacher training school | 1  | 0.96           |
| School of health | 2     | 1.92           |
| Polytechnic school | 5   | 4.81           |
| Junior college  | 4      | 3.85           |
| University      | 1      | 0.96           |

| Nationality | Number | Proportion (%) |
|-------------|--------|----------------|
| Naxi        | 74     | 71.15          |
| Lisu        | 16     | 15.38          |
| Han         | 5      | 4.81           |
| Zang        | 5      | 4.81           |
| Bai         | 3      | 2.88           |
| Yi          | 1      | 0.96           |

| Ways of learning medicine | Number | Proportion (%) |
|---------------------------|--------|----------------|
| Ancestral                 | 73     | 70.19          |
| Ancestral,*master         | 8      | 7.69           |
| Master                    | 7      | 6.73           |
| Ancestral, self-taught    | 6      | 5.77           |
| Master, self-taught       | 4      | 3.85           |
| Ancestral, learning at school | 2 | 1.92           |
| Ancestral, self-taught, learning at school | 1 | 0.96 |
| Master, learning at school | 1     | 0.96           |
| Master, self-taught, learning at school | 1 | 0.96 |
| Self-taught               | 1      | 0.96           |

*Master: an authority qualified to teach apprentices

### Diversity of medicinal plants and fungi in the Dongba sutras

According to our investigation, a total of 85 species of medicinal plants and fungi belonging to 51 families and 71 genera were recorded in the Dongba Sutras (Table 2). In the middle and high altitude areas, the main tree species belonged to the families Pinaceae, Cupressaceae, Ericaceae, and Fagaceae. Almost all parts of these plants can be used as medicine, especially their branches, which are often used by Naxi priests for various sacrificial activities. The highest numbers of plant species recorded belonged to the families Asteraceae (six species) and Polygonaceae (six species), followed by the Rosaceae (four species). It is worth mentioning that from the genus *Rheum* alone, we recorded three species. In addition to *R. officinale* recorded in the Pharmacopoeia of People’s Republic of China [23], we also recorded *R. delavayi* and *R. likiangense*, but their usage was different from that of *R. officinale* recorded in the Pharmacopoeia of People’s Republic of China.

Of all recorded species, herbaceous plants (49 species) accounted for the greatest number (Table 3), followed by trees (21 species) and shrubs (5 species). As herbaceous plants can more easily survive in a new environment than trees and shrubs [24], especially in the alpine mountains inhabited by the Naxi people, there is a lack of diversity of tree species, whereas the low herbaceous plants were abundant. At the same time, herbaceous plants are more convenient to collect than other plant

| Living habits | Number of species | Proportion (%) |
|---------------|------------------|----------------|
| Herbs         | 46               | 54.12          |
| Trees         | 21               | 24.71          |
| Shrubs        | 5                | 5.88           |
| Woody vines   | 4                | 4.71           |
| Climbing shrubs | 3             | 3.53           |
| Herbaceous climbers | 3            | 3.53           |
| Macro-fungi   | 3                | 3.53           |

| Total         | 85               | 100.00         |
life forms. Thus, the utilization rate of herbaceous plants is higher than that of trees and shrubs.

The medicinal parts of 85 medicinal plant and fungus species used by the respondents are indicated in Tables 4 and 10. The Naxi people knew that different medicinal parts have different effects. According to our analysis, in addition to the plant’s medicinal efficacy, the difficulty of its collection also affects which parts would be used. The Naxi people preferred to collect easily collectible plant parts as raw materials for medicinal preparations. Among plant life forms, herbs and small shrubs are most commonly used as medicines, and the respondents reported that for this purpose, they used whole plants, roots, or rhizomes, whereas when trees, big shrubs, or woody vines are used for medicinal preparations, the respondents used stems, branches, leaves, or bark. The flowering and fruiting periods of these plants are short; therefore, their fruits, seeds, flowers, and buds are seldom used as medicinal parts. Plant secretions are rarely used as medicinal materials because of the difficulty of their collection.

Most of the medicinal plants in the Dongba Sutras are common plants in the studied area. The abundance of medicinal plants, determined according to the classification of abundance by Germany Ecologist Oscar Drude [25], is shown in Table 5. According to this classification, the highest number of species used by the respondents is forest species, such as Quercus aquifolioides, Q. aliena var. acuteserrata, Populus rotundifolia var. bonatii, and Pinus yunnanensis. The group with few or dispersed organism included only three species: Poria cocos, Dobinea delavayi, and Panax japonicus var. major. Although the medicinal materials from these species are rarely found in the wild, they have been cultivated in the area and thus have been successfully used as medicines.

Since ancient times, Naxi people have lived in mountainous areas, where transportation is inconvenient. The medicines they used were collected in the mountains, and rare medicinal plants were cultivated in their courtyards in order to be convenient for collection. Therefore, the medicinal plants described in the Dongba Sutras were mainly wild plants, accounting for 76.47% of all medicinal plants described in the Dongba Sutras (Table 6). Because of the small population of Naxi people, their use of wild medicinal plants does not present a threat to the stability of wild plant populations.

Food therapy is an important characteristic of Chinese culture and traditional Chinese medicine (TCM). “One Root of medicine and food” is a summary of the Chinese people’s understanding of medicine and food and their relationship [26]. The life of the Naxi people is closely related with medical dietary plants, and their medicinal diets are indispensable to the health of their communities [27]. Among the medicinal plants in the Dongba Sutras, 22 species can be consumed as vegetables, fruits, dried fruits, or condiments (Table 7). For example, Lagenaria siceraria, Brassica rapa, Foeniculum vulgare, and Allium ascalonicum are common vegetable species. Setaria italica

| Table 5 | Abundance of medicinal plants and fungi contained in the Dongba Sutras |
| Abundance* | Number of species | Proportion (%) |
|----------------------|---------------------|----------------|
| Soe                   | 4                   | 4.71           |
| Cop3                  | 13                  | 15.29          |
| Cop2                  | 17                  | 20.00          |
| Cop1                  | 38                  | 44.71          |
| Sp                    | 10                  | 11.76          |
| Sol                   | 3                   | 3.53           |
| Un                    | 0                   | 0.00           |
| Total                 | 85                  | 100.00         |

*Soe (Sociales): High number of individuals, the above-ground plant part is closed
Cop3 (Copiosae): High number of individuals, but the above-ground plant part is not closed
Cop2: Large and common plants
Cop1: Large plants, but small populations
Sp (Sparsal): Low number of plants, scattered
Sol (Solitariae): Low number of plants, sparse
Un (Unicum): Only one individual

| Table 6 | Sources of drugs contained in the Dongba Sutras |
| Sources                                  | Number of species | Proportion (%) |
| Wild                                     | 65                 | 76.47          |
| Cultivated                               | 7                  | 8.24           |
| Mixture of wild and cultivated           | 13                 | 15.29          |
| Total                                    | 85                 | 100.00         |

Note: One or more parts of the same plant can be used as medicine, which is why the total number of medicinal parts exceeds the total number of species.
var. germanica is also used as food. For a long time, the Naxi people considered that these foods and vegetables can be used to treat and prevent diseases. Thus, they recorded them in the Dongba Sutras. Some of these medicines are used to prepare tea and do not have any negative side effects. For example, the aerial parts of *Elsholtzia rugulosa* which has the effect of relieving summer heat. The plant as a substitute for tea is easy to collect and prepare and has widely been used by the Naxi people. This indicated that in the Naxi people, maintaining a healthy daily diet is a very important factor in disease prevention.

**Medicine preparation methods and applications**

The folk preparation methods of traditional Naxi medicine were relatively simple (Fig. 1a); most of them included washing and direct drying of the plant material (49.18%), followed by crushing (20.49%), soaking (13.93%), using fresh products (9.84%), blending with other agents (3.28%), and carbonization (3.28%). The medium used in the soaking process was mainly wine or water, whereas the medium used in blending included edible oils, vinegar, and honey, etc. The use of fresh plant parts as medicine is characteristic of Naxi medicine because this method is simpler to use than other methods. In this method, the medicinal parts are removed from the plants and washed, and they are used after mashing or chewing. In addition, juice extracted directly from the plant is also a common method of fresh plant intake and is mostly used for topical application. The main method of medicine consumption was oral, followed by topical and rarely buccal (Fig. 1b). Oral administration included three methods: boiling in water, washing in warm water, and drinking after soaking.

**ICF, conditions, and diseases treated by the studied plants and fungi**

The informant consensus factor (ICF) is a measure of information diversity. The higher the ICF value, the greater the difference among plant species used in the treatment of a given disease, and the lower the ICF value, the smaller the difference among plant species used in the treatment of a disease [22]. We found that the medicinal plants and fungi in the Dongba Sutras are used to treat 96 conditions, which can be classified into 13 disease groups according to ICPC-2 (Table 8 and Table 9). The highest ICF values were recorded for the eye group (F), cardiovascular group (K), and psychological group (P) (ICF = 1.50), followed by the neurological group (N), female genital group (X), and male...
genital group (Y) (ICF: 1.00). Among the medicinal plants provided by different respondents, there are very few (only one or none) identical plants that can be used to treat the same group of diseases. This showed that there are many differences among Naxi people in the methods of treating a specific disease, i.e., that they have low consensus about disease treatment methods. There are two possible reasons for this: (1) as the Naxi people live in biodiversity-rich areas, the abundant medicinal plant resources provided them with a wide choice of medicinal plants to use [28], and (2) different Naxi folk healers may have different degrees of understanding of the same disease (e.g., some may be focused more on the symptoms of a disease, but ignore or miss the real cause of the disease).

Further analysis indicated that most of the plant species were utilized for the group of digestive diseases (D; Nur=36, Nt=15), followed by the respiratory (R; Nur=29, Nt=13), musculoskeletal (L; Nur=21, Nt=12), and the general and unspecified disease group (A; Nur=21, Nt=5). The ICF values of these four disease groups were low: Group D: 0.60, Group R: 0.57, group L: 0.45, and group A: 0.75. These low values indicated that these four groups of diseases are common diseases in Naxi people living areas, and Naxi folk healers have a high consensus on the treatment of these diseases.

For the treatment of diabetes (T89: Diabetes Insulin Dependent or T90: Diabetes Non-Insulin Dependent), which is an endocrine disease that belongs to the group of endocrine/metabolic and nutritional, only one plant species was cited in the Dongba Sutras. *Diaphragma juglandis fructus*, the dry wood diaphragm tissue (xylem septa) that grows inside the walnut (*Juglans regia*), was reported as a medicinal plant that can be used to treat diabetes, and the consensus on this treatment was high. A previous study reported that the flavonoids from *Diaphragma juglandis fructus* have significant anti-diabetic activity [29]. This shows that as the knowledge on folk medicine is collected from long-term practical experience, its scientific nature has yet to be proven by modern science. With more research, more information from traditional medicinal practices will be scientifically proven.

The plant species with the highest number of use reports were *Rheum likiangense* (13 use reports), *Reineckea carnea* (11 use reports), *Rheum delavayi* (10 use reports), and *Hypericum augustinii* (10 use reports). *Rheum likiangense* and *R. delavayi* are endemic to a

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**Table 8** Informant consensus factor (ICF) values of the medicinal plants and fungi contained in the Dongba Sutras

| Disease types                        | The sum of plant species (Nur) | The number of identical plant species used (Nt) | ICF  |
|--------------------------------------|-------------------------------|-----------------------------------------------|------|
| A: General and unspecified           | 21                            | 6                                             | 0.75 |
| D: Digestive                        | 36                            | 15                                            | 0.60 |
| F: Eye                               | 3                             | 0                                             | 1.50 |
| K: Cardiovascular                    | 3                             | 0                                             | 1.50 |
| L: Musculoskeletal                   | 21                            | 12                                            | 0.45 |
| N: Neurological                      | 4                             | 1                                             | 1.00 |
| P: Psychological                     | 3                             | 0                                             | 1.50 |
| R: Respiratory                       | 29                            | 13                                            | 0.57 |
| S: Skin                              | 11                            | 2                                             | 0.00 |
| T: Endocrine/metabolic and nutritional | 1                             | 1                                             | -    |
| U: Urological                        | 12                            | 4                                             | 0.73 |
| X: Female genital                    | 16                            | 1                                             | 1.00 |
| Y: Male genital                      | 14                            | 1                                             | 1.00 |
| Chinese name | Naxi name | Scientific name | Family/voucher specimen/habitat | Part used | Preparation method | Route of administration | Diseases treated/number of respondents (ICPC-2) |
|-------------|-----------|----------------|-------------------------------|-----------|-------------------|------------------------|-----------------------------------------------|
| Zhu Sheng Rou Qiu Jun | Men Mu | Engleromyces goetzi P. Henn. | Hypocreaceae/ NX0759/W/M | Fruit body | Drying | Oral | Elevated Blood Pressure K85 (57)/Headache N01 (64) /Throat Symptom R21 (52) |
| Lie Zhe Jun | Si Du Mou Pei | Schizophyllum commune Franch. | Schizophyllaceae/ NX0360/W/M | Fruit body | Drying | Oral | Cough R05 (104)/Pleurisy/Pleural Effusion R82 (104) |
| Fu Ling | Tuo Ken Liu | Poria cocos (Schw.) Wolf | Polyporaceae/ NX0581/W/M | Fruit body | Drying/Soaking | Oral/Topical | Gonorrhoea Female X71 (12)/Limited Function/Disability (L) L28 (68) |
| Dian Zhan Huang Juan Bai | Ci Liu Liu Ru Da Bie | Selaginella pulvinata (Hook. et Grev.) Maxim. | Selaginellaceae/ NX0281/W/H | Roots | Charring | Oral | Bleeding/Hemorrhage NOS A10 (76) |
| Jie Jie Cao Mie Liu Ku Sa | Equisetum ramosissimum Desf. | Equisetaceae/ NX0364, NX0657/ W/H | Whole plants | Charring/ Drying | Oral | Eye Discharge F03 (80)/Genital Disease Male other Y99 (46)/Menstruation Excessive X06 (72) |
| Chuan Dian Hu Jue | Lu Ba Di Li | Drynaria delavayi Christ | Drynariaceae/ NX0151/W/H | Rhizomes | Crushing | Topical | Fracture: Femur L75 (78)/Fracture: Hand / Foot Bone L74 (64)/Fracture: Other L76 (43)/Fracture: Radius/Ulna L72 (37)/Fracture: Tibia/Fibula L73 (90)/Limited Function/Disability (L) L28 (89)/Musculoskeletal Disease other L99 (44)/Osteoarthrosis other L91 (37)/Pelvis Symptom/Complaint Female X17 (18) |
| Li Jiang Yun Shan | Li Ben Le | Picea likiangensis (Franch.) Pritz | Pinaceae/NX0318/ W/T | Fruits | Drying | Oral | Osteoarthrosis other L91 (102)/Rheumatoid/Seropositive Arthritis L88 (99) |
| Hua Shan Song | Se Tong | Pinus armandii Franch. | Pinaceae/NX0223, NX0322/W/T | Secretion | Drying | Oral | Constipation D12 (25)/Cough R05 (52)/Epilepsy N88 (37) |
| Yun Nan Song | Ge Bo Ha | Pinus yunnanensis Franch. | Pinaceae/NX0159/ W/T | Flowers, branches | Crushing/ stirring | Oral | Acute Bronchitis/Bronchiolitis R78 (75)/Chronic Bronchitis R79 (84)/Limited Function/Disability (L) L28 (28)/Pneumonia R81 (76)/Tuberculosis A70 (23) |
| Gan Xiang Bai | Xiong Ban | Cupressus duclouxiana Hickel | Cupressaceae/ NX0558/W/T | Branches, leaves | Drying | Topical | Leg/Thigh Symptom L14 (87)/Low Back Symptom L03 (68)/Muscle Pain L18 (104) |
| Gao Shan Bai | Xiu Xu | Juniperus squamata Buch.-Ham. ex D.Don | Cupressaceae/ NX0257, NX0614/ W/S or T | Branches, leaves | Drying | Oral/Topical | Intermenstrual Bleeding X08 (100)/Menstruation Irregular/Frequent X07 (86) |
| Hong Hua Wu Wei Zi | Gua Ji Liu | Schisandra rubriflora Rehder et E.H.Wilson | Schisandraceae/ NX0248/W/W | Bark | Soaking | Oral | Abdominal Pain Localized other D06 (44)/Cystitis/Urinary Infection other U71 (32)/Pain General/Multiple Sites A01 (104)/Sleep Disturbance P06 (46)/Trauma/Injury A80 (104) |
| Shan Yu Lan | Han Yi Ba Da | Magnolia delavayi Franch. | Magnoliaceae/ NX0701/C/T | Flowers | Soaking | Oral | Abdominal Pain Epigastric D02 (53) |
| Chinese name       | Naxi name          | Scientific name                      | Family/voucher specimen/habit\(^a\)/habit\(^b\) | Part used     | Preparation method                  | Route of administration | Diseases treated/number of respondents (ICPC-2) |
|-------------------|--------------------|--------------------------------------|-----------------------------------------------|---------------|--------------------------------------|-------------------------|------------------------------------------------|
| Xin Zhang Sei Bi  | Neocinnamomum delavayi (Lec.) H. Liu | Lauraceae/ NX0760/W/T                 | Leaves, bark                                  | Stirring      | Topical                             | Diarrhoea D11 (45)        |                                                               |
| Chang Pu Ji Chu Buer | Acorus calamus Linn. | Acoraceae/ NX0116/C, W/H             | Whole plants                                  | Crushing      | Oral                                | Abdominal Pain Epigastric D02 (99) |
| Chang Pu Ji Chu Buer | Acorus calamus Linn. | Acoraceae/ NX0116/C, W/H             | Whole plants                                  | Crushing      | Oral                                | Influenza R80 (104)       |
| Dong Fang Ze Xie  | Alisma orientale (Samuel.) Juz. | Alismataceae/ NX0520/C,W/H           | Roots                                         | Drying        | Oral                                | Mumps D71 (104)           |
| Shou Shen A You La Ba | Gymnadenia conopsea (Linn.) R. Br. | Orchidaceae/ NX0352/W/H             | Roots                                         | Crushing/drying | Oral                              | Upper Respiratory Infection Acute R74 (58) |
| Xian Nan Shou Shen | Gymnadenia orchidis Lindl. | Orchidaceae/ NX0348/W/H             | Roots                                         | Crushing/drying | Oral                              |                                                               |
| Shou Cao Lu Bu Ge  | Reineckea carnea (Andr.) Kunth | Orchidaceae/ NX0122, NX0544/ W/H     | Whole plants                                  | Crushing/soaking/stirring | Oral/Topical                          | Cough R05 (74)             |
| Xian Nan Shou Shen | Gymnadenia orchidis Lindl. | Orchidaceae/ NX0348/W/H             | Roots                                         | Crushing/drying | Oral                              | Low Back Symptom L03 (45) |
| Dian Jiang Hua    | Hedychium yunnanense Gagnep. | Zingiberaceae/ NX0610/W/H           | Roots                                         | Drying/fresh  | Oral/Topical                         | Pain General/Multiple Sites A01 (55) |
| Shou Cao Lu Bu Ge  | Reineckea carnea (Andr.) Kunth | Orchidaceae/ NX0122, NX0544/ W/H     | Whole plants                                  | Crushing/soaking/stirring | Oral/Topical                          | Sexual Function Symptom/ Complaint Male Y08 (31) |
| Suan Gu           | Allium sativum Linn. | Amaryllidaceae/ NX0746/C/H           | Whole plants                                  | Drying        | Oral                                |                                                               |
| Kuan Ye Jiu Ju Ge Shu | Allium hookeri Thwaites | Amaryllidaceae/ NX0750/C, W/H       | Leaves, roots                                  | Fresh         | Topical                             | Allergy/Allergic Reation A92 (93) |
| Mi Chi Tian Men Dong | Asparagus meioclados Lévl. | Asparagusaceae/ NX0640/W/H           | Roots                                         | Drying        | Oral                                | Animal/Human Bite S13 (98) |
| Ji Xiang Cao Gu | Reineckea carnea (Andr.) Kunth | Orchidaceae/ NX0122, NX0544/ W/H     | Whole plants                                  | Crushing/fresh/drying | Oral/Topical                          | Insect Bite/Sting S12 (104) |

  \(^{a}\) Specimen, \(^{b}\) Habitat

**Table 9 Ethnomedicinal data of medicinal plants and fungi recorded in the Dongba Sutras (Continued)**
Table 9  Ethnomedicinal data of medicinal plants and fungi recorded in the Dongba Sutras (Continued)

| Chinese name | Naxi name | Scientific name | Family/voucher specimen/habitat | Part used | Preparation method | Route of administration | Diseases treated/number of respondents (ICPC-2) |
|--------------|-----------|----------------|---------------------------------|-----------|--------------------|------------------------|---------------------------------------------|
| Chang Yuan Qiao Jian Zhu | Ju Me Yi | Fargesia orbiculata T. P. Yi | Poaceae/NX0665/ W/S | Leaves | Charring | Oral | Upper Respiratory Infection Acute R74 (74) |
| Su | Chong Jing | Setaria italica var. germanica (Mill.) Schred. | Poaceae/NX0765/ C/H | Whole plants | Drying | Oral | Influenza R80 (58) Trauma/Injury A80 (28) Upper Respiratory Infection Acute R74 (79) |
| Jin Mao Tie Xian Lian | Hai Ke Si Zi Beng | Clematis chrysocoma Franch. | Ranunculaceae/ NX0370/ W/W | Whole plants | Drying | Oral | Dyspepsia/Indigestion D07 (35) |
| He Bing Tie Xian Lian | Ze Die Ba | Clematis connata DC. | Ranunculaceae/ NX0271/ W/W | Stem | Drying | Oral | Bladder Symptom U13 (67) |
| Pao Hua Shu | Gai Si Ze | Meliosma cuneifolia Franch. | Sabiaceae/ NX0669/ W/T | Leaves, stem | Drying | Oral | Pelvis Symptom/Complaint Female other X17 (39) |
| Chuan Qian Que Er Dou | Wen Lu Ban Qi Shi | Chesneya polystichoides (Hand.-Mazz.) Ali | Fabaceae/NX0265, NX0699/ W/H | Roots | Soaking | Oral | Weakness/Tiredness General A04 (85) |
| Fen Ge | Gai Gan Er | Pueraria montana var. chinensis (Ohwi) Sanjappa et Pradeep | Fabaceae/ NX0632/ W/SC | Roots, flowers | Drying | Oral | Elevated Blood Pressure K85 (86) Headache N03 (103) Neck Symptom L01 (74) Pneumonia R81 (41) Vertigo/Dizziness N17 (104) |
| Mei | Se Ka Hao | Prunus mume Siebold et Zucc. | Rosaceae/ NX0435/ C, W/T | Fruits | Charring/ drying | Topical/Oral | Abdominal Pain D01 (104) Asthma R96 (77) Diarrhea D11 (86) Nose Bleed/Epistaxis R06 (104) |
| Fen Zhi Mei | Qi Pa Ke | Rubus biflorus Buch.-Ham. ex Sm. | Rosaceae/ NX0145, NX0552/ W/CS | Roots, branches, leaves | Drying | Oral | Menstruation Irregular/Frequent X07 (67) |
| Mao Ye Cha Tian Pao | Qi Dong Bei | Rubus coreanus var. tomentosus Card. | Rosaceae/ NX0661/ W/CS | Roots | Drying | Oral | Cystitis/Urinary Infection other U71 (100) Menstruation Irregular/Frequent X07 (67) Prostate Symptom Y06 (53) Urinary Calculus U95 (99) |
| Hong Pao Ci Teng | A He Le De Ken | Rubus niveus Thunb. | Rosaceae/ NX0461, NX0699/ W/CS | Roots, leaves, fruits | Drying | Oral | Cystitis/Urinary Infection other U71 (94) Menstruation Irregular/Frequent X07 (67) Prostate Symptom Y06 (53) Urinary Calculus U95 (99) |
| Zhou Zhi Shu Li | Qi Na Ze | Rhamnus virgata Roxb. | Rhamnaceae/ NX0655/ W/T | Leaves, branches | Drying | Oral | Malignancy A79 (86) |
| Da Ma | Sa | Cannabis sativa Linn. | Cannabaceae/ NX0561, NX0630/ C,W/H | Fruits, leaves, stem, bark | Crushing/ drying | Oral | Constipation D12 (46) |
| Rui Chi Hu Li | La Ze | Quercus aliena var. acutidentata Maxim. ex Wenz. | Fagaceae/ NX0646/ W/T | Branches, leaves | Drying | Oral | Osteoarthritis other L91 (101) Rheumatoid/Seropositive Arthritis L88 (104) |
| Chuan Qian Gao Shan Li | Bei Shi | Quercus aquilifoideae Rehd. et Wils. | Fagaceae/ NX0241/ W/T | Fruits, bark, flowers | Drying | Oral | Nose Bleed/Epistaxis R06 (55) Viral Hepatitis D72 (66) |
| Hu Tao | Gu Di Bai Duo | Juglans regia Linn. | Juglandaceae/ NX0570/ C, W/T | Bark | Soaking/ drying | Oral | Cholecystitis/Cholelithiasis D98 (63) Diabetes Insulin Dependent T89 (75) |
| Chinese name | Naxi name | Scientific name | Family/voucher specimen/habitat^a/habit^b | Part used | Preparation method | Route of administration | Diseases treated/number of respondents (ICPC-2) |
|-------------|-----------|-----------------|------------------------------------------|-----------|-------------------|------------------------|-----------------------------------------------|
| Hu Lu       | Bei Pu Gu De | Lagenaria siceraria (Molina) Standl. | Cucurbitaceae/ NX0675/C/HV | Leaves | Drying | Oral | Diabetes Non-Insulin Dependent T90 (69) |
| Mao Guan    | Bu Luo Lan | Solena amplexicaulis (Lam.) Gandhi | Cucurbitaceae/ NX0763/W/HV | Roots | Fresh | Topical | Genital Disease Male other Y99 (68) |
| Wu Bing     | Ni Mei Hei Tu Ba | Hypericum augustini N. Robson | Hypericaceae/ NX0142/W/WW | Whole plants | Crushing/drying | Oral/Topical | Acute Hepatitis A D73 (75) |
|             |           |                 |                                         |          |                   |                        | Dyspepsia/Indigestion D07 (48) |
| Dian Nan    | La Ka     | Populus rotundifolia var. bonatii (H. Lév. L.) C. Wang & S. L. Tung | Salicaceae/ NX0672/W/T | Bark | Soaking/drying | Oral/Topical | Genital Disease Male other Y99 (90) |
| Chui Liu    | Re Pei    | Salix babylonica Linn. | Salicaceae/ NX0555/W/T | Branches, leaves, roots | Fresh | Oral | Gonorrhoea Male Y71 (101) |
| Qiu Hua     | Ji Re     | Salix variegata Franch. | Salicaceae/ NX0563/W/T | Branches, leaves | Drying | Oral | Pain General/Multiple Sites A01 (12) |
| Zi Di Yu    | Qie Sai Che E | Geranium strictipes R. Knuth | Geraniaceae/ NX0378/W/H | Roots | Crushing/drying | Oral | Prostate Symptom Y06 (96) |
|             |           |                 |                                         |          |                   |                        | Psoriasis S91 (42) |
| Yang Jiao   | Ju Luo Lan | Dobinea delavayi (Baill.) Baill. | Anacardiaceae/ NX0762/W/H | Roots | Crushing | Oral | Viral Hepatitis D72 (59) |
| Chuan       | Ba De Zi  | Sapindus delavayi (Franch.) Radlk. | Sapindaceae/ NX0125/C, W/T | Fruits | Drying | Oral | Worms/Other Parasites D96 (97) |
| Chuan       | Da Liu Liu | Melia toosendan Sieb. et Zucc. | Meliaceae/ NX0169/W/T | Whole plants | Drying | Oral | Infectious Disease A78 (88) |
|             |           |                 |                                         |          |                   |                        | Viral Disease A77 (79) |
| Lang Du     | Lei Bu     | Stellera chamaejasme Linn. | Thymelaeaceae/ NX0077/W/H | Roots | Crushing | Oral | Worms/Other Parasites D96 (22) |
|             | Ne Du     |                 |                                         |          |                   |                        | Teeth/Gum Symptom D19 (17) |
| Lan Cang     | Wai De    | Wikstroemia delavayi Lec. | Thymelaeaceae/ NX0066, NX0066/ W/S | Whole plants, flowers or bark | Crushing | Oral | Haematuria U06 (97) |
|             | Rao Hua   |                 |                                         |          |                   |                        | Urinary Calculus U95 (79) |
| Wu Jing     | A Ke      | Brassica rapa Linn. | Brassicaceae/ NX0761/C/H | Roots | Drying | Oral | Viral Hepatitis D72 (45) |
|             |           |                 |                                         |          |                   |                        | Limited Function/Disability (L) L28 (53) |
| Tong Qiao    | Mu Gu Xu  | Balanophora involucrata Hook. f. et Thomson | Balanophoraceae/ NX0502, NX0666/ W/H | Whole plants | Soaking/drying | Oral | Dyspepsia/Indigestion D07 (82) |
| Shui Bai    | Ji Xiu    | Myricaria paniculata P. Y. Zhang et Y. J. Zhang | Tamariaceae/ NX0197, NX0717/ | Branches, leaves | Drying | Oral/Topical | Mumps D71 (62) |
|             |           |                 |                                         |          |                   |                        | Pneumonia R81 (75) |
|             |           |                 |                                         |          |                   |                        | Viral Hepatitis D72 (48) |
|             |           |                 |                                         |          |                   |                        | Limited Function/Disability (L) L28 (53) |
|             |           |                 |                                         |          |                   |                        | Dyspepsia/Indigestion D07 (25) |
|             |           |                 |                                         |          |                   |                        | Limited Function/Disability (L) L28 (53) |
| San Chun    | Shui Bai  |                 |                                         |          |                   |                        | Abdominal Pain D01 (100) |
|             |           |                 |                                         |          |                   |                        | Asthma R96 (94) |
|             |           |                 |                                         |          |                   |                        | Diarrhoea D11 (96) |
|             |           |                 |                                         |          |                   |                        | Constipation D12 (85) |
|             |           |                 |                                         |          |                   |                        | Epilepsy N88 (23) |
|             |           |                 |                                         |          |                   |                        | Bladder Symptom U13 (42) |
|             |           |                 |                                         |          |                   |                        | Neoplasm of Eye/Adnexa F74 (23) |
|             |           |                 |                                         |          |                   |                        | Orchitis/Epididymitis Y74 (85) |
|             |           |                 |                                         |          |                   |                        | Trauma/Injury A80 (36) |
|             |           |                 |                                         |          |                   |                        | Viral Hepatitis D72 (27) |
|             |           |                 |                                         |          |                   |                        | Osteoarthrosis other L91 (103) |
|             |           |                 |                                         |          |                   |                        | Rash Localized S06 (100) |
| Chinese name | Naxi name | Scientific name | Family/voucher specimen/habitat| Part used | Preparation method | Route of administration | Diseases treated/number of respondents (ICPC-2) |
|-------------|-----------|-----------------|-------------------------------|-----------|-------------------|-------------------------|-----------------------------------------------|
| Zhi         | Ruo A Kao Ken | *Fagopyrum dibotrys* (D. Don) Hara | Polygonaceae/ NX0490, NX0528/W/H | Roots     | Crushing/drying   | Oral                    | Rheumatoid/Seropositive Arthritis L88 (98) |
|             |            | *Polygonum chinense* Linn. | Polygonaceae/ NX0708/C, W/H | Whole plants | Drying | Oral                    | Abdominal Pain Epigastric D02 (69)        |
|             |            | *Rheum delavayi* Franch. | Polygonaceae/ NX0353/W/H | Roots      | Drying/fresh | Oral/Topical            | Cholecystitis/Cholelithiasis D98 (61)       |
|             |            | *Rheum likiangense* Sam. | Polygonaceae/ NX0262, NX0693/W/H | Roots | Soaking/drying | Oral                    | Acute Bronchitis/Bronchiolitis R78 (89)    |
|             |            | *Rumex nepalensis* Spreng. | Polygonaceae/ NX0074/C, W/H | Roots      | Drying/fresh | Oral/Topical            | Acute Hepatitis A D73 (103)                |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Bleeding/Haemorrhage NOS A10 (26)          |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Chronic Bronchitis R79 (104)               |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Gastrointestinal Infection D70 (71)        |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Haematuria U06 (59)                       |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Heartburn D03 (78)                        |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Mumps D71 (90)                            |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Peptic Ulcer other D86 (49)               |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Rheumatoid/Seropositive Arthritis L88 (104) |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Trauma/Injury A80 (104)                   |
|             |            | *Psammosilene tunicoides* W. C. Wu et C. Y. Wu | Caryophyllaceae/ NX0488/W/H | Roots      | Crushing/soaking  | Topical                 | Dyspepsia/Indigestion D07 (39)            |
Table 9  Ethnomedicinal data of medicinal plants and fungi recorded in the Dongba Sutras (Continued)

| Chinese name | Naxi name | Scientific name | Family/voucher specimen/habit*/habitb | Part used | Preparation method | Route of administration | Diseases treated/number of respondents (ICPC-2) |
|--------------|-----------|-----------------|--------------------------------------|-----------|-------------------|------------------------|-----------------------------------------------|
| Gu           |           | hypochondrácus Linn. | NX0525/W/H                          | Whole plants | Fresh | Topical | Sleep Disturbance P06 (24) |
| Li Guo Xian Ren Zhang | Cong Hei | Opuntia ficus-indica (Linn.) Mill. | Cactaceae/NX0109/C, W/H | Whole plants | Drying | Oral | Burn/Scald S14 (99) Gonorrhoea Male Y71 (63) |
| Jun Qian Zi | Tao Zhi | Diospyros lotus Linn. | Ebenaceae/NX0170/C, W/T | Fruits | Drying | Oral | Abdominal Pain Localized other D06 (86) Chronic Bronchitis/Bronchiolitis R78 (95) Influenza R80 (70) Mouth/Tongue/Lip Symptom D20 (79) |
| Pu Tong Lu Ti Cao | Jiu Gu Lei | Pyrola decorata H. Andr. | Ericaceae/NX0152, NX0652/W/H | Whole plants | Drying | Oral | Acute Bronchitis/Bronchiolitis R78 (95) Influenza R80 (70) Mouth/Tongue/Lip Symptom D20 (79) |
| Ye Hua Du Juan | Shua Dai Lan Ba | Rhododendron racemosum Franch. | Ericaceae/NX0085/W/S | Branches, flowers | Crushing | Topical | Pruritis S91 (34) |
| Huang Bei Du Juan | Mu Gu Ba Shi | Rhododendron wardii W. W. Sm. | Ericaceae/NX0310, NX0312/W/T | Flowers, fruits | Crushing/drying | Oral/Topical | Musculoskeletal Disease other L99 (87) Osteoarthritis other L91 (76) Rheumatoid/Seropositive Arthritis L88 (82) |
| Dian Long Dan Cao | Ji Ka | Gentiana rigescens Franch. ex Hemsl. | Gentianaceae/NX0350/W/H | Whole plants | Crushing/soak | Oral | Cholecystitis/Cholelithiasis D08 (104) Vira Hepatitis D72 (104) |
| Xi Nan Cu Kang Shu | Nu Ao Ke Du | Ebertia corylifolia C. H. Wright | Boraginaceae/NX0111/W/T | Whole plants | Soaking | Topical | Pruritus S02 (35) |
| Ye Ba Zi | Ke Du | Elsholtzia rugulosa Hemsl. | Lamiastraceae/NX0178/W/H | Leaves, flowers | Crushing/drying | Oral | Influenza R80 (77) Upper Respiratory Infection Acute R74 (104) |
| Li Jiang Huang Qin | Bai Qi Ba Pei Ke | Scutellaria lixiangensis Diels | Lamiastraceae/NX0696/W/H | Roots | Soak/drying | Oral/Buccal | Swallowing Problem D21 (95) |
| Bian Da Xiu Qiu | A You Jian Da Ke | Hemiphagagma heterophyllum Wall. | Plantaginaceae/NX0228/W/H | Whole plants | Drying | Oral | Lower Back Symptom L03 (75) Menstruation Irregular/Frequent X07 (33) Musculoskeletal Disease other L99 (69) Osteoarthritis other L91 (88) Pain General/Multiple Sites A01 (75) |
| Kuan Ye Tu Er Feng | Du Mei Gu Fu Pie | Ainsliaea latifolia (D. Don) Sch.-Bip. | Asteraceae/NX0098/W/H | Whole plants | Drying | Oral | Cough R05 (104) Haemoptyasis R24 (82) Malaria A73 (36) Rheumatoid/Seropositive Arthritis L88 (87) |
| Niu Wei Hao | Qi Ai | Artemisia dubia Wall. ex Bess. | Asteraceae/NX0707/W/H | Stem, leaves | Soaking | Topical | Menstruation Absent/Scanty X05 (53) |
| Nan Ai Hao | Beng Pei | Artemisia verlotorum Lam. | Asteraceae/NX0358, NX0658/W/H | Above-ground part | Crushing/soaking/drying | Oral/Topical | Anal Fissure/Perianal Abscess D95 (45) Influenza R80 (104) Upper Respiratory Infection Acute R74 (75) |
| Yun Nan Hao | Beng Na Ze Ge | Artemisia yunnanensis J. F. Jeffrey ex Diels | Asteraceae/NX0618/W/H | Branches, leaves | Crushing | Topical | Nose Bleed/Epistaxis R06 (68) |
| Wu Jing | | Crepis napifera (Franch.) | Asteraceae/ | Roots | Fresh | Topical/Oral | Genital Disease Male other Y99 |
small district, and Reineckea carnea and Hypericum augustinii are endemic to China. This emphasizes the uniqueness of Naxi medicinal plants.

**Analysis of endemic species**

Among the medicinal plants in the Dongba Sutras, 25 species are endemic to China, accounting for 29.41% of the total number of medicinal plant species in the Dongba Sutras (85 species) (Table 10). Moreover, there are eight species only distributed in the areas inhabited by Naxi people (Fig. 2), including northwest Yunnan, southwest Sichuan, and Southeast Tibet. Examples include Populus rotundifolia var. bonatti, Rheum likiangense, Chesneya polystichoides, Geranium strictipes, Dobinea delavayi, Wikstroemia delavayi, Rhododendron wardii, and Scutellaria likiangensis.

The Naxi people consider human beings and nature as brothers. This ecological ethics concept lays the foundation for the Naxi people to live in harmony with nature; it shows the most primitive and simple concept of environmental conservation by human beings [30]. The distribution area of these plant species is very small. Although the Naxi people have been using these plants as medicinal materials for a long time, their populations are still stable, indicating that Naxi people attach great importance to plant conservation when collecting these...
medicinal plants. The Naxi people collect medicinal materials from their surroundings to treat many diseases. They never harm the environment during plant collecting, and they are grateful for being able to take advantage of wild medicinal plants. This fully embodies their idea of maintaining ecological balance. Meanwhile, artificial cultivation was adapted to expand the population of medicinal plants with rare natural resources in order to minimize their impact on wild plant resources.

**Conclusions**

A variety of herbal medicine was recorded in the Dongba sutras

The medicinal plants used by the Naxi people are diverse. A variety of herbal medicine closely related to the life of the Naxi people was recorded in the Dongba Sutras. A total of 85 species of medicinal plants and fungi belonging to 51 families and 71 genera were recorded in the Dongba Sutras, among which 25 species are endemic to China, and 8 species are distributed in a small region. There were 22 species of medicinal dietary plants recorded in the Dongba Sutras.

The basic features of traditional Naxi medicine

The knowledge of traditional Naxi medicine is always in the hands of the elderly and clergy. The traditional apprenticeship between the elderly and the young makes an assurance of the knowledge inheritance from age to age. Dongba, as the clergyman in the Naxi people, records the most important medical knowledge in the Dongba Sutras for better inheritance.

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**Table 10: Chinese endemic plant species recorded in the Dongba Sutras**

| ID | Family             | Scientific name          | Distribution* | Abundance** | Resource type   |
|----|--------------------|--------------------------|---------------|-------------|----------------|
| 1  | Anacardiaceae      | Dobinea delavayi         | SW            | Sol         | Wild           |
| 2  | Boraginaceae       | Eretia corylifolia       | SW            | Cop1        | Wild           |
| 3  | Caryophyllaceae    | Psammomosene tunicoides  | SW            | Sp          | Wild           |
| 4  | Compositae         | Artemisia yunnanensis    | SW,W          | Cop2        | Wild           |
| 5  | Compositae         | Crepis napifera          | SW            | Cop2        | Wild           |
| 6  | Cupressaceae       | Cupressus duclosiana     | SW            | Cop1        | Wild           |
| 7  | Ericaceae          | Rhododendron racemosum   | SW            | Cop3        | Wild           |
| 8  | Ericaceae          | Rhododendron wardii      | SW            | Cop1        | Wild           |
| 9  | Geraniaceae        | Geranium strictipes      | SW            | Cop1        | Wild           |
| 10 | Gramineae          | Fargesia orbiculata      | SW            | Cop1        | Wild           |
| 11 | Gutierrezaceae     | Hypericum augustini      | SW            | Cop3        | Wild           |
| 12 | Labiateae          | Scutellaria lijiangensis | SW            | Cop1        | Wild           |
| 13 | Leguminosae        | Chesnya polystichoides   | SW            | Sp          | Wild           |
| 14 | Liliaceae          | Asparagus meloclados     | SW            | Cop1        | Wild           |
| 15 | Magnoliaceae       | Magnolia delavayi        | SW            | Sp          | Cultivated     |
| 16 | Pinaceae           | Pinus yunnanensis        | SW,S          | Soe         | Wild           |
| 17 | Polygonaceae       | Rheum lijiangense        | SW            | Sp          | Wild           |
| 18 | Polygonaceae       | Rheum officinalis        | SW,C,W        | Cop2        | Cultivated,wild|
| 19 | Rosaceae           | Rubus coreanus var. tormentosus | SW,C,W | Cop2        | Wild           |
| 20 | Sabiaceae          | Meliosma cuneifolia      | SW,C,W        | Cop1        | Wild           |
| 21 | Salicaceae         | Populus rotundifolia var. bonati | SW         | Soe         | Wild           |
| 22 | Salicaceae         | Salix variegata          | SW,C,W        | Cop3        | Wild           |
| 23 | Sapindaceae        | Sapindus delavayi        | SW,C          | Sp          | Cultivated,wild|
| 24 | Tamaricaceae       | Myrcaria paniculata      | SW,C,W        | Cop1        | Wild           |
| 25 | Thymeleaceae       | Wikstroemia delavayi     | SW            | Cop1        | Wild           |

*Note: SW—Southwest China; C—Central China; W—West China; S—South China

**Soe (Sociales): High number of individuals, the above-ground plant part is closed

Cop3 (Copiosae): High number of individuals, but the above-ground plant part is not closed

Cop2: Large and common plants

Cop1: Large plants, but small populations

Sp (Sparsal): Low number of plants, scattered

Sol (Solitariae): Low number of plants, sparse

Un (Unicum): Only one individual
In the processing of medicinal materials, Naxi people make good use of fresh products, medicinal liquids, and plant powders. No complex processing is required from the raw plants to the medicine used, which is very convenient. Medicinal liquids can fully dissolve alcohol-soluble active substances and are easy to store. Different types of mixed powder are used internally or externally suiting the remedy to the different cases, which not only brings convenience to clinical uses but also protects the intellectual property rights of the folk healers because it is hard to know which medicinal plants are used in the powders.

The Naxi ancestors inhabit mountainous areas and are seldom influenced by alien cultures. As a result, the methods of medication are easy to follow, mainly including decocting, oral consumption with warm water, and topical. And the processing technology of Naxi medicine only includes some simple procedures like washing, drying, and crushing.

Four groups of diseases are common diseases in Naxi people living areas: they are the group of digestive...
diseases (D), followed by the respiratory (R), musculo-
skeletal (L), and the general and unspecified disease
group (A). The Naxi folk healers have a high consensus on the treatment of these diseases.

The ecological ethics of Naxi people have positive
significance for the conservation of wild plant
resources
Hengduan mountainous where the Naxi people who live
own one of the greatest abundant biodiversities in the
world. Naxi people always keep the scientific ecological
ethics concept in mind. The Naxi people never harm the
environment during plant collecting, and they are grate-
ful for being able to take advantage of wild medicinal
plants. Meanwhile, artificial cultivation is adapted to ex-
pand the population of medicinal plants with rare nat-
ural resources in order to minimize their impact on wild
plant resources.

Dongba Sutras are recorded in hieroglyphics (Fig.
3); thus, only the Dongbas, as the clergymen, can
fully understand them. Contents of the Dongba Sutras
are all-encompassing. Medical knowledge only takes a
small part of the whole contents, and the records are
not comprehensive enough. In addition, the folk me-
dicinal knowledge is orally passed down. Thus, it is
necessary to further deepen the investigation and re-
search efforts to systematically organize and catalog

Abbreviations
APG IV: The Angiosperm Phylogeny Group classification for the orders and
families of flowering plants ed.IV; AQSIQ: General Administration of Quality
Supervision of China; IMDY: The Herbarium, Yunnan Branch, Institute of
Medicinal Plants, Chinese Academy of Medical Science; ICF: The informant
consensus factor; ICPC-2: International Classification of Primary Care, revised
second ed; WONCA: World Organization of Family Doctors; WHO: World
Health Organization

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Authors’ contributions
Jianqin Liu designed the study. Jingyuan Song designed and revised the
manuscript. Haitao Li performed the ethnobotanical plant surveys; prepared
the herbarium samples, botanical identification of the plant species, data
curation data, formal analysis, analysis, and writing—original draft; and wrote
the manuscript. Zhiyong Li performed the ethnobotanical plant surveys, data
curation data, and formal analysis. Xiaobo Zhang contributed to the data
curation data and formal analysis. Shaohua Yang performed the
ethnobotanical plant surveys and prepared the herbarium samples and
botanical identification of plant species. Cui Chen performed the
ethnobotanical plant surveys and prepared herbarium samples and botanical
identification of plant species. Qingning Yang performed the
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Availability of data and materials
All data generated or analyzed during this study are included in this published article (and its supplementary information files).

Declarations

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Not applicable.

Consent for publication
Prior and informed consent of local people's pictures had been obtained for publication.

Competing interests
The authors declare that they have no competing interests.

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